

Chapter 7 An Ecological Exploration of the Internet of Toys in Early Childhood

Everyday Life

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Introduction

The IoToys are the latest in a long line of technological developments that have permeated children's lives (Mascheroni & Holloway, 2017). Computers and screen-based media no longer monopolise young children's engagement with the Internet; rather, children's tactile toys and artefacts are connecting children to the virtual world. These advances continue to raise questions about the role of technologies in children's lives, reinvigorating the relevance of Craft's (2013) discussion of Childhood in a Digital Age as either passive/ at risk or empowered. Similar to James & Prout's (2015) theory, her focus is on how childhood as a construct is changing rather than on examining how play/ learning are changing with the introduction of technology (Marsh et al., 2015; Stephen & Edwards, 2017; Yelland, 2015). It provides a broad, holistic analysis of the notion of child and childhood to underpin this chapter. Thus, here, we seek to understand this image of the child in the broader, socio-ecologically mediated digital world.

Throughout this chapter, the focus is on the importance of children's agency in their use of the Internet of Toys (IoToys). We think about children's capabilities as part of digitally

mediated social worlds. Informed by a socio-ecological model, children's, practitioners' and parents' dispositions help to contextualise the factors that shape children's use of IoToys.

We provide the following key messages throughout the chapter:

1. A discussion of passivity or empowerment as part of children's digital lives with IoToys, in line with Craft's (2013) work.
2. A reanalysis of perceptions of childhood in the digital age, linking to the sociological models of childhood and the role of children as competent and agentic.
3. An account of socio-ecological influences on digital lives, likened to Rogoff's (2008) three planes relating to individual, interpersonal and community, alongside a discussion of how the interpersonal plane can be reimagined to include interactions between child and machine.
4. A note of caution against a passive child agenda and recurrent moral panic.

While previous research has acknowledged that children are part of complex socioeconomic and technological systems informed by political factors (e.g. Stephen & Edwards, 2017), few attempts capture the holistic, and often messy or complicated, ecological discussions of childhood. The ecological discussions presented thus far offer Bronfenbrennian-style discussions of children in the virtual world (e.g. Johnson & Puplampu, 2008; Wang, Berson, Jaruszewicz, Hartle, & Rosen, 2010), where clear boundaries of separation are presented between systems. They are useful in helping to identify the main influences driving children's play in the era of IoToys, but we suggest that the child's digital life is not so neatly confined and so evidence of childhood needs to document its messiness. Particularly with the introduction of IoToys – which connect children via the Internet to multiple realms and contexts – children's digital lives cannot be compartmentalised or separated into various systems. Instead, children's digital worlds need to be viewed more holistically, in an interconnected and inseparable manner, similar to Rogoff's (2008) discussion of inseparable

mutually constituting planes in children's learning experiences that correspond to personal, interpersonal and community. Within this messiness, we also need to understand the extent to which children's digital lives are empowered or passive (Craft, 2013).

This chapter addresses this complexity by analysing children's everyday digital lives in connected contexts. We utilise three case studies of children's lived experience with IoToys to provide examples of the child's digitally mediated social worlds. In the case of IoToys, we present some specific contributory factors that help to shape the child's sense of empowerment as well as the ways in which the child is capable of directing and leading their own learning experiences through realising their own power to shape experience.

Understanding the dispositions of practitioners, parents and children towards how these artefacts form part of the cultural and agentic context offers a route towards understanding the view of the child as either passive or empowered.

The Study: IoToys, Methodology and Ethics

The project employed 12 empirical case studies of children's digital (and Internet-connected) lives across four countries (England, Scotland, Northern Ireland (NI) and Greece) to investigate:

- Parents' and practitioners' dispositions, attitudes and aptitudes towards children (ages 0–8) engaging with IoToys.
- Ecological factors shaping young children's (ages 0–8) experiences with IoToys.

Across the four data collection countries, IoToys were integrated to varying degrees.

Households in England were already equipped with IoToys, but in Scotland, Greece and NI families had few artefacts for observation. As such, a range of IoToys (two hybrid learning games which marry the virtual and physical world, Bluetooth-enabled programmable floor

robots and a wireless digital microscope, as well as learning robots). The learning robots were purchased as part of the project and loaned to Early Childhood settings and families.

Data were collected via a case study, across 25 children at home and their early childhood settings with data spanning five months of a continuing study. While the starting point for data collection was Early Childhood Education settings (ages 3–5) siblings were included in home data (our oldest sibling was 6.5 years old). Data collection included:

- Interviews with parents
- Interviews with keyworkers
- Participant observation of children's play with IoToys in Early Childhood Education (3–5 years).
- Multimedia messages (pictures, videos, short written reflections from parents in consultation with children) of children's play in the home, submitted by parents (extending Plowman and Stevenson's (2012) methodology).
- Photo Voice conversations with children, whereby the multimedia data presented by parents and observation photos were used to stimulate conversations with children.

