Article

new media & society
2018, Vol. 20(9) 3283–3303

DOI: 10.1177/1461444817745320
journals.sagepub.com/home/nms
SAGE

Children and Minecraft: A survey of children's digital play

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Abstract
Digital games such as Minecraft currently hold a position of significance in the media diets of many children. However, little is known explicitly about just who plays, with whom and how. This article presents the quantitative results of a survey of 753 parents of children aged 3–12 years about their child's engagement with Minecraft. Our results establish Minecraft as the dominant digital game title played by this age group, particularly on tablet devices. We provide evidence of a marked early gendering of children's Minecraft play and engagement with meta-game material. This research gives particular impetus to efforts aimed at ensuring gender equity in digital game–related cultural spaces inhabited by children. It also highlights the importance of collecting game-specific descriptive information, rather than limiting studies to aggregate measures of 'screen time'.

Keywords
Children, digital games, digital play, gender, Minecraft, survey, tablet devices

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Introduction

With over 100 million copies sold, Minecraft (Mojang, 2011) is one of the most popular games ever produced. This enormous popularity has coincided with drastic changes in younger children's access to digital game play due to the ubiquity of tablet computing, the rise in popularity of digital game–related content on YouTube (MacCallum-Stewart, 2013), and the 'mainstreaming' of gamer culture more generally (Golding and Van Deventer, 2016). As a result, research ranging across education (Nebel et al., 2016), culture studies (Apperley, 2014; Potts, 2015; Willett, 2015), game studies (Dooghan, 2016) and psychology (Baek and Touati, 2017) has begun examining the Minecraft phenomenon, its impact and ways to leverage its potential benefits.

However, despite this attention, there has been a lack of fine-grained quantitative research on children's digital play in general (Holloway et al., 2013; Houghton et al., 2015; Straker et al., 2013), with many studies homogenising games as a subset of overall screen use (Przybylski and Mishkin, 2016). This is a significant gap, considering the growing interest in the benefits of children's digital game play (Beavis et al., 2017; Granic et al., 2014; Hayes, 2008; Toppo, 2015), the release of an education version of Minecraft (Microsoft, 2016a) and the linking of Minecraft play in particular (Hughes, 2017) with efforts to increase gender diversity in Science Technology Engineering and Mathematics (STEM) disciplines.

In this article, we present an analysis of children's Minecraft use, based on the results of a broader ($N = 753$) survey of parents about the digital game play habits of children aged 3–12 years (digital game play was defined as any game played on a digital device including video games, computer games and game apps). Our results show the strong dominance of Minecraft among children in this age range, as well as the dominance of the tablet as a game play device and the gendering of Minecraft play. We present our results following a review of related work, before discussing the significance and relevance of our findings, focusing, in particular, on how our results may assist researchers in reframing the narrative around Minecraft play, and digital play more generally, and as a guide for future qualitative work.

Background and context

Screen time

In a recent survey of Australian adults, excessive 'screen time' was rated as the top child health concern (Rhodes, 2015). In this context, children's digital game play exists within a unique and polarising discourse (Mavoa et al., 2017a). On one hand, digital games are, in popular discourse, associated with violence, addiction, antisocial behaviour, passivity and poor physical health (Ferguson, 2010; Mustola et al., 2018; Shin and Huh, 2011), while on the other, they are also associated with 'tech-savviness' and broader digital literacy skills (Mustola et al., 2018; Narine and Grimes, 2009).

In the face of these conflicting presentations, it follows that parents seek information about how to manage the digital play of their children (Holloway et al., 2013; Willett, 2015). However, guidelines specifically regarding digital games are sparse. In addition, up until recently, guidelines around 'screen time' in general have been heavily centred on

time limits (Blum-Rose and Livingstone, 2017). This advice has recently changed. The American Academy of Pediatrics' (AAP) 2016 policy statement on children's media urges consideration of content and context as fundamental to questions about children's media use (AAP Council on Communications and Media, 2016). In fact, they suggest that the term 'screen time' is itself obsolete. This perspective is echoed and built upon by Blum-Rose and Livingstone (2017) who state that what children do with their screen-based media 'cannot be homogenised as a uniform or inevitably problematic activity' (p. 27).

In keeping with this perspective, there have been calls to take a more fine-grained approach to the way quantitative information about children's general media use is collected (Holloway et al., 2013; Houghton et al., 2015; Straker et al., 2013). Advice about restricting media use tends to make connections between statistics on overall 'screen time' with research making claims about effects of media on children (McPake et al., 2013). The risk of this approach, when it comes to digital games, is that we miss crucial information about what type of play children are engaging in, as well as the 'social and cultural dimensions of use' (Plowman, 2016: 6).

