Connected grandparents: Are smart toys the future for intergenerational play?

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Abstract

Previous research has described how digital games can enhance interaction between older (55-81 year-olds) and younger (4-22 year-olds) players (see De la Hera et al., 2017 for a review). However, the majority of this research has focused on the use of games consoles (e.g. Aarsand et al., 2007). The way children access digital games has seen huge changes in recent years, with tablet PCs now more popular than games consoles, within the 5 to 15 year-old age range (Ofcom, 2011-2017) and sales of connected toys (also known as smart toys, or IoT toys) expected to triple over the next five years (Juniper Research, 2017). We therefore propose a small-scale study exploring whether the benefits of digital games extend to connected toys. We will employ a mixed methods approach to investigate older people's current attitudes towards connected toys and the effect of these toys on intergenerational play between grandparents and grandchildren. This will include a paper-based questionnaire, measuring the attitudes of 50 older people towards digital play, including connected toys. This will indicate whether older people generally have a positive or negative opinion of connected toys, and whether this varies by age, gender, and self-perceived digital literacy. Additionally, we will invite eight grandparents and their grandchildren (aged 8 to 10 years old, to allow for comparison with previous digital game research) to play with a connected toy. As the cooperative element of digital games has been identified as an important feature of the enjoyment for both older and younger parties (De la Hera et al., 2017), we will use a connected toy that encourages this play pattern. These sessions will be recorded, and the videos analysed for evidence that demonstrates the exchange of knowledge and skills across the two generations, one of the benefits of digital games identified by De la Hera et al. Furthermore. Previous research indicates that the controls of a console game presents barriers to the older, less experienced player (e.g. Aarsand et al., 2007, excerpt 2, page 244). We will therefore analyse from the recorded sessions whether similar barriers are present when connected toys are played with, as these use tangible objects which more closely resemble traditional, physical toys. It has also been suggested by De la Hera et al. that digital games can

lead to reinforcement of family relationships and increased understanding of the other generation. To investigate this, we will carry out semi-structured interviews with the grandparents and grandchildren, before and after the play session.
Keywords: Digital gaming, grandparents, intergenerational play, role reversal, smart toys, social interaction

As digital games become an integral part of children's play time, this research explores how grandparents – who are also engaging more with technology – can continue to connect with their grandchildren through play. Study 1 (N=44) used a self-report survey to measure grandparents' (55-85 year-olds) attitudes towards technology, intergenerational play, the use of technology to play with their grandchildren, and smart toys. Study 2 (N=8) utilised interviews and an observed play session with grandparent (58-70 year-olds) and grandchild (8-10 year-olds) pairs to further examine the key trends from Study 1, investigate the appeal of smart toys as hybrids of physical and digital play, and understand how the two generations interacted when using a smart toy. Grandparents were moderately open to using smart toys to play with their grandchildren; they cited their grandchild as the main influence on choosing this activity. Four key positive factors of smart toys were identified: (1) Tactile/sensory experience, (2) Reduced passive screen use, (3) Improved social interaction, and (4) Similarity to traditional board games, supporting previous research showing that tactile controls are preferred by older adults. In relation to role reversal theory as an aid for social interaction, it was found that grandparents presented themselves as the less knowledgeable partner but children did not take on a particularly strong mentoring role. The implications for our understanding of intergenerational, digital play using smart toys is discussed.

With the progression of the digital age, technology has become an established part of play and leisure activity for children. With 8 to 12 year-olds playing games on electronic devices for an average of 79 minutes a day (Common Sense Media, 2015, pp. 20), smart devices, games consoles and computers are essentially the toys of a digitally focused era.

But what does this mean for the grandparents of the children using these digital toys? As life expectancy increases and grandparents are able to be part of their grandchildren's lives for longer (Boon, Shaw & MacKinnon, 2008 cited in Costa & Veloso, 2016), this group represents a growing share of the population. This very valuable relationship also affords many social and emotional benefits, such as improved empathy and greater self-disclosure (Drury, Abrams & Swift, 2017).

