Yamada-Rice, D. (2019) Including children in the design of the internet of toys. In: Mascheroni, G. & Holloway, D. (eds) *The Internet of Toys: Practices, Affordances and the Political Economy of Children's Smart Play*. Studies in Childhood and Youth, Palgrave.

Chapter 10: Including Children in the Design of the Internet of Toys

Dr Dylan Yamada-Rice, Royal College of Art

Introduction

Like previous work in the field of co-design with children (Bruckman & Bandlow, 2003; Jones, McIver, Gibson, & Gregor, 2003; Williamson, 2003), this chapter seeks to ask: 'How can the ideology and practice of participation improve design practices?' (Lee, 2008, p. 34) and thus produce better products. In the case of the specific focus here, this is in relation to improving the quality of digital and connected toys by better matching design to children's play patterns and interests. To make this point the chapter draws on three different collaborative research projects in which I have considered children in relation to the design of digital play. Through the sharing of specific insights from the findings of these three projects, I advocate that there are benefits in considering toy design and play in relation to one another (Nesset & Large, 2004). Further, this is better done by positioning the child as a knowledgeable and able partner in this process (Carsaro & Molinari, 2017; Roberts, 2017). In order to achieve this, the chapter is structured first to review past literature about designing digital play and second in the area of co-design and participatory research with children.

Following the literature review, the remainder of the chapter is divided into sections that outline one key design-related finding from each of the three separate research projects. These are projects that considered (1) the extent to which children's use of a connected toy matched the designers' intentions, (2) how children can be included in the early stages of digital games design, and (3) children's making in the context of Virtual Reality (VR), a rapidly emerging form of digital play. These three studies are used to show how children's play and design should be mapped more carefully to one another. Specifically, that there are differences between designers' intentions and children's use. Second, children are experts in play and can therefore make a very valuable contribution to design. Third, adults' and children's use of cut- ting edge play technology (in this case VR) are different from one another. This is particularly important because technology is usually developed for adults first and then this is used as a benchmark for younger users. Collectively, these findings are used to emphasise the value of including children in the design process of connected toys.

Designing Digital Play

In an earlier publication (Yamada-Rice, 2018), I drew on theories of object orientedness (Kaptelinin, Nardi, & Macaulay, 1999), object ethnographies (Carrington, 2012), artefactual literacies (Pahl & Rowsell, 2010) and material stuff (Miller, 2008, 2009; Shove, Watson, & Hand, 2007) to show how the design of digital toys and content, and the materials used, can be framed as having equal agency in play to the child. In other words, digital play is the product of two agency-bearing halves, that of product/content and that of the player. 'Knowing', in this case understanding children's use of digital toys and play, necessitates looking beyond the child and his/her use to that of the 'matter' of the play as well. We must do this, Barad (2003) says, because 'practices of knowing cannot be fully claimed as human practices, not simply because we use non-human elements in our practices but because knowing is a matter of part of the world making itself intelligible to another part' (p. 829). With regard to digital play specifically, Giddings and Kennedy (2008) also support Barad's ideas:

…that the distinct nature of video game play is generated in the intimate and cybernetic circuit between the human and the nonhuman.
(Giddings & Kennedy, 2008, p. 15)

Applying this theory to gaming practice, Giddings and Kennedy (2008) describe how accomplished gamers should not be solely defined as highly skilled. Instead, the authors ask the reader to consider a perspective in which decentring the human can show how highly skilled gamers are not necessarily gaming geniuses but rather the:

> …game has thoroughly and completely mastered him [the player], it had taught his fingers the precise micro-movements needed to fulfil its intentions (continued play), and had imprinted on his brain cognitive analogues of its virtually mapped game world. The player is mastered by the machine. We would argue that this mechanic language should not only be read metaphorically. Gameplay is an intense event, a set of intimate circuits between human bodies and minds, computer hardware and the algorithms and affordances of the virtual worlds of videogames.
>
> (Giddings & Kennedy, 2008, p. 15)

These ideas are also shared by others, such as Pérez Ferrer et al. (2016). Thus if children are as much being 'played with' by the game, i.e. by the 'affordances', those are the properties of the game (Norman, 2013); as they are playing with the game then it seems logical that there would be benefits to including children in the design of digital play in order to enable the production of connected toys that better suit child-users. The next section outlines previous literature on children in the co-design process in order to set the context for including them specifically in play design.