Digital games

Ito (2017) argues that children have potentially missed out on opportunities offered by digital games because of the legacy of the AAP's previous time-based, non-content sensitive guidelines (AAP Council on Communications and Media, 2013). Referring specifically to digital games research, Przybylski and Mishkin (2016) urge researchers to delve into 'kinds' and 'amounts' of play. Their own findings show evidence of content, play-style and genre differences in relation to outcomes. This points to the need to gather detailed descriptive information about children's digital play in a nuanced, game-specific manner.

Prior descriptive information about children's digital game play outside of school hours has often been captured as a subset of information within broader media-use surveys, and using varying methods. For example, Rideout (2013, 2016) employed a device-level down approach, asking about 'video game' usage (frequency and duration) based on the device used, in American children aged 0–8 years (2013) and 8–16 years (2016). While Houghton et al. (2015) instead asked about game genres (e.g. 'indie games', 'action adventure' and 'shooter games') and specifically whether Australian children aged 8–16 years generally exceeded 2 hours per day playing 'video games'. In the United Kingdom, the Ofcom (2015) media uses and attitudes report, capturing information about children aged 3–15 years, asked about devices used to play games (both with others and alone), amount of time spent playing and attitudes to in-game purchases but not about the types of game played.

Marsh et al. (2015) took a more nuanced approach in their 'Technology and Play' project. Although here, surveyed types of play were broken down into different categories (such as 'creating virtual worlds' and 'role play'), potentially obscuring play with titles that include elements of more than one category. Holloway et al. (2013) further note that 'virtual worlds' lacks a consistent definition. Furthermore, complicating this task is the ambiguity of terminology about digital games in general (Apperley, 2006), where even genre classifications (e.g. those used by Houghton et al., 2015) are open to different interpretations by both participants and researchers.

While acknowledging the inherent difficulties in gathering descriptive information about children's media use (Rideout, 2016; Vandewater and Lee, 2009), the lack of content and context details in these approaches increases the likelihood of a 'reductive and narrow rejectionist agenda' (Marsh, 2010: 25) in advice given to parents about managing their children's digital play. Therefore, in our research, we sought to gather descriptive information by game title, allowing for more reliable description of children's digital play diets. In this article, we present the results of our survey that specifically asked parents about their children's outside of school hours Minecraft play.

Minecraft

Minecraft is a 'sandbox' video game first released to the public in 2009, where players control a virtual avatar in a Lego-like world made up of blocks that can be moved to construct buildings and used to create items and structures. Because of the multitude of play options both within Minecraft, and surrounding it in the form of modifications ('mods') which can be downloaded to add various alternative game play elements (Duncan, 2011), the game has the potential to appeal to a wide age range. This means that play can adapt as a child's ability and interest develops (Ito, 2015). Based on its sales figures (Microsoft, 2016b), the US$2.5 billion purchase price paid by Microsoft for the title (Stuart and Hern, 2014), and the fact that 'Minecraft' was the second most searched for term on YouTube in 2014 (Lang, 2015), Minecraft is an established cultural phenomenon. It is a game particularly popular with children (Dredge, 2014; ETonline, 2015).

We also know that Minecraft is different to other successful titles because of its perceived virtues. These include purported educational affordances that have seen Microsoft release Minecraft.edu, a version of the game marketed as a 'collaborative and versatile platform that educators can use across subjects to encourage 21st-century skills' (Microsoft, 2016a); claims that the game itself helps children gain cognitive and social skills (Haxton, 2015; Ito, 2015); its likeness to Lego, a toy that has long held a reputation as being beneficial to children beyond instances of play (Smith, 2016); and because it is as much a setting for digital play as it is a 'game' (Lastowka, 2012). It is therefore not surprising that there is an emerging academic interest in the game, from a variety of different fields, though most notably education (e.g. Dezuanni et al., 2015; Kervin et al., 2015; Schifter and Cipollone, 2015) and culture studies (e.g. Apperley, 2014; Potts, 2015; Willett, 2015).

Yet, despite these benefits and the game's apparent popularity, very little research has examined Minecraft specifically in terms of who plays, how and with whom. However, we are aware of two studies that have detailed some Minecraft specific results. Marsh et al., in their study of 0- to 5-year-old children's use of tablet devices, found that Minecraft was the fifth most popular app used by this group. Parents also indicated that 30% of children used apps for 'creating virtual worlds (e.g. Minecraft)' (Marsh et al., 2015: 61). However, as mentioned earlier, we do not know whether parents included other titles in their responses to this category, so this result could include titles other than Minecraft. Beavis et al. (2015) report the results of a survey of 9- to 14-year-olds' digital game practices at home as part of a larger project looking at using digital games to promote learning and literacy. The children in this sample most frequently mentioned Minecraft as a favourite title, well surpassing the second most frequently mentioned title, 'Call of Duty'.

However, these two studies do not account for the Minecraft play of children between the ages of 5 and 9 years. Given that the Ofcom (2015) and Rideout (2013, 2016) reports indicate this age group as significant digital game players, and because of the importance of Minecraft described above, there is a need to collect game-specific information about this age group.