For many years the two generations have enjoyed playing together with toys that are, on the whole, the same as the toys the grandparents themselves grew up with. A doll styled on a modern Disney character is still a doll; card and board games may have different rules, but a familiar set up. Unlike traditional toys that are relatively intuitive to play with, digital gaming introduces a usability barrier to any player who is new to the technology. The older adult needs to either be familiar with digital controls, or open to learning them, before they can take part.

It is therefore promising to find that the older generation is becoming more engaged with technology in recent years. In the US, the number of smartphone owners aged over 50 doubled between 2013 and 2016, and 67 per cent of older adults now have access to the internet compared to just 14 per cent in 2000 (Anderson & Perrin, 2017). Older adults also comprise a significant and growing segment of the gaming market across the US and Europe, as the young adult gamers from the days of the original console games such as the Atari (1977) approach their senior years.

Even so, children are often considered to be more digitally literate than the older generations. Known as the digital divide or generation gap, this is thought to be as a result of opportunity, rather than innate competence (Aarsand, 2007). Although the terms suggest separation between the age groups, research shows that the digital divide may actually promote social interaction between older and younger players, through role reversal.

In typical intergenerational interactions, the grandparent often leads as the carer or teacher (De la Hera et al., 2017; Zhang & Kaufman, 2016). But with digital play, the older person may position themselves as the less knowledgeable party, allowing the younger person to become the mentor (Aarsand, 2007; Costa & Veloso, 2016; Zhang & Kaufman, 2016; De la Hera et al., 2017). Aarsand's (2007, pp. 244) example of children teaching their grandparents, which buttons to use on the controller, describes how this social interaction is prompted through the exchange of knowledge.

Social interaction through digital gaming has been shown to have many benefits. In their meta-analysis of 16 empirical studies, De la Hera et al. (2017) categorised these into four groups: (1) reinforcing family bond, (2) enhancing reciprocal learning, (3) increasing understanding of the other generation and (4) reducing social anxiety. Costa and Veloso (2016) support these benefits in their discussion of the value of digital games for encouraging communication, solidarity, and social connectedness between the older and younger generations.

The present research was carried out to extend the understanding of the benefits of intergenerational digital play and the theory of role reversal. The majority of existing studies in this area have concentrated on computer and console games, with only a few exploring newer technology such as augmented or mixed reality (Khoo et al., 2007; Mahmud et al., 2010; Rice et al., 2013; cited in De la Hera et al., 2017, p. 5-6). Computers and games consoles are quickly losing favour amongst children in some areas of the world, including the UK and US, as preferences shift towards mobile games (Common Sense Media 2015, 2017; Ofcom, 2017). Consequently, up-and-coming technology needs to be considered in this area of research to ensure the findings continue to be relevant.

This research therefore focused on the relatively new yet fast-growing area of the mobile gaming industry – smart toys – sales of which are expected to triple

over the next five years (Juniper Research, 2017). Also known as 'connected toys' or 'Internet of Things toys', smart toys can be defined as, "toys featuring both tangible objects and electronic components that facilitate two-way child–smart toy interactions to carry out purposeful tasks" (Cagiltay, Kara & Cigdem, 2014). There is currently a minimal range of smart toys available, with some controlled predominantly by a screen (e.g. the app-enabled robot *Sphero*) and others by physical pieces (e.g. the *Osmo* gaming system).

Controllers have been identified as one of several accessibility barriers for older adults (Loos, 2014, cited in De la Hera et al., 2017, p. 13). Instead, it has been suggested that older adults would benefit from tactile controls (Costa & Veloso, 2016; De la Hera et al., 2017) or controls that require familiar physical actions, such as Wii Tennis, where players are required to swing the controller like a tennis racket (Abeele & De Schutter, 2010). It was therefore anticipated that smart toys controlled by physical pieces would be easier for grandparents to use compared to computers, games consoles or mobile devices.

Considering the appeal of technology for children and the indication that familiar, tactile controls would be preferred by older adults, it was proposed that smart toys – as hybrids of physical and digital play – would offer 'the best of both worlds' for grandparents and grandchildren. To understand the likelihood of the real-world adoption of smart toys the first stage of the research was used to find out whether grandparents would be open to using technology (including smart toys) to play with their grandchildren. The second stage of research then examined these attitudes further. Study 2 also explored how the generations interacted with the smart toy and each other, to gain evidence of appeal, usability for older adults, and the role reversal theory.