Our project was guided by key characteristics of participatory research (Groundwater-Smith, Dockett, & Bottrell, 2014). Parents were asked to use technologies in a way that fits with their lifestyle. Children's participation was voluntary; parents were advised that children's lack of engagement was a reasonable finding and not to force participation.

The EECERA Ethical Code of Practice (2015) was followed, approval was granted by the University Ethics Committees and relevant local authorities. The standard consents were sought, including parental, keyworkers' and managers' written informed consent. The research team were also concerned with nuanced ethical considerations for this project, including:

1. The children's own perceptions of the uses of data from this project, the permanency of data collected and their associated consent.
2. The role of Internet safety in children's play.

Our belief that young children are 'reliable, voluntary' participants in research (Farrell, 2016: 226) gave grounds for negotiating consent directly with children. To the best of our ability, we sought to inform children about the project and ensure their awareness of the consequences of their participation. Furthermore, the researchers worked in partnership with parents and keyworkers to encourage discussion and learning experiences, designed around safe Internet use in order to raise awareness. The preschool safe Internet use policy was employed at all times.

Inductive reasoning was employed and emerging codes were grounded in the data. Although specific a priori codes were not employed in the analysis for this chapter, the researchers' thinking was underpinned by Craft's (2013) conceptualisation of childhood in a digital age; sociological interpretations and constructions of child and childhood (James & Prout, 2015); Rogoff's (2008) three planes of participation, alongside our socio-ecological lens (presented next).

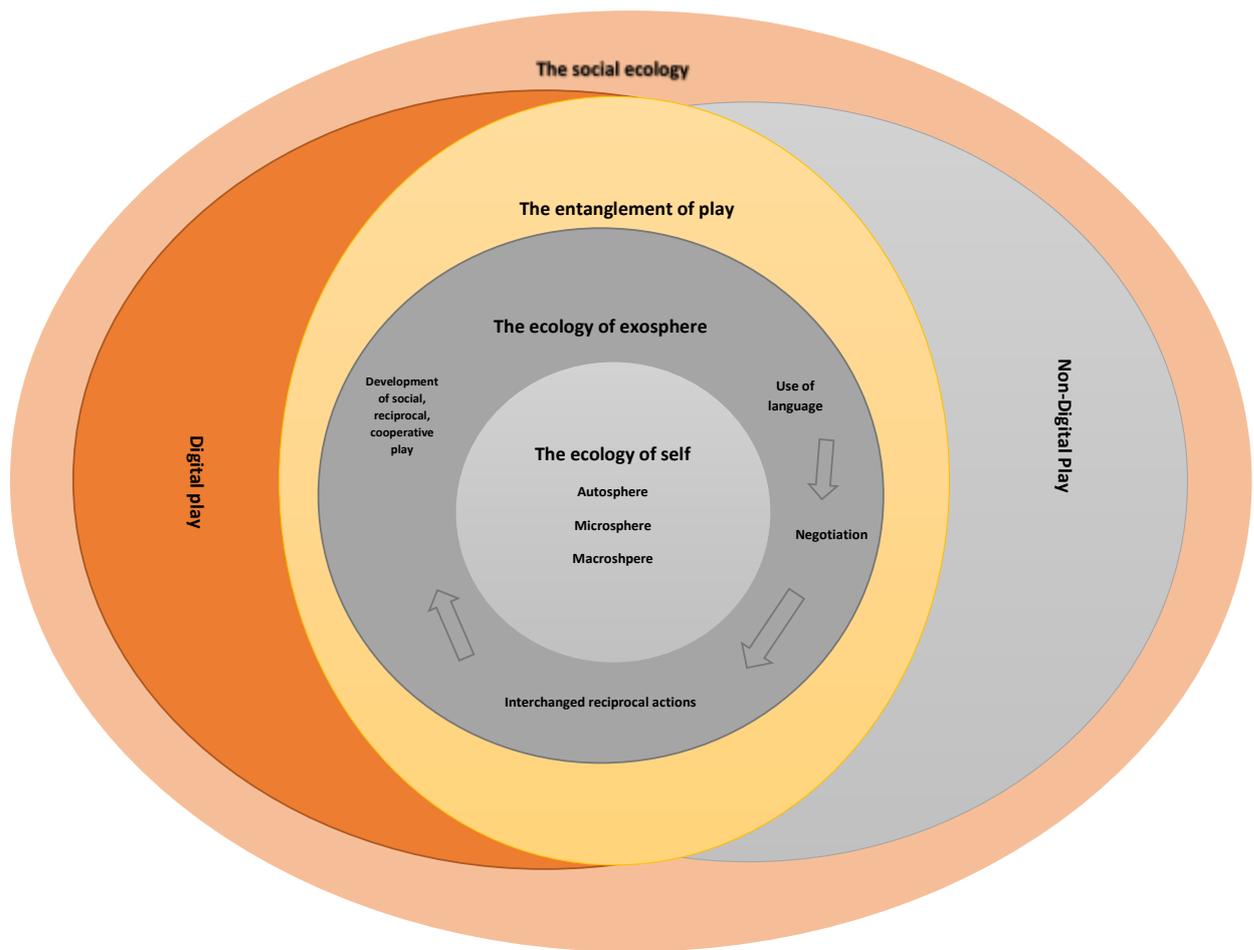
Children as Empowered Agentic Digital Creators in Digitally Mediated Social Worlds