Co-design with Children

Continuing to draw on the perspective that digital play is as much a combination of tools as it is of humans, Pérez Ferrer et al. (2016) show how we are currently in an era where 'recent technological advances have enabled large numbers of people to express themselves creatively, who perhaps would not have been able to do so previously' (p. 19), and as a result there have been a number of software applications written that have allowed non-specialists to partake in creating simple video games, such as *Scratch* for children of school age. This, Pérez Ferrer et al. (2016) state, is the 'democratisation of Game Design, i.e. bringing the ability to create digital games to a much broader section of society' (ibid.).

Within the context of design in general, there have been attempts to include users in the design process ever since 'an international conference entitled 'Design Participation' in 1971' encouraged and popularised the process (Lee, 2008, p. 31). Williamson (2003) states that, initially, children were included in the design of technologies as 'testers' of prototypes and end products. In more recent years, there has been an increasing interest in including children in the earlier processes of design. For example, Van Mechelen (2016) produced a tool kit for 'designing technologies with and for children'.

Different methods have been suggested as to the best means to include users in the design process. Lee (2008) states this can vary from the designer having full power through to every part of the process being undertaken collaboratively by both designer and user. With regard to children specifically, Love, Gkatzidou, and Conti (2016) suggest the use of three particular methods: a co-design workshop that draws on principles from participatory design, future workshop techniques and rich pictures with regard to the co-design of technology. Specifically, Nesset and Large (2004) outline four roles children can have in the design process: user, tester, informant and/or design partner. Van Mechelen (2016), on the

other hand, writes that children are 'especially useful to generate ideas and co-construct knowledge at the early, fuzzy stages of the design process where the design problem is still being defined' (p. 4).

Following on from the work of these researchers, the rest of this chapter presents findings from three different studies. These findings illustrate what I have learnt from including children in the design of digital play in a variety of roles. These are (1) as testers of a connected toy with the findings being considered in relation to the designers' intentions for their toys, (2) as co-designers in the early stages of game development similar to that used by Van Mechelen (2016), and (3) as informants to the design of play for emerging technologies. Findings and discussion from the three sections show how design and children's role in it should be considered an integral part of academic studies on connected toys and digital play, as well as form part of commercial processes in the production of these toys.

Children as Expert Testers of Digital Play Design

This section discusses a study undertaken during a short-term scientific mission as part of the COST Action DigiLitEY, which is a European network researching young children's digital literacy practices. The project considered the extent to which the design intentions of Justyna Zubrycka and Matas Petrikas for a digitally connected wooden doll known as Avakai (Fig. 1) were taken up during play by a group of young children.

Data for the study were collected through a series of interviews and conversations with the two designers and then comparing their answers with observations of 4–6-year-olds playing with the Avakai in an after- school setting in a Northern city of the UK. As discussed in more detail in Yamada-Rice (2018), the findings of the study showed that children's use of the toy coincided with the designers' intentions at some points, but in others, children used the Avakai in ways that had not been considered by the adult-makers. This section focuses on two ways in which the toy was used that had not been accounted for by the designers. These examples illustrate that children have expertise and imagination beyond that of adult-designers and toy manufacturers, which if listened to could be fed into the design process in order to produce products that better match children's play practices.