On gender, while surveys of adult populations have found trends towards equity in male and female rates of digital game play (Bertozzi and Lee, 2007; Fisher and Jenson, 2017), surveys of children routinely find that boys are more likely to play digital games at all (Ofcom, 2015; Rideout, 2016), play for longer (Beavis et al., 2015; Houghton et al., 2015; Nikken and Schols, 2015; Ofcom, 2015; Santaliestra-Pasías et al., 2014), play on consoles (Rideout, 2013; Ofcom, 2015) and play online with people unknown to them (Ofcom, 2015). While some narratives around Minecraft suggest that it is equally appealing to boys and girls (Davies, 2016; Gauquier and Schneider, 2013; Youth Digital Blog, 2016), both Beavis et al. (2015) and Marsh et al. (2015) found more boys than girls played Minecraft. Interestingly, Minecraft was the only title mentioned as a favourite by both girls and boys in Beavis et al. (2015).

A more detailed understanding of any gender differences in Minecraft play is warranted because of the use of Minecraft as an educational product (Microsoft, 2016a), the situating of digital games (Apperley, 2015), particularly Minecraft (Ito, 2015), as a pathway to STEM careers, as important for digital citizenship (Dezuanni et al., 2015; Ito, 2015), and increasing attention paid to the problematic long-term effects of gendering children's digital play (Hughes, 2017; Kafai, 2008). Understanding engagement with Minecraft on YouTube is also key to these questions, as it is noted as a key site for how children engage and develop literacies with Minecraft (Ito, 2015).

It is also necessary to examine which devices are used and what modes of play are preferred because – as called for by the AAP Council on Communications and Media (2016) – understanding the context and content of children's digital play is extremely important. Thus, a detailed picture of which devices are popular will provide insight into how (and at what age) digital games introduce children to various levels of digital literacy, such as that associated with tablets, consoles or desktop-computers. The rate of tablet ownership has increased dramatically since the release of the Apple iPad in 2010, potentially changing the digital play landscape, as these devices are easier to use by younger children who may have difficulty with the motor and technical skill requirements of desktop-computers or game consoles (Beschorner and Hutchinson, 2013; Chaudron, 2015; Plowman, 2016). While we do have information about what devices children use for digital game play generally (e.g. Ofcom, 2015; Rideout, 2013, 2016), we do not have this for Minecraft play in particular.

Minecraft also features distinct play modes; in Creative mode, play is focused on creative construction as resources are freely available and avatars can fly. In Survival mode, players can't fly, can be injured by falls and hostile creatures, and must manually collect resources to build structures. Playing Minecraft in Survival mode, therefore, entails a degree of competition which is not inherent in Creative mode. Beavis et al. (2015) suggest that this choice of play mode may 'help to explain girls' and boys' shared interest' in Minecraft (p. 27). Minecraft can be played solo, with others over local area networks, or with strangers over the Internet. Taken together, these differences are

relevant because the complexity of Minecraft affords different types of play and thus potential literacy and social benefits. Homogenising the types of Minecraft play would erase this useful granularity in examining how Minecraft play varies across age and gender.

Method

To address some of the concerns outlined above, we have sought to provide quantitative, statistically reliable information about trends in Minecraft play across age and gender.

Participants and procedure

Parents and carers of children aged between 3 and 12 years living in Metropolitan Melbourne completed the survey. Lists of all primary schools and early learning centres (ELCs), including kindergartens, preschools and child-care/day-care centres, in Metropolitan Melbourne were randomised. Working down these randomised lists, schools and ELCs were emailed information about the study and invited to participate by either forwarding the study advertisement by email to parents, handing out paper-based advertisements about the study to students/parents, including the advertisement in newsletters or some combination of these.

The advertisement asked, 'Do you want to help screen time research?' and 'Are you a parent or carer of a child aged 3-12 living in Melbourne?' as well as a brief statement about the survey and a link to it. The plain language statement gave further background to the study (including a statement saying that we were interested in hearing from parents of children who play digital games and those who do not) and was included in the survey preamble before parents were asked to select whether they did or did not consent to participate.

The project was approved by the Human Research Ethics Committee of The University of Melbourne, The Victorian Department of Education and Catholic Education Melbourne. In order to increase response rates, an amendment to ethics approval was made to also allow for recruitment via word of mouth and social media. The survey was open between November 2015 and May 2016 (this included a school holiday period when recruitment was paused).

Instrument and measures

Data were collected using the REDCap (Research Electronic Data Capture) survey tool (Vanderbilt, 2016) hosted on The University of Melbourne data centre infrastructure. Questions began with basic demographic information related to the target child, then asked about general digital game play, followed by a set of Minecraft specific questions, YouTube use, general 'screen time' and finally basic parent demographic questions.