Craft (2013) suggests that in response to questions and concerns about digital childhoods, one of two perspectives can be adopted: the view of children as *passive* or *empowered*. The former suggests that they are at risk from the dangers associated with technologies and that it is the role of adults to protect children from associated harm. Alternatively, the view that children are empowered by increased easy access to technologies suggests that new devices, such as IoToys, are giving them increased opportunities for creative expression.

In essence, Craft detailed the evolution of the Sociology of Childhood in a digital age, yet her conceptualisation has not translated into empirical research approaches for understanding children and technology in Education. Two decades ago James, Jenks and Proud (1998) provided an overview of *The Sociological Child*, which contributed to a significant shift in research, policy and practice regarding children's agency and competence (Ärlemalm-Hagsér, 2014; Esser, Baader, Betz, & Hungerland, 2016; I'Anson, 2013). Yet, while perceptions of 'child' have moved on considerably over this time, the focus on the agentic child around technology still lacks a research base. Digital childhoods may be the focus of tabloid media – predominantly to wallow over lost childhoods and to 'romanticise the past', as described in Plowman, Stephen and McPake (2010) – but in research the child as a subset of education or households, and in relation to technology, is presented. We see explorations of how technologies can support children's play (Aldhafeeri, Palaiologou, & Folorunsho, 2016; Edwards & Bird, 2015; Marsh et al., 2015), how children interact in the presence of technologies (Arnott, 2013, 2016) and how technologies are transforming or shaping play (Danby, Davidson, Theobald, Houen, & Thorpe, 2017). With the exception of Craft's (2013) theorisation, however, we know very little about the extent to which Digital Childhoods are characteristically passive or empowered. Furthermore, in the context of IoToys, we do not know what social-ecological factors are contributing to children's sense of passivity or empowerment and the impact this has on their identity as a digital child.

This disconnect still occurs because there is still a need to understand children's lives as part of digital social worlds. We build on Arnott's (2016) digital play context and Palaiologou, Arnott, & Gray's (under review) recent work on social-ecologies in digital childhoods. We present evidence of children living and learning as part of digitally mediated social worlds, which involve an entanglement of play across digital and non-digital resources. We take the position that IoToys are the latest technological development that encompasses this

entanglement of digital and non-digital. Similar to Rogoff's (2008) planes of apprenticeship, guided participation and participatory appropriation, our conceptualisation considers the individual (in the ecology of self), the interpersonal (ecology of exosphere – including interactions with IoToys) and the community (social world). We propose that this social-ecological paradigm is seeking to develop an understanding of empowerment in the context of the entanglement of the digital and the non-digital across social worlds. While we collected data across home and education, we do not present these as separated bounded cases, instead we aim to break down barriers and create synergistic relationships between home and early childhood education that synchronise children's play with the digital social worlds in which we now live. This conceptualisation is visualised in Figure 7.1.



© Figure 7.1: The social ecologies of play in digital lives (Palaiologou, Arnott & Gray, under review)

The premise that underpins this conceptualisation is children's own agentic involvement in their digital lives, what Craft (2013) describes as the empowered child. We know from research that children are capable of such an empowered response to technologies when afforded the opportunities to develop their own agency as part of their play. Arnott's (2016) empirical work provided the grounding for the conceptualisation of nano-systems, whereby the empowered-agentic child engages in a negotiation process, manoeuvring peers and technologies to direct their own digital play. This process is embedded in an ecological system consisting of agents, cultural contexts and artefacts, which intertwine to contribute to children's digital experiences. Yet, crucially, it suggests that as children engage with their

own status as part of the group, position themselves in relation to technology and exhibit tactical behaviours and interactions, they own their digital play. Arnott, 2016).