Fig. 1 Avakai

Justyna and Matas designed and built a heart into each Avakai. When the doll is picked up, the heart can be felt beating through its wooden body. Further, when two Avakai come into contact their hearts beat faster, simulating an emotional response to their connection. While watching the children play it became obvious that the design of the heart intrigued them as much as the designers had hoped. However, not in the exact way they intended. The children anticipated the heart's function in relation to their own. One boy picked up the Avakai and started to run with it, doing laps of the room and trying to raise its heartbeat. As the boy became more and more out of breath he checked the heartbeat to see if its rate had increased, but the speed at which it beat remained constant. In the end, the boy declared the Avakai strong, like an athlete, who was unaffected by racing around the room. The fact that the heart rate did not change did not seem to affect this child's play. However, this observation opens up questions about whether if the Avakai's heart had responded in the way the boy anticipated the product might have produced an entirely different type of play—perhaps one better connected to children's practices. In other words, if we take the ideas of Giddings and Kennedy (2008), that digital play is a unique connection between technology and humans, then we must also con- sider that adult-designers and child-users might make these connections in different ways from one another. This is an idea that is also supported by Mazzone, Read, and Beale (2011):

> A User-Centred approach is recommended in the design of novel technology for children in order to reduce the discrepancy between the system conceptual model, defined by adult designers, and the mental model of children users.
>
> (Mazzone et al., 2011, p. 1)

Another example is the way in which the designers embedded speakers into the Avakai doll in a place that made them seem to the children as though they represented ears. The speakers disseminate sounds based on emotional responses to movements made with the doll. For example, if an Avakai is shaken it makes a noise representing annoyance.

One girl in the study became very attached to the Avakai. At the end of the first day, she whispered 'I love you' into one ear (speaker) of the Avakai she had been playing with. On consecutive days, I saw her whispering into the doll's speakers in an inaudible hushed voice. This example illustrates how for this one child, at least, the placement of the speakers in the location of the ears meant she perceived them like her own, in that they were for receiving sounds rather than output- ting them. When I reported this finding back to one of the designers, Justyna, she immediately saw ways in which the finding could be incorporated into the doll's design, such as by creating a means of recording sound to allow the doll to be played with in a way that fitted with how this one child had used the doll.

The two examples shared in this section show how, as Barad (2003) proposes, it is important to consider the 'matter' of children's play in order to fully understand a child's use. In this project, the design intentions were known first-hand and so this made it easy to compare them to the children's uptake. The practice of user-testing in commercial play development is not uncommon, but it tends to be undertaken rapidly by market researchers who fund research differently from academia. What this section shows is that academic experts in play have knowledge and resources to map children's use and design together in other ways. Thus, if detailed observations of children's play with objects of the Internet of Things are undertaken, they can allow the design of toys to potentially better reflect the play practices of the children they are aimed at. The next section goes a step further to suggest that not only is the 'matter' of digital play important but that children could be involved in designing it.

Children as Co-designers in the Early Stages of Game Development

The study discussed in this section was funded by the Higher Education Funding Council for England, and it took the form of an industry sabbatical to explore the possibility of including children in the design of video games. At the time of the study, I was a full-time academic lecturing in Early Childhood Education. My research to this point had primarily been concerned with how children use digital tools for play. In other words, I was a researcher working at the end of the design process looking at children's use of products already on the market. During these earlier studies, I often had questions about why certain design decisions were made. For example, if I found a design feature that children didn't like or couldn't use, I wondered how it had materialised. Was it because of limitations in the technology? A financial decision? Or a lack of understanding of young children on the part of the developers? Just before the start of the project I met Peter Robinson, Head of Global Research at Dubit, a company specialising in research on and development of digital play for children. Peter talked to me about the different research processes Dubit used at the time to ensure the best

possible products were being made for children. We had different ideas about the possible usefulness or limitations of regularly including young children in the design of digital products being made for them. To this end we undertook a very small-scale project working with three children aged 5–6 years old to explore what would happen if we included them in the initial design process.