Data analysis

Descriptive results and inferential statistics were calculated using SPSS software, version 22 (IBM Corp, 2013). Missing and 'don't know' responses were not included in the

analyses. Differences were considered statistically significant if p values were less than .05. All p values reported are results of Fisher's exact test for differences in proportions. Confidence intervals (CI) are reported for estimates of population proportions and estimated differences in proportions where pairwise comparisons have been conducted; in all cases, these are 95% CIs.

Results

A total of 753 completed responses were received. The sample was collapsed into age groups for analysis. Responses were from 277 parents of 3- to 5-year-old children, 243 parents of 6- to 8-year-old children and 233 parents of 9- to 12-year-old children. The sample consisted of 57% male and 43% female children. Parents were predominantly aged between 36 and 45 years (67% of responses were from this age range), and most were university educated (75% of the sample).

Who plays Minecraft?

Parents were asked to list up to three of their child's favourite games at the time of the survey. Minecraft was mentioned approximately three times as frequently (N = 259) as the next most dominant title (Lego games, N = 76). Parents were then asked, 'Has your child played Minecraft in the last month?' Almost half (45%; CI = [42%, 49%]) of the parents reported that their child had played Minecraft in the month prior to completing the survey.

Older children in the sample were statistically significantly more likely to have played Minecraft than those in the 3- to 5-year-old group, with only 11% (CI = [7%, 16%]) of the youngest children having played in the last month compared to 53% (CI = [47%, 60%]) of 6- to 8-year-olds and 68% (CI = [62%, 74%]) of 9- to 12-year-olds (p = <.001).

At the whole sample level, parents reported significantly more boys (54%; CI = [49%, 59%]) than girls (32%; CI = [27%, 38%]) had played Minecraft in the past month (p = <.001). Gender differences in Minecraft play were present across the younger two age groups (Table 1). Statistically significantly more 3- to 5-year-old boys and 6- to 8-year-old boys than girls of the same age group had played Minecraft. No significant gender differences in overall Minecraft play were present in the children aged 9–12 years. However, when broken down into 2- rather than 3-year age groupings (Table 2), a higher

Table 1. Percentage of children who had played Minecraft in the past month.

Age group (years)	Played Minecraft		Difference of percentages		
	Boys (%)	Girls (%)	Boys − Girls	95% CI	p
3–5	14	3	11	[4, 17]	.004
6–8	68	29	39	[27, 50]	<.001
9–12	66	63	3	[−10, 16]	.882

CI: confidence interval.

Table 2. Percentage of children who had played Minecraft in the past month - 2-year age groups.

Age group (years)	Played Minecraft		Difference of percentages		
	Boys (%)	Girls (%)	Boys − Girls	95% CI	*p*
9–10	72	64	8	[–8, 2]	.416
11–12	54	62	−8	[–21, 6]	.622

CI: confidence interval.

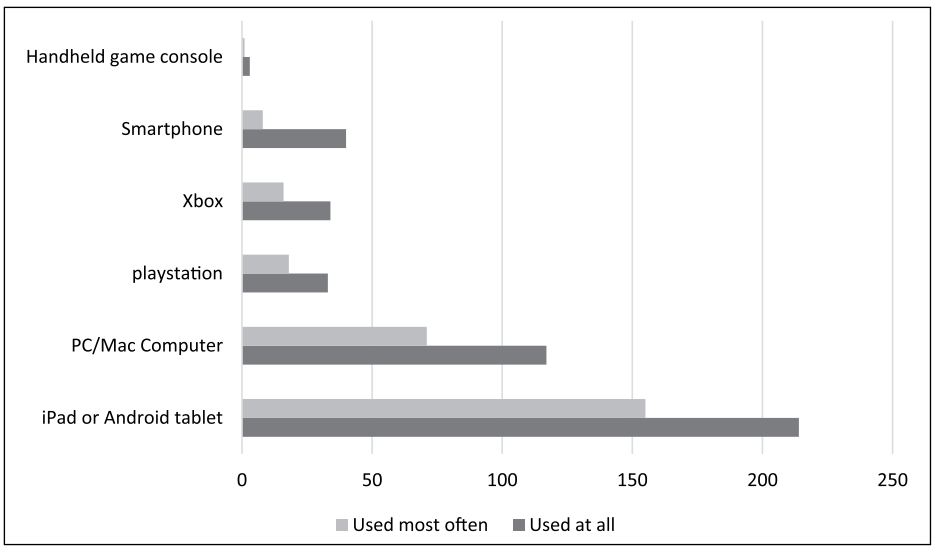

Figure 1. Devices used to play Minecraft.

proportion of girls aged 11–12 years had played Minecraft than boys of the same age and this is largely due to a drop off of boys playing from 72% of boys aged 9–10 years to 54% of boys aged 11–12 years. This difference between 9–10 and 11- to 12-year-old-boys was not statistically significant (estimated difference between percentages: 18%; CI = [0.08%, 35%]; $p = .056$).

What devices are used to play Minecraft?