Study 1: Survey

Aims

Study 1 was a quantitative investigation into grandparents' interest in using technology to play with their grandchildren. In addition attitudes towards technology and intergenerational play were separately measured.

Due to the increasing use of technology by older adults (Anderson & Perrin, 2017), it was hypothesised that grandparents of children under the age of 18 would have a positive attitude towards using technology, indicated by an average score of 4 and above for the technology-related items in the survey. It was also predicted that grandparents of children under the age of 18 would consider using new technology (e.g. smart toys) to play with their grandchild, indicated by an average score of 4 and above for the related item in the survey.

Finally, it was expected that there would be a significant relationship between the grandparents' attitudes towards intergenerational play, and their interest in

using new technology (e.g. smart toys) to play with their grandchild; and also between grandparents' attitudes towards technology and their interest in using new technology (e.g. smart toys) to play with their grandchild.

Participants

Participants were 52 grandparents (38 female, 14 male) with at least one grandchild under the age of 18. The sample was accessed via one retirement/semi-retirement group, one grandparent-toddler group, and three children's groups in the East of England. Participation was on a voluntary basis with no compensation.

Participants under the age of 55, or over the age of 85, were excluded in further analyses (n=6). This was done to allow better comparison with previous research on intergenerational digital play (De la Hera et al., 2017). Incomplete responses (n=2) were also excluded. A total of 44 participants were therefore included in the final analyses.

Materials

A self-report survey was developed by the researchers consisting of 10 opinion-based items (e.g. "I feel confident using technology (e.g. computers, tablets)."), rated using a five point Likert scale (where 1= "Strongly disagree" and 5 = "Strongly agree"). To avoid potential bias by limiting responses to computer literate participants only, printed surveys were used.

Procedure

Individuals were approached and asked if they had any grandchildren under the age of 18, and if so, whether they would like to take part in a short survey about grandparents and technology. If they agreed, the participant was presented with an information sheet and consent form by the researcher, who read this through with them. Participants were given the information sheet to keep.

Once written consent had been obtained, the researcher gave the participant the survey to complete, with the option to do so presently or to take it home to return at the next session. Some participants completed the survey with help from the researcher or a friend, due to visual or mobility impairments that prevented them from reading or writing their answers.

Results

Attitudes towards technology

The survey scores relating to technology were neutral (Table 1), indicating that the participants enjoy using technology somewhat, are mildly confident using technology, and are interested in trying new technology to some extent.

Table 1. *Means and standard deviations of attitudes towards technology.*

Survey item (presentation order in brackets)	*M*	*SD*
(2) I am interested in trying out new technology (e.g. smart home products).	3.57	1.21
(5) I enjoy using technology (e.g. computers, tablets).	3.82	1.11
(6) I feel confident using technology (e.g. computers, tablets).	3.77	1.20

Attitudes towards using technology in intergenerational play

The survey scores for openness to using digital games or new technology as part of intergenerational play were moderate (Table 2), indicating that the participants have a neutral interest in using digital games (including smart toys) to play with their grandchild.

Table 2. *Means and standard deviations of attitudes towards technology in intergenerational play.*

Survey item (presentation order in brackets)	*M*	*SD*
(3) I enjoy playing with my grandchild using digital games (e.g. games consoles, tablet apps.).	3.11	1.15
(10) I would consider using new technology (e.g. smart toys) to play with my grandchild.	3.82	1.11

A Spearman's rank-order correlation found that grandparents who enjoyed digital gaming with their grandchild were more likely to be interested in technology, enjoy using technology, and feel confident in their digital skills (Table 3). No relationship was found between enjoyment of playing digital games with grandchildren and attitudes towards intergenerational play in general.

Participants were more likely to be open to using new technology to play with their grandchild, if they felt their grandchild enjoyed playing with them and they were confident entertaining their grandchild (Table 3). Additionally, participants were more likely to consider using new technology to play with their grandchild if they themselves enjoyed using technology and were interested in trying out new technology (e.g. smart home products).