In creating the project methodology, Peter and I positioned the children in the study as experts in their play lives, as many researchers before us had done (e.g. Corsaro & Molinari, 2017; Roberts, 2017). We started by explaining to the child-participants that Peter worked for a digital games company and that we were exploring ways in which children could help make the design of digital play better. All three children were very excited to meet someone who worked for a digital games company and positioned him as an expert in an industry that they held in high esteem. On the days Peter was unable to join the research sessions the child-participants expressed disappointment and sought reassurance that they would meet him again. I took this interest as an early indication that, because digital play is an integral part of most children's lives, they were interested in how the products they use were made and were excited to be included in the process.

Each child was lent a tablet for the duration of the project and we started by asking them to take photographs/videos of the kinds of digital and non-digital play they enjoyed outside school. We then inter- viewed each participant separately about their physical and digital play using photographs they had recorded as prompts. After this they were asked to choose a collection of themed apps to test until we met again when they were asked what they liked and disliked about the products. The collections offered included groups of apps within the following themes: superheroes; music; food and cooking; art; and animals.

One of the reasons for doing this was to determine if the children would choose a theme that related to their wider play interests and, if they did, whether they could be seen as 'experts' who could bring a highly informed opinion to the design of digital play in that specific area. For example, Peter and I questioned whether or not a child who classified themself as having an interest in animals would also have good insights into how to improve an app with an animal theme. If this proved to be the case, we concluded it would be a straightforward way to work out which children to draw on in relation to the design of specific products. Thus, it would potentially be easier to include children in established commercial digital play development practices. For as Mazzone et al. (2011) and Van Mechelen (2016) state, we also recognised that including children regularly in the design process

necessitates the creation of a framework to simplify their involvement and bring about useful results. This should include decisions about the key points in the process for inclusion and a list of best methods for co-designing at specific ages.

The findings which emerged from our thematic analysis (Braun & Clarke, 2006) showed that all three children had threads of interest that linked their physical and digital play. One girl chose the category of apps within the theme 'Art'. Her reasons for doing so related to her interest in drawing. She described how art was part of her home life and that her mum was really good at drawing fonts. She gave specific examples, such as asking me if I knew the Twentieth Century Fox logo and then telling me that her mum can draw it exactly how it looks. The second girl similarly chose art-themed apps. The data about her physical play suggested that, as with the first girl, these matched her other interests. She took many photographs with the tablet and said that ordinarily she liked taking photographs, especially of herself and her family. She also liked to read and write and stated that she loved creating mysteries and had watched and read all the Harry Potter books except the last one, which she did not want to start because it would mean bringing the series to an end. The only boy in the study was very interested in digital gaming and also liked to read comics. He chose to use the super- hero-themed apps, which seemed connected to this theme.

Young children having thematic interests that they explore across different domains and platforms of play relates to findings of other research I have undertaken (Yamada-Rice, 2014). As a result, it seems to suggest that children can be seen as experts in relation to specific themes of play in the way Peter and I had anticipated. Thus, unlike the findings of Love et al. (2016), who found that the inclusion of children in the design of new technology can be challenging because they have a more difficult time verbalising their thoughts than adults, the three children in this study were very knowledgeable in seeing links across their physical and digital play and as a result could easily articulate how a game following that particular theme could be made more enjoyable. As a result, children, even those young in age like the ones in this project, could be valuable contributors to the early stages of game design.

The final section discusses children's use of VR and how their under- standing of the medium, and how it is different to other media, illustrates that children could be useful partners in the design of emerging technologies and play in its earliest stages of development.

Children as Informants to the Design of Play for Emerging Technologies

This final section focuses on the importance of including children in the earliest stages of emerging forms of digital play, in this case VR. In doing so, I show how children's needs and uses of emerging forms of digital play are likely to be different from adults'. This is important, given that content for new technologies is usually developed for adults first, then this knowledge is applied to products aimed at a child-market.