Minecraft is played on a range of devices. Our results indicate that tablets are the device used most at all for Minecraft play and most often for Minecraft play (Figure 1). More children in the 9- to 12-year-old age group compared to the other age groups most often played Minecraft on a PC/Mac computer according to their parents (Table 3). However, tablets and smartphones remained dominant in this group. Consoles were the least used device for Minecraft play in all age groups and both genders, but the children who did play Minecraft most often on a console were statistically significantly more likely to be

Table 3. Devices used most often to play Minecraft.

	Tablet/smartphone		PC		Console		*p*
	%	95% CI	%	95% CI	%	95% CI	
Age group (years)							
3–5	70	[46, 88]	15	[3, 38]	15	[3, 38]	<.001
6–8	74	[64, 82]	15	[9, 23]	11	[6, 19]	
9–12	50	[41, 59]	37	[29, 45]	13	[8, 20]	
Gender							
Boys	58	[51, 66]	26	[20, 32]	15	[11, 21]	.057
Girls	66	[55, 77]	29	[19, 40]	5	[1, 13]	

CI: confidence interval.

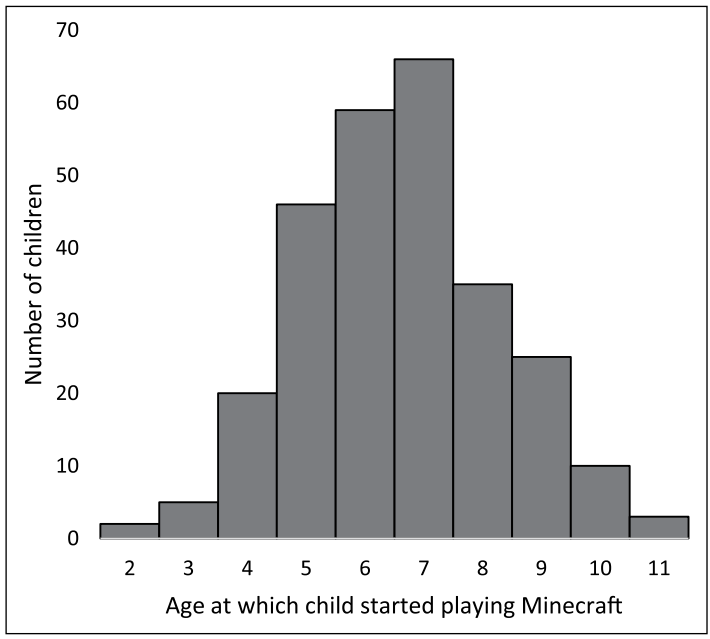

Figure 2. Age at which children start playing Minecraft.

boys (estimated differences between percentages: 19%; CI=[9%, 28%]; $p=.03$). Minecraft was not available for the Wii or Wii U at the time of data collection.

When do children start playing Minecraft?

In total, 46% of parents in this sample reported that their child started playing Minecraft at age 6 or 7 years (CI=[40%, 52%]). There was a sharp increase in the number of children starting to play Minecraft from 4 to 5 years. Relatively few children in this sample picked up the game after the age of 7 years (Figure 2).

Table 4. Frequency and duration of Minecraft play.

	%	95% CI
Frequency		
Daily/more than once daily	22	[18, 27]
One to a few times per week	54	[48, 60]
Less than weekly	24	[19, 29]
Duration weekdays (hours)		
<1	84	[79, 89]
1–2	11	[8, 16]
>2	5	[2, 8]
Duration weekend days (hours)		
<1	49	[43, 54]
1–2	31	[25, 36]
>2	20	[16, 26]

CI: confidence interval.

Near equal proportions of parents of boys (25%; CI=[19%, 32%]) and girls (24%; CI=[15%, 35%]) reported that their child started playing Minecraft at age 7. Both boys and girls were more likely to start playing at 7 years or younger (74% of all children who play Minecraft; CI=[68%, 79%]); however, a statistically significantly higher proportion of girls (39%; CI=[28%, 50%]) than boys (22%; CI=[16%, 28%]) started playing at 8 years or older (estimated difference in percentages 17%; CI=[5%, 29%], $p=.006$).

How often do children play Minecraft?

Respondents were asked, 'About how OFTEN does your child usually play Minecraft?' Most reported that their children played 'one to a few times per week' (Table 4). There were no statistically significant age ($p=.882$) or gender ($p=.652$) differences in frequency of play.

How long do children play Minecraft for?

The vast majority of parents reported children played Minecraft for 'less than and up to one hour per day' on weekdays with children tending to play for longer on weekend days (Table 4). More children played for 'more than 2 hours per day' on weekend days (compared to weekdays) $p=<.001$. There were no statistically significant age or gender differences in length of play either on weekdays or weekend days.

Single-player or multi-player Minecraft?

A higher proportion of parents reported that their children played Minecraft in single-player mode most often (Table 5). There was no gender difference in single- or multi-player preference, with boys and girls equally likely to prefer single-player. Children aged 9–12 years were more likely to play most often in multi-player mode.