Table 3. *Spearman's rank-order correlations for 'I enjoy playing with my grandchild using digital games (e.g. games consoles, tablets, apps)' (Digital gaming), and 'I would consider using new technology (e.g. smart toys) to play with my grandchild' (New technology play).*

	Digital gaming	New technology play
Survey item (presentation order in brackets)	r_s (42)	r_s (42)
(2) I am interested in trying out new technology (e.g. smart home products).	.613**	.474**
(5) I enjoy using technology (e.g. computers, tablets).	.553**	.502**
(6) I feel confident using technology (e.g. computers, tablets).	.387**	.274
(1) I enjoy playing with my grandchild.	-.138	.108
(4) I am confident entertaining my grandchild.	.275	.442**
(7) I feel that my grandchild enjoys playing with me.	.171	.449**
(8) I would like to play more with my grandchild.	.116	.035
(9) I enjoy playing with my grandchild using physical toys (e.g. puzzles, board games).	-.041	.148

** $p < .01$
*** $p < .001$

Discussion

Grandparents were found to have a neutral attitude towards technology in general, and towards using new technology (e.g. smart toys) to play with their grandchild. Despite the fact that these two hypotheses were not supported, it was interesting to find that older adults did not hold conversely hold negative attitudes towards technology, digital games and smart toys. Although there is no comparable data, it would be useful to revisit these attitudes in later studies, to understand if this is a changing trend.

There was a high level of disagreement between the participants on the technology-related items, indicating that both positive and negative attitudes both present, possibly due to demographic differences. Anderson and Perrin (2017) suggest that younger, more affluent and more highly educated seniors have a higher likelihood of owning and using technology, so comparison of these demographics in future research would be of particular value.

As predicted, there was a significant relationship between some attitudes towards technology and intergenerational play, and participants' interest in using new technology (e.g. smart toys) to play with their grandchild. This helps to illustrate the type of grandparent who is most likely to be open to adopting smart toys. An especially interesting finding was that grandparents who felt confident using technology had a more positive attitude towards playing digital games with their grandchild, yet there was no relationship between confidence and openness to smart toys. This suggests that older adults view the concept of smart toys as distinct from digital games, perhaps feeling that they are more familiar and less daunting to use in comparison.

Overall, it was also shown that grandparents did not reject the idea of using smart toys to play with their grandchildren. This suggests there is an opportunity to explore smart toys as a new form of digital, intergenerational play.

Study 2

Aims

Study 2 was a qualitative investigation of the attitudes identified in Study 1. It also explored the appeal of smart toys and tested the role reversal theory as demonstrated in previous research with digital games.

The study started by exploring how grandparents typically engaged with technology and digital games alone and/or with their grandchild; and why they may or may not play digital games with their grandchild.

Engagement with an example smart toy was then investigated. It was hypothesised that children would enjoy the digital aspect of the game due to high rates of screen use within this age group (Common Sense Media, 2015, pp. 20). It was also predicted that the physical controls would be appealing to grandparents (Abeele & De Schutter, 2010; Costa & Veloso, 2016; De la Hera et al., 2017).

To gather evidence to support the role reversal theory (Aarsand, 2007; Costa & Veloso, 2016; De la Hera et al., 2017; Zhang & Kaufman, 2016), it was expected that the grandparent would present themselves as the less knowledgeable partner when using a smart toy with their grandchild. It was also hypothesised that the grandchild would adopt a mentoring role when using a smart toy with their grandparent.

Participants

Participants were 4 grandparents aged 58-70 (2 female, 2 male) and 4 grandchildren aged 8-10 (2 female, 2 male) from the East of England. The children's ages were chosen to allow comparison with Aarsand's (2007) study investigating the digital divide with parents and grandparents. Grandparents were recruited from within the same age range as Study 1 for consistency.

The grandparents were contacted through a market research recruiter and asked if they would like to take part in a study about digital games, with their grandchild. Participation was compensated with a small cash incentive.

There was an equal mix of same-sex and opposite-sex pairs. All grandparent and grandchild pairs spent time together at least once a week. Grandchildren were all daily users of tablet and smartphone devices and grandparents played, or were open to playing, console or mobile games.

Materials

The smart toy used was *Beasts of Balance* (Sensible Object Ltd.), which could be played as a single player or as a collaborative multiplayer game. This toy was chosen because previous research indicated that older adults have a preference for intellectual challenges and collaborative games, over reflex-oriented and competitive games respectively (De la Hera et al., 2017).