The findings discussed in this section are drawn from my involve- ment with Deborah Rodrigues and Justyna Zubrycka on the German part of an EU-funded project called MakEY, about young children and Makerspaces. Deborah runs her own company called Glück which provides tech and play workshops in various locations around the world, where she teaches children how to create with physical and digital materials. Justyna, as outlined in the first case study, is the designer of the connected toy called Avakai. Our ideas for the German part of the MakEY project developed from one of the findings from a study looking at children's engagement with VR (Yamada-Rice et al., 2017), in which children wanted to play across physical and vir- tual spaces. Thus we sought to explore children's play and making across physical and virtual spaces. Specifically, Deborah produced a virtual world based on Avakai dolls designed by Justyna. We asked children to use physical materials to design something that might be of use to an Akakai in the virtual world. All participants created an object that related directly to the virtual Avakai world and were able to articulate clearly how the object did so. For example, Fig. 2 shows the creations of two of the research participants, one created a rocket for the Avakai and the other made a mirror.

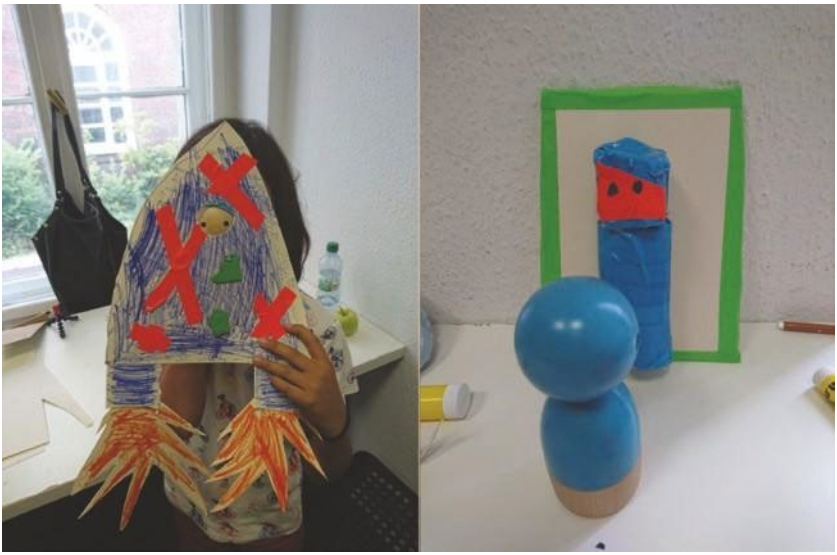

Fig .2 Physical making for the Avakai
These examples show how children were able to produce physical objects that directly related to the design of VR content and also imagine how they would play across both domains. Using this finding as a starting point we explored differences and similarities in children's play and making in physical and virtual contexts.

Children were asked to recreate their physical models by using the application *Google Tiltbrush* to create within a virtual world. Children immediately picked up differences in creating with physical and vir- tual materials. For example, the boy who had created the rocket showed frustration at not being able to make it look as abandoned as the physical rocket he had made when using virtual tools:

Boy trying to create a broken and abandoned looking rocket: "You can't get black on here. It comes out like that [sparks of blue light shoot out everywhere]."
Researcher 1: "Because it [the VR environment] is dark." Researcher 2: "How about the yellow?"
Boy: "The yellow? This is like an Orange."
Researcher 2: "Oh, OK. How about a green? Remember how sometimes when metal goes rusty it goes green?"
Boy: "Yeah, like coins." Researcher 2: "Yep."
Boy: [showing frustration]: "You can't see it here."
Researcher 2: "You can walk around, you don't need to stay in the same place always. Walk around."
Boy: "Yeah but how would you make it [the rocket he has drawn] more abandoned?"
Researcher 2: "More abandoned?"
Boy: "Yeah, so it's got like more cracks in it."