Table 5. Mode of Minecraft played usually.

	Single-player mode			Creative mode		
	%	95% CI	*p*	%	95% CI	*p*
Age group (years)						
3–5	55	[32, 77]	.882	71	[42, 92]	.644
6–8	72	[63, 80]		81	[71, 89]	
9–12	41	[33, 50]		78	[69, 85]	
Gender						
Boys	55	[47, 62]	.652	75	[67, 81]	.018
Girls	57	[45, 68]		89	[79, 96]	
All	55	[49, 61]	–	79	[73, 84]	–

CI: confidence interval.

Creative or survival?

Most parents reported children usually played Minecraft in creative mode, and this is the case across all age groups (Table 5), with no statistically significant difference in mode of play across age groups. The minority of children, who did usually play in survival mode, were more likely to be boys.

Who do children play Minecraft with?

This question is about play with other people, either play in multi-player or single-player mode (with other players in separate games or spectators nearby). In total, 80% of parents reported that children who played Minecraft had at times played with other people (siblings, friends, other people online, parents or other relatives; Table 6). A slight majority of children most often played Minecraft on their own, while the remainder most often played with other people. Children aged 3–5 and 9–12 years were both more likely than 6- to 8-year-olds to play with other people, $p = <.001$. There was no gender difference in sociality of play, with 53% (CI = [46%, 60%]) of boys and 60% (CI = [48%, 71%]) of girls most often playing alone, $p = .35$.

Minecraft YouTube videos

Respondents were asked whether their child had watched any YouTube videos in the last week, if so how often, and what kind. Only responses relating to Minecraft videos are presented here. A total of 37% of children in the entire sample had watched Minecraft-related videos (CI = [32%, 41%]) in the week preceding their parent completing the survey.

According to respondents, boys aged 6–8 years were statistically significantly more likely than girls of the same age to watch Minecraft videos (Table 7). A higher percentage of girls aged 9–12 years watched Minecraft videos compared to boys of the same age, though this difference was not statistically significant. Older children, overall, were statistically significantly more likely than the younger children to watch Minecraft YouTube videos (Table 8).

Table 6. People who children play Minecraft with.

	At all		Most often	
	%	95% CI	%	95% CI
On own	59	[53, 65]	55	[49, 60]
Siblings	50	[44, 56]	26	[20, 31]
Friends	46	[40, 52]	13	[10, 18]
Internet/not known to child	13	[9, 17]	3	[1, 6]
Parents	11	[8, 16]	3	[1, 5]
Other relatives	8	[5, 12]	0.07	[0.1, 3]
Either siblings, friends, other people not known to child, parents or other relatives	80	[75, 85]	45	[39, 51]

CI: confidence interval.

Table 7. Minecraft YouTube videos watched – differences between age group and gender.

	Minecraft YouTube videos		Difference of percentages		
	Boys (%)	Girls (%)	Boys – Girls	95% CI	*p*
Age group (years)					
3–5	5	2	3	[–2, 8]	.305
6–8	32	9	23	[13, 32]	<.001
9–12	34	43	−8	[–21, 4]	.261
All	31	14	17	[12, 23]	<.001

CI: confidence interval.

Discussion

Prior to this research, there has been a lack of fine-grained quantitative information regarding children's (aged 3–12 years) digital play (Holloway et al., 2013; Houghton et al., 2015; Straker et al., 2013). Instead, previous research has focused on games as a subset of overall screen use without acknowledging games as a different form of media (Przybylski and Mishkin, 2016). In this article, we have presented an analysis of parents' reports of their child's Minecraft practices, based on the results of an $N=753$ survey. Our results have shown that Minecraft is the most dominant digital game title played by children in this age group, and that the tablet is the most dominant game play device. These results are significant as they highlight the rapidly changing landscape of contemporary digital play. We have also identified several differences in play practices based on both age and gender.

The dominance and sociality of Minecraft play

This survey has verified that in Melbourne, Australia, Minecraft is the most dominant digital game, by a significant margin, played by 3- to 12-year-old children. Almost half of the parents

Table 8. Minecraft YouTube videos watched – differences between age groups.

Age group (years)	Minecraft YouTube videos		
	%	95% CI	*p*
3–5	4	[2, 7]	<.001
6–8	22	[17, 28]	
9–12	32	[26, 39]	

CI: confidence interval.

in this sample reported their child had played Minecraft in the week prior to completing the survey. This proportion increases with age such that a clear majority (68%) of 9- to 12-year-old children were Minecraft players at the time of the survey. We found that children are most likely to have started playing the game at age 7 and identified possible evidence that Minecraft play begins to drop off from 11 years. Children tend to play Minecraft frequently, but there is no evidence in this data set that the game is played to excess by many children. These findings validate the importance of research into the Minecraft phenomenon, removing the need for reliance on proxy measures, such as sales figures, of the game's popularity.