Beasts of Balance consisted of a Plinth with a touch scanner, six scannable plastic Beast (animal-shaped) blocks, four types of scannable element blocks (earth, water, air and fire), and additional scannable artefact blocks that changed the Beasts in-game or added extra challenges (e.g. a timer). An iPad (with 9.7 inch screen) with the Beasts of Balance app pre-installed was connected to the smart toy. The app showed a digital habitat with sky, land, and an ocean.

Figure 1. Beasts of Balance smart toy (Fundamentally Children/Good Toy Guide).

Players were required to scan the blocks on the Plinth and stack them on top of one another. If the blocks fell down, players had a time limit in which to rebuild

the tower before losing the game (shown on-screen). Each time a block was scanned and added to the tower an effect was shown in the digital habitat, for example, adding a new Beast or increasing the number of points a beast had. The aim of the game was to add and evolve as many Beasts as possible, without the tower of blocks falling down.

To facilitate the first semi-structured interview, labelled play activity picture cards (see appendix) and a simple printed rating scale ('I don't enjoy playing this together', 'I enjoy playing this together', and 'We never play this together') were used. Two Go-Pro cameras were used to record the sessions.

Procedure

A researcher read through the information sheet and consent form with the grandparent participant, who provided written consent on behalf of themselves and their grandchild. Participants were given the information sheet to keep. A researcher also asked for verbal consent from the child.

Each grandparent and grandchild pair were first interviewed separately using a semi-structured approach. Participants were shown play activity picture cards asked to indicate which activities they did together and to what extent they enjoyed them. This was used to prompt discussion about the participant's likes and dislikes about the activities. If the participant indicated they had never engaged in digital gaming together, the researcher prompted them to explain why.

Participants then took part in a 20 minute play session. They were given the iPad and the Beasts of Balance smart toy in-box, and allowed to play a game. Aside from the instructions included in the box and on the app, researchers did not offer additional help unless participants appeared unable to play the game after several minutes. The researchers did not otherwise intervene or ask questions, and observed from a distance while participants played. Participants were left to reach a natural stopping point in their game before continuing to the next stage of the session.

Following the play session, a second semi-structured interview was carried out with each grandparent and grandchild pair. They were asked about their enjoyment of the game, the appeal of the digital and physical elements of the toy, and how the toy compared to traditional and digital games they had used before.

Researchers reviewed the video recordings and compared their observations to ensure inter-rater reliability. From this, common themes were identified relating to attitudes towards technology in intergenerational play, the appeal of the smart toy for both parties, and role reversal.

Results

Attitudes towards technology in intergenerational play

Choice of activity guided by grandchild, when playing with grandmother. Grandfathers preferred doing activities with their grandchild that they themselves enjoyed, whereas the grandmothers described getting their enjoyment from seeing their grandchild happy regardless of the activity. For example, a grandmother who used a walking stick said she played football with her grandchild by standing in goal, although she said she wasn't very good and didn't enjoy it herself.

Minimal use of digital games for intergenerational play. Grandparents and grandchildren did not play many, if any, digital games together. Participants typically spent time together at the grandparent's house, as the grandparent is usually helping out with childcare, or because of accessibility (grandparents unable to use the stairs at their grandchild's house). As a result, the pair rarely had access to a gaming device.

Grandparents do not own games consoles. Grandparents explained that they didn't own consoles because they never used them themselves. They also rarely had enough younger visitors to warrant having a console permanently set up, or to invest in new versions when their current console became outdated.

Grandchild's device typically used. Those who did play digital games together usually played on the grandchild's device, or sometimes the grandparent's smartphone or computer, on pre-installed games or games chosen by the grandchild.

Limited access to multiplayer digital games. Children and grandparents said they didn't own any multiplayer games, so digital play usually involved taking turns on a single player game. Both parties said could become boring as it meant long periods of simply watching someone else enjoy the game. Participants also cited this as a reason why they didn't play many digital games together.

Open to playing non-reflex based games. Grandparents were open to playing digital games with their grandchild, if their grandchild wanted to. Grandparents said they would be interested in playing some digital games with their grandchild, but would not want to play shooting or racing style games.