In the above example, the child tried to create in the VR world using very similar techniques he had employed with his physical creation. Similarly, another boy tried to recreate a character he had drawn with pen and paper in VR and become frustrated by the three-dimensional space. This is because, unlike drawing on a physical material, there was nothing to resist the pressure of his virtual drawing tool, so when he drew a line in *Tiltbrush* it was impossible for his next line to begin where the last had ended and join it exactly. Therefore, his physical colouring technique could not be employed in VR. The difficulties both children experienced showed how they began to understand and critique the affordances of VR in relation to how they differed from the physical environment and other media they had used. Unlike in the co-design project described in the last section, children found it harder to apply their play skills and expertise across the physical and digital (in this case VR) domains.

An unexpected finding was to discover that including children in the early stages of new technology development allowed them to begin to understand its affordances, how it worked and thus start to critique the con- tent. This is unsurprising given that the anthropologist Tim Ingold (2013) writes that making builds an active connection between thinking and knowing and that we humans have forever learned about the world through our hands. The examples show how including children in the design of digital play with emerging technologies can provide insights into how their use of the medium matches what is known about

their play on other platforms, or in this case the physical environment. It also informs design aspects specifically needed for children. For example, each child in this study could have benefitted from better onboarding that allowed them to understand that, unlike other forms of drawing, they could fully immerse themselves in their compositions, such as by walking amongst their virtual brushstrokes. Also, that drawing with light has properties that do not replicate those of physical materials.

Conclusion

The examples given from the three studies included in this chapter show that there is still scope for investigating how best to include children in the design process. In particular, as new forms of digital play emerge, such as VR, existing methods from previous studies (e.g. Van Mechelen, 2016) might need to be adapted or abandoned for new ones. Nonetheless, it seems likely that, in all circumstances, 'due attention will need to be given for how to 'scaffold children's creative abilities' into the [design] process' (Van Mechelen, 2016, p. 16). This scaffolding approach is also shared by Mazzone et al. (2011) who propose a frame- work for doing so. Once this is established, the examples shared here, along with others that have gone before, such as those from Nesset and Large (2004), suggest there are strong benefits in including children in the design process and that these outweigh any negatives, such as cost. Including children in the design of the Internet of Toys is therefore no exception. For example, in relation to observing them as end-users of designs, such as in the first study with the Avakai doll, it is possible to elicit valuable ideas for the development of digital toys and play. In that particular case, this related to how the doll could include a voice- recording device or making the heart beat differently depending on how the doll is moved. The second study showed how children can be positioned as expert advisers on digital play that relates to their phys- ical interests and thus have ideas which they can clearly articulate on the importance of different game mechanics for the enhancement of the product. Finally, the last case study showed how children explore the affordances of new types of digital play and provided findings that call for adequate on-boarding of children within this process.

There are benefits not only for digital play developers but also for the children included in the design process. First, the empowerment brought about by recognising them as experts in their own play practices builds confidence. Second, by allowing them to gain insights into the processes of the digital games industry, they have an opportunity to decide if they may wish to work in game design when they become adults. Including children also allows them to have digital products that better match their needs. Finally, it allows children to be critical of digital content and toys.

References

Barad, K. (2003). Posthumanist performativity: Toward an understanding of how matter comes to matter. *Journal of Women in Culture and Society, 28*(3), 801–831.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101.

Bruckman, A., & Bandlow, A. (2003). Human-computer interaction for kids. In *The human computer interaction handbook*. Hillsdale, NJ, USA: Erlbaum Associates Inc.

Carrington, V. (2012). 'There's no going back': Roxie's IPhone®: An object ethnography. *Language and Literacy, 14*(2), 27–40.

Corsaro, W. A., & Molinari, L. (2017). Entering and observing in children's worlds: A reflection on a longitudinal ethnography of early education in Italy (Chapter 1). In P. Christensen & A. James (Eds.), *Research with children: Perspectives and practices* (3rd ed.). Abingdon: Routledge.

Giddings, S., & Kennedy, H. (2008). Little Jesuses and *@#?-off robots: On cybernetics, aesthetics and not being very good at Lego Star Wars. In Swalwell & J. Wilson (Eds.), *The pleasures of computer gaming: Essays on cultural history, theory and aesthetics* (pp. 13–32). Jefferson, NC: McFarland.