Furthermore, nearly half of the parents in this sample reported that their child most often played Minecraft with other people, and the majority of them at times played Minecraft with other people. This makes claims or concerns about digital play being a predominantly solitary activity (e.g. Mundy et al., 2017) appear overstated, at least in the case of Minecraft. We also found that children aged 3–5 and 9–12 years are both more likely than 6- to 8-year-olds to play with other people. This could be because younger children require assistance from older siblings or parents to play (Plowman, 2016). Older children may be giving this assistance and may also be more likely to have friends who play Minecraft. These older children may also have more digital literacy skills than younger groups and therefore be able to access multi-player games, which require several additional steps in game set-up. Children aged 9–12 years in our sample were indeed more likely to play multi-player Minecraft (where other players are in the same game world). Having said this, development of digital skills does not necessarily follow a solely age-dependent trajectory (Cameron et al., 2011), so future qualitative research could further probe the reasons for this difference in shared play.

Also of note is the finding that relatively few children in this sample ever played Minecraft with parents. This indicates that, when it comes to Minecraft, parents are not necessarily heeding the advice of those advocating co-play as a mediation strategy (Brown et al., 2015). This is surprising, as prior work would suggest that Minecraft's positive perception would increase the likelihood of co-play (Shin and Huh, 2011). However, our results do not mean that parents are not actively mediating their children's Minecraft play in other ways. They may be talking to their children about Minecraft worlds, or otherwise taking an interest in their children's Minecraft play and related practices. Indeed, text responses to other parts of this survey included many references to Minecraft being the focal point of child–parent conversation. Our findings also do not lead to the conclusion that parents do not co-play with their children at all, but perhaps that they do not have the desire to play Minecraft in particular.

Our data also support the findings of the Ofcom (2015) media uses and attitudes report which found relatively few children (2% of those aged 5–7 years and 9% of those aged 8–11 years) play digital games online with people unknown to them. In our sample, parents reported just 13% of children ever played Minecraft with other people unknown to them online and 3% most often played this way. While we have purposefully only asked about Minecraft play in the current survey, and there are numerous other avenues for playing with unknown people, these numbers should help provide some context to sensationalised reports of the dangers of online Minecraft play (Family Zone Team, 2017; Jenkins, 2015; Newton, 2016).

Tablet-based play

A further notable finding from this study has been the confirmation of the dominance of tablets in children's digital game practices, including Minecraft play. Previous studies have found either consoles the most used device for game play overall (Rideout, 2013) or tablets being used only slightly more than other devices in particular age groups (Ofcom, 2015). Our research has instead found that tablets are the primary play device across all age groups and genders in Melbourne-based children.

Given that overall rates of tablet ownership in the United Kingdom and Australia are similar (Google, 2016), and the two countries share many similarities both being representatives of the 'global North', perhaps the differences in tablet use found by the survey reported in this article and the Ofcom (2015) report are due to a higher proportion of schools in Australia having BYOD (bring your own device) programmes. These programmes encourage families to provide a tablet device for their child to bring to school each day for learning, and as a result, children potentially also have access to these devices for leisure purposes after school. In Australia and New Zealand, 54% of schools encourage students to bring their own device (Softlink, 2015), compared to 30% of secondary and just 9% of primary schools in the United Kingdom (Bird, 2016). Alternatively, these findings may be due to an increasing pervasiveness and acceptability of tablet use by children.

One of the core affordances of tablet devices is the mobility of the platform. Whereas desktop and console-based play is restricted within the home to specific locations, and under specific supervisions, the adoption and growth of tablets means that spaces previously off-limits to digitally enabled play are now opened up as potential sites for this kind of play. Public libraries, for example, are now sites of digital play (Cilauro, 2015), with children gathering to play after school with the devices they have been using for school work during the day transitioning from tools for education to tools for play. However, handheld consoles were infrequently used by children in the current survey, suggesting that the appeal of tablet devices extends beyond portability.

How Minecraft play is gendered

Our research has contributed deeper understanding into the highly gendered nature of children's digital play. While the original developer of Minecraft, Notch, has claimed that 'gender doesn't exist' in Minecraft (Persson, 2012), and popular discourse

commonly refers to children's digital play in Minecraft as un-gendered (Davies, 2016; Youth Digital Blog, 2016), our results indicate that this does not translate to parity in play.

The gendering of adult digital play is well researched in studies of games (for a review, see Fisher and Jenson, 2017). This research has consistently shown that women play digital games on average less than men, although the most recent studies (Bertozzi and Lee, 2007; Brand, 2015; Fisher and Jenson, 2017) show this gap is decreasing. Our study similarly found that girls are much less likely to play Minecraft at all ages, until age 9, at which point the difference disappears, with a full reversal of the difference at age 11 (possibly due to boys moving on to other titles as evidenced in other parts of this survey). Our study showed boys are more likely to start playing at a younger age and are more likely to play in the more competitive and challenging Survival mode. Beavis et al. (2015) note that boys in their sample were more likely than girls to rate 'competing' as a 'very important' aspect of game play, perhaps explaining this difference (p. 29). However, grouping interest in game elements by gender is contentious and potentially obscures more meaningful individual differences (Hayes, 2008; Wilhelm, 2016).