Pressure to adopt technology with ageing grandchild. It was suggested that as grandchildren got older they would become more interested in digital play, so the grandparents felt they would need to increasingly adopt technology to keep interacting with their grandchildren (Transcripts 1 & 2).

Transcript 1

> **Grandfather**: "I'm certain she'll move down this route [points to digital game picture cards] herself, because of her age group, the culture she's grown up in, and therefore in order to remain in contact from a, from a social point of view we're

probably going to have to follow along and have materials available in order to continue the interaction."

Transcript 2.

Grandfather: "I've learned a lot today, I've learned that I've got to get on top of this sort of thing, because as it gets more and more advanced he'll want to play more and more and I'll be left further and further behind."

Appeal of the smart toy

Children enjoyed the digital element. Children were increasingly motivated by the on-screen effects (such as animals gaining or losing points as blocks were added), expressing concern over endangered animals in their digital world and excitement about evolving their animals.

Tactile/sensory experience. The physical blocks seemed to particularly appeal to the grandparents because they had the same sensory impact as a physical toy, which grandparents felt could not be captured on a screen (Transcript 3).

Reduced passive screen use. Participants felt that the blocks brought the action and attention away from the tablet. Grandparents felt this was good, because they did not like the idea of their grandchild concentrating on a screen for long periods of time (Transcript 4).

Improved social interaction. Grandparents suggested that the physical element made the game more social (Transcript 3). Although children took over adding the blocks to the plinth, it was observed that the pairs used the blocks to communicate their thoughts and ideas (Transcript 6 & 7). When the tower collapsed, both players exchanged surprised glances and giggles.

Similar to traditional board game. Grandparents likened the smart toy to a board game, because of the physical blocks (Transcript 5). Therefore they did not feel that the smart toy controls were comparable to digital games.

Grandparents indicated an interest in competitive gameplay, particularly for grandfathers. One grandfather suggested he would lose interest in the game after a few plays, because it did not offer him enough of a challenge; he had previously commented that he would choose to play strategic digital games against other players to increase the level of challenge. Grandmothers suggested that the smart toy would be enjoyed by the child's grandfather, especially if it was competitive.

Transcript 3.

Grandfather: "This is, this is more interactive. This is what we touched on earlier with the social element, this provides a bit more because it's quite fun, where you see it collapse, everyone enjoys that. But when you see it collapse on the com-

puter, it doesn't have the same…[gestures to room]. Even, they might be able to recreate the noise, make the iPad move, they can do all that but, but it doesn't have the same sensory effect as it actually falling in front of you."

Transcript 4.

Grandmother: "The way the world's going I really think that, it is going more and more this way [digital] which I don't actually think is always a good thing. But, this [points to smart toy] is a much better solution than just sitting them in front of a tablet, where they are very much often isolated."

Transcript 5.

Grandfather: "I don't actually [mimes touching tablet screen] interact with the computer in that way so I, I'm happy using the mouse and the keyboard to give instructions, so this sort of activity even though it's a game and it's using computer technology as part of it, they're not related from my point of view. This is much more related to a physical game, almost like a board game with a, electronic support, rather than it being a computer game."

Role reversal

Grandparents provided support with reading and strategy. Grandparents supported children by reading the instructions (which were above the reading level for some of the participants), offering praise when the child succeeded, providing suggestions for the placement of the blocks, and acting as a sounding board for the child's ideas (Transcript 6).

Expectation of grandchild's superior digital competence. The grandparents tended to immediately pass the tablet device to their grandchild. Several commented that they (the grandchild) would be better at using the tablet device than themselves.

Grandparents avoided using the tablet device. Some participants said they found the on-screen instructions confusing, and/or ignored the screen element altogether. Instead, the grandchild took control of navigating the app.

Grandchildren supported grandparents with some digital steps. Children corrected their grandparent when they did something wrong, such as not scanning the block before adding it to the tower. After the play session, both grandfathers commented that they had needed more help than they had given, because they didn't understand how to use the tablet as competently as their grandchild (Transcript 7).

Transcript 6.

Grandfather: "So what one are you going to put on?"

Granddaughter: "Put this one on." [she picks up the octopus block]

Grandfather: "Where are you going to put it? Think about what you're going to put on after you've done that."