Ingold, T. (2013). *Making: Anthropology, archaeology, art and architecture*. London: Routledge.

Jones, C., McIver, L., Gibson, L., & Gregor, P. (2003). Experiences obtained from designing with children. In *Proceedings of the 2003 conference on inter- action design and children* (pp. 69–74). Preston, UK.

Kaptelinin, V., Nardi, B. A., & Macaulay, B. C. (1999). Methods & tools: The activity checklist: A tool for representing the 'space' of context. *Interactions, 6,* 27–39.

Lee, Y. (2008). Design participation tactics: The challenges and new roles for designers in the co-design process. *Co-design, 4*(1), 31–50.

Love, S., Gkatzidou. V., & Conti, A. (2016). Using a rich pictures approach for gathering students' and teachers' digital education requirements. In L. Little, D. Fitton, B. Bell, & N. Toth (Eds.), *Perspectives on HCI research with teenagers: Human-computer interaction series*. Cham: Springer.

Mazzone, E., Read J. C., & Beale R. (2011). Towards a framework of Co-design sessions with children. In P. Campos, N. Graham, J. Jorge,
N. Nunes, P. Palanque, & M. Winckler (Eds.), Human-computer interac- tion—*INTERACT 2011*. Lecture Notes in Computer Science (Vol. 6949). Berlin and Heidelberg: Springer.

Miller, D. (2008). *The comfort of things*. London, UK: Polity Press. Miller, D. (2009). *Stuff.* London, UK: Polity Press.

Nesset, V., & Large, A. (2004). Children in the information technology design process: A review of theories and their applications. *Library & Information Science Research, 26,* 140–161.

Norman, D. A. (2013). *The design of everyday things* (Revised and Expanded Edition). Cambridge: MIT Press.

Pahl, K., & Rowsell, J. (2010). *Artifactual literacies: Every object tells a story*. New York: Teacher's College Press.

Pérez Ferrer, B., Colton, S., Powley, E., Krzywinska, T., Ceelhoed, E., & Cook, M. (2016). *Gamika: Art-based game design.* The MetaMakers Institute, Falmouth

University, UK. Available online at http://ccg.doc.gold.ac.uk/ccg_old/papers/perezferrer_artgames2016.pdf. Accessed 1 May 2018.

Roberts, H. (2017). Listening to children: And hearing them (Chapter 8). In P. Christensen & A. James (Eds.), *Research with children: Perspectives and practices* (3rd ed.). Abingdon: Routledge.

Shove, E., Watson, M., Hand, M., & Ingram, J. (2007). *The design of everyday life*. Oxford and New York: Berg.

Van Mechelen, M. (2016). *Designing technologies for and with children, a tool kit to prepare and conduct codesign activities and analyse the outcome*. Mint Lab. Available online at https://soc.kuleuven.be/mintlab/blog/wp-content/uploads/2017/01/CoDesign-Toolkit-Van-Mechelen-2016-highRes-II.pdf. Accessed 1 May 2018.

Williamson, B. (2003). *The participation of children in the design of new technology*. Paper, Nesta Futurelab, Bristol, UK.

Yamada-Rice, D. (2014). The semiotic landscape and three-year-olds' emerging understanding of multimodal communication practices. *Journal of Early Childhood Research, 12*(2), 154–184.

Yamada-Rice, D. (2018). Designing play: Young children's play and communication practices in relation to designers' intentions for their toy. *Global Studies of Childhood, 8*(1), 5–22.

Yamada-Rice, D., Mushtaq, F., Woodgate, A., Bosmans, D., Douthwaite, A., Douthwaite, I., … Whitley, S. (2017). *Children and virtual reality: Emerging possibilities and challenges.* Available online at http://childrenvr. org. Accessed 1 May 2018.