Our findings also show that boys aged 6–8 years are significantly more likely than girls of the same age to watch Minecraft YouTube videos. While there is no statistically significant difference in children aged 9–12 years, a large percentage of boys move away from playing Minecraft at this age which may explain the shift. However, the strong differences in children aged 6–8 years we observed do point towards a gender-based disparity in engagement with the Minecraft 'metagame' (Carter et al., 2012; Consalvo, 2007). This corresponds with earlier findings that girls are less likely to create in-game or out-of-game content such as recorded walk-throughs or fan-fiction (Hayes, 2008).

Taken together, these results indicate that not only is the practice of children's digital game play gendered, so too is early immersion in other parts of gaming culture. Indeed, these results are not surprising. 'Gamer' culture is notably constructed to be hostile towards women. Studies of female player experiences have found that there are a number of gate-keeping mechanisms that effectively demonstrate to women that they are not welcome in this space (Bergstrom, 2013; Graso, 2016; Kuznekoff and Rose, 2013). Our results point to the need to interrogate the presence and nature of these prohibitive features presented to female children. Furthermore, there is evidence to suggest that parents consider digital games differently in relation to boys and girls, and that this may impact girls' opportunities for play and engagement with surrounding media. For example, Nikken and Jansz (2006) found that parents were more likely to meditate the digital game play of girls overall and to also use more restrictive mediation strategies than for boys. Smette et al. (2016) also found parents of boys to be particularly concerned with the risks they attributed to digital games. Consideration should also be given to the fact that the vast majority of Minecraft YouTubers are male, therefore reducing opportunities for gender-based identification for female children.

There are significant consequences to the gender differences in Minecraft engagement. Prior work recognises that gendered digital play, as well as non-digital play, has the potential to 'limit children's play experiences in ways that stifle skill development' (Sweet, 2016). Hayes (2008) notes that an interest in gaming outside of formal education fosters a range of skills including both technical and social, which are indicators of future

information technology and STEM interests and careers. There is a well-documented gender disparity in academic graduates and STEM industry workforces (Office of the Chief Scientist, 2016). Minecraft in particular is often framed as a game that encourages skills relating to STEM disciplines (Ito, 2017). Numerous text responses from parents in other parts of our survey mentioned attributes such as planning, spatial awareness, building and design as positive benefits of playing Minecraft (Mavoa et al., 2017b). These skills map well onto descriptions of STEM focus in school curricula.

Our findings overall support the provision of measures to ensure that girls, particularly those aged 8 and under, do not miss out on opportunities for, and potential benefits of, digital play. It is promising, however, that despite some notable and important differences in the amounts and types of Minecraft play between genders, many girls do indeed play the game and interact with Minecraft content outside the game.

Limitations

Because of our survey methodology, there will have been a degree of self-selection bias involved in shaping the final sample. This could mean that parents with a particular interest in 'screen time' and digital games would be more likely to take the survey and perhaps the children of these parents have media habits that are different to other children. Our sample consisted of a large percentage of parents with university-level education which is also a limitation in terms of the degree to which our findings are representative of other populations. However, very similar rates of digital game play were found between this survey and the large nationally representative Ofcom (2015) report, as well as the Digital Australia Report (Brand, 2015) which used an online panel of paid survey respondents.

We asked parents to complete the survey rather than children themselves. This decision involved trade-offs in terms of the risk that parents may not have accurate knowledge of what their children are playing (particularly older children), and that responses may be prone to social desirability bias given the polarised discourse surrounding digital games (Ferguson, 2010; Narine and Grimes, 2009; Rideout, 2016; Vandewater and Lee, 2009). On the contrary, children from as young as 3 years may not have sufficient recall or ability to answer questions about their digital play (Rideout, 2013). In the interests of consistency in data collection across the sample, we decided to have parents answer the questions.

Conclusion

As a whole, our findings make a significant contribution to understanding the contemporary play worlds of children. By examining parent reports of Minecraft play specifically rather than relying on aggregate measures such as 'screen time', we have provided a set of descriptive information that is more refined than previous surveys of children's media use. Our results signal Minecraft as the dominant title engaged with by children aged 3–12 years at this point in time, and tablets as the go-to device for Minecraft play. Finally, we have provided evidence that Minecraft play is gendered. This information indicates that further investigation into how and why children use games such as Minecraft, and how this use relates to non-digitally mediated play and other uses of leisure time, is significantly warranted.

Acknowledgements

The first author is grateful for the assistance of the Statistical Consulting Centre of The University of Melbourne in performing statistical analyses for this paper.

Funding

The author(s) received no financial support for the research, authorship and/or publication of this article.

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