[Granddaughter puts octopus block on plinth]

Grandfather: "Okay, what else? Are you doing another piece, or…?"

Transcript 7.

Grandfather: "I felt I had to be taught. I think she wants to move faster than I do. And I think…there's an age element in here in that the layout of the screen, the icons they're using, she's more familiar with some of these functionalities than I am. So therefore she instinctively recognises elements on that screen that I have to think about."

Discussion

Grandparents rarely played digital games with their grandchildren because they had limited access to gaming devices, consoles, and multiplayer games that could be enjoyed by both players. This highlights the importance of the device that the game is available for and emphasises the value of developing multiplayer games appropriate for this niche market. Although the Nintendo Wii and Microsoft Kinect have been praised for their accessible gesture-based controls (Costa & Veloso, 2016), the current study suggests that grandparents may not wish to own these consoles unless they are confident they will be frequently used. Instead, the findings suggest that intergenerational games should be available to install on a grandparent's computer, or grandchild's tablet device.

As expected, the children engaged well with the screen-based aspect of the game. Although grandparents showed little interest in this digital world, they suggested that they would be guided by their grandchild's interests, so they would be happy to play a digital game if that is what their grandchild wanted to do. This supports Mahmud et al.'s (2009, cited in De la Hera et al., 2017) proposal that priority should be given to the preferences of the child in the design of intergenerational games.

Physical controls were also found to be appealing to grandparents, as predicted. Overall there were four key themes identified; (1) Tactile/sensory experience, (2) Reduced passive screen use, (3) Improved social interaction, and (4) Similarity to traditional board games. For the older adults, the physical controls brought the game to life outside of the screen and made the experience more enjoyable, interactive and social. The belief that the smart toy was more comparable to a board game than a digital game may indicate that grandparents felt the physical controls were intuitive. This complements existing research that suggests tactile controls requir-

ing familiar actions are particularly suitable for digital intergenerational play (Abeele & De Schutter, 2010; Costa & Veloso, 2016; De la Hera et al., 2017).

In support of the role reversal theory (Aarsand, 2007; Costa & Veloso, 2016; Zhang & Kaufman, 2016; De la Hera et al., 2017), grandparents presented themselves as the less knowledgeable partner when using the smart toy with their grandchild. Children were expected to also take a mentoring role, as described in previous research (Aarsand, 2007; Costa & Veloso, 2016; Zhang & Kaufman, 2016; De la Hera et al., 2017), but this was not strongly demonstrated in the current study.

The lack of mentoring from the grandchildren could due to the fact that, unlike with other digital games, the grandparent's ability to use the digital controls had no impact on the child being able to play the game. Thus, there was no motivation for children to provide guidance. Grandparents liked that they were able to play the game without having to use the tablet device and the physical controls allowed them to do this. However, it did seem to discourage role reversal and so may have implications for the social interaction this would be expected to encourage. It is important that future research serves to understand this in more depth.

Conclusion

Recognising the role of digital games in children's lives today, this research set out to explore how this could be used to the advantage of grandparent and grandchild relationships, rather than something that widens the digital divide between the generations. The first study sought the attitudes of grandparents towards technology and intergenerational play and the second study expanded on these opinions, while also investigating whether smart toys could bridge the gap between physical and digital play.

Implications

Taken together, the studies show that smart toys could indeed be the future for intergenerational play. Having found a moderate interest in using smart toys for intergenerational play (Study 1), further investigation showed that this is likely to be influenced by the grandchild's interests (Study 2). A concurrently interesting and concerning discovery was that grandparents appeared to feel almost pressured to adopt technology through the fear of missing out on their grandchild's life as they grew older (Study 2). This strongly supports the argument for the development of more digital games and toys that are suitable for intergenerational play, but it also indicates a potentially delicate social issue that should be dealt with empathetically.

Surprisingly, grandparents' confidence using technology was linked to a positive attitude towards playing digital games with their grandchild – but the same

relationship was not found for smart toys (Study 1). Grandparents also suggested that the example smart toy used was more comparable to a board game than a console or computer game (Study 2). It is therefore possible that smart toys are perceived to be more familiar and intuitive than other digital games.

It is hoped that having shown the mutual appeal of smart toys for grandparents and grandchildren, this research will inspire further exploration of smart toys for intergenerational play and convince product developers of the value of designing for an intergenerational market. With increased access to technology designed to be simultaneously enjoyed by the young and old, older adults can stay connected both socially and digitally.

Limitations

Due to the method of recruitment and limited access to the population, males were not equally represented in Study 1. Additionally, openness to using smart toys may be influenced by the grandparent's age, affluence and level of education (Anderson & Perrin, 2017). Prospective research should use a larger sample size that allows for comparison of these demographics.

Furthermore, Study 2 focused on one smart toy as an example, but additional studies could explore other smart toys with different gameplay styles and controls (e.g. the voice-controlled Google Home quiz). The current research also concentrated on appeal, although technology has much more potential than this. For example, games consoles enable people from all over the world to play together; a toy that could be played with in a similar way could have huge potential for grandparents and grandchildren who live far apart from one another.

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References

AARSAND, P.A. (2007). Computer and Video Games in Family Life: The digital divide as a resource in intergenerational interactions. *Childhood*, 14, pp. 235–256.

ABEELE, V., & DE SCHUTTER, B. (2010). Designing intergenerational play via enactive interaction, competition and acceleration. *Personal and Ubiquitous Computing*, 14(5), pp. 425-433.

ANDERSON, M. & PERRIN, A. (2017). *Tech adoption climbs among older adults.* Pew

Research Center, <http://www.pewinternet.org/2017/05/17/technology-use-among-seniors/>

CAGILTAY, K., KARA, N., & CIGDEM, C. (2014). Smart toy based learning. in J. M. Spector, M. D. Merrill, J. Elen, M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (4th ed. pp. 703-711). New York, NY: Springer.

COMMON SENSE MEDIA (2015). *The common sense census: Media use by tweens and teens*, <https://www.commonsensemedia.org/sites/default/files/uploads/research/census_researchreport.pdf>

COMMON SENSE MEDIA (2017). *The common sense census: Media use by kids age zero to eight.* <http://cdn.cnn.com/cnn/2017/images/11/07/csm_zerotoeight_full.report.final.2017.pdf>

COSTA, L., & VELOSO, A. (2016). Being (grand) players: review of digital games and their potential to enhance intergenerational interactions. *Journal of Intergenerational Relationships*, 14(1), 43-59.

DE LA HERA, T., LOOS, E., SIMONS, E. & BLOM, J. (2017). Benefits and Factors Influencing the Design of Intergenerational Digital Games: A Systematic Literature Review. *Societies*, 7, 18

DRURY, L., ABRAMS, D., & SWIFT, H. J., (2017). *Making intergenerational connections: What are they, why do they matter and how to make more of them.* London: Age UK

FUNDAMENTALLY CHILDREN/GOOD TOY GUIDE. *Beasts of Balance.* Accessed 30 November 2018 <https://www.fundamentallychildren.com/toy/beasts-of-balance/>

JUNIPER RESEARCH (2017). *Juniper Research: Smart Toy Sales to Grow Threefold to Exceed $15.5 Billion by 2022.* <https://www.prnewswire.com/news-releases/juniper-research-smart-toy-sales-to-grow-threefold-to-exceed-155-billion-by-2022-628177033.html>

OFCOM (2011-2017). *Devices available to children in the home in the United Kingdom (UK) from 2011 to 2017.* <https://www.ofcom.org.uk/__data/assets/pdf_file/0020/102755/adults-media-use-attitudes-2017.pdf>

ZHANG, F. & KAUFMAN, D. (2016). A review of intergenerational play for facilitating interactions and learning. *Gerontechnology*, 14(3), 127-138

APPENDIX

Study 2 activity picture cards.

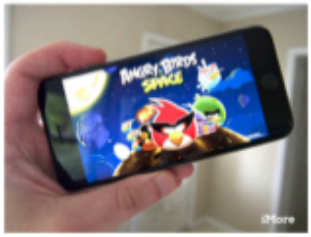
Card game

Arts and Crafts

Outdoor game
(e.g. football, tennis)

Puzzles

App (Phone or Tablet)



Games console

Computer games

Board game