In the next section, we use the conceptualisation of childhood as either passive or empowered as part of their digitally mediated social world, involving the individual, the interpersonal and the community, to present our empirical data of children's lived experiences with IoToys.

The lived Experience of Children and IoToys.

We present our findings as case studies of children's lived experiences with IoToys to portray a relational understanding of individual children. That is, we want the reader to connect with the children and to understand the individual child as part of an Internet-connected world, in context. Thus, we justify the use of stories or case studies in the importance of a qualitative – almost ethnographic – presentation of children's digital lives across social worlds.

The chapter introduces a small sub-section of our data from this project, selected for its relevance to passivity and empowerment. While we set out to understand the child's position in the social world, we also found that the IoToys fostered empowerment for practitioners as well, adding to our understanding of children's digitally mediated social world.

Case Study 1: IoToys for the Empowerment of Children

Case Study 1 demonstrated how technologies may empower children when supportively integrated into the child's world. For example, the case below details how a child who is supported with IoToys is able to overcome a degree of shyness. We see the parent as *facilitator* (Rose & Rogers, 2012) in this learning experience, and she affords him the opportunity to take ownership of the play. Across the child's digitally mediated social world, we then see this ownership transcend into a different physical setting and cultural group (the early childhood setting) in an empowered way.

Case Study 1: Larry Brown and the learning robot.

Larry is aged 4. He lives in a relatively affluent area in Central Scotland with his younger brother, Henry (aged 2), his mother Jennifer and his father, Peter. We describe the home as a moderately technological household. They have a tablet and a few remote-controlled toys. The parents did not mention any games consoles or more advanced IoToy resources but indicated that Larry loves to operate mechanical or technological household resources (e.g. TV remote control, operating a microwave and unlocking screenbased locks with passwords).

He attends a local childcare setting and has deferred his start at Primary School (an option available to all families in Scotland, when the child's birthday falls in January or February), making him one of the oldest in his setting. The childcare setting describes his family as very engaged with preschool life, with Jennifer regularly attending stay-and-play sessions or engagement events. Despite Larry's mother's active engagement, the staff indicated that prior to the IoToys Project, Larry remained quiet and more reserved in preschool.

Larry's family were loaned a learning robot as their first IoToy for the project. In addition to Larry's interest, Jennifer talked about Henry, saying: 'He loves the learning robot too!' Jennifer took the time to learn how to use the resource in order to support her children's play, as she said: "*I now know how to feed him etc. We couldn't get it to work earlier. Amazing piece of technology. He's currently snoring in his charger!*" The learning robot quickly became a

favourite resource. The delight on Larry's face when the learning robot says his name is quite striking (see left side of Fig. 3, below).

Across a 2.5-week period, Jennifer spent a significant amount of time supporting Larry using the learning robot. She sent 24 separate videos of her talking Larry through the process of controlling and operating the learning robot. She facilitated Larry's physical control of the resource, rather than operating the toy for him.

The *progression* in Larry's play with the learning robot became significant. Initially Larry's fascination revolved around observing the tangible learning robot and what he was capable of doing with various blocks. Yet, as the videos progressed, Larry appeared to move on from interacting with the learning robot's robotic form, to developing a fascination with manipulating the learning robot's movements using the App on the tablet. For example, Jennifer sent 18 videos of Larry using the App to control the learning robot and 'teach' him to verbally say the names of his family; not just Jennifer, Peter and Henry, but also several cousins and two best friends at preschool. In other videos Larry is shown practising 'fast' typing and finding this fascinating (see right side of Fig. 3, below).

Over this phase of the project, Larry's confidence and interest in the learning robot grew. This confidence transferred into his life in preschool. The staff talked about their amazement at how Larry appeared to have 'come out of his shell' since beginning the project. After Larry had been loaned the learning robot, the staff facilitated an adult-supported activity with the learning robot involving a small group of children. When reflecting on this task, they talked

about Larry's resounding confidence in leading other children in the group, demonstrating to them how the learning robot should be operated, a confidence that was lacking prior to the IoToys project. The staff suggested that the 'responsibility' of being involved with the project gave Larry this increased confidence. When Jennifer was asked about increased confidence, her response was: *"Definitely! I would agree."*

As it was time to rotate the IoToy resources that were loaned to the families, Larry was firm and steadfast in indicating his desire to take home the programmable floor robot next...



Figure 7.1: Larry and the learning robot

Larry's empowerment is fostered through relatively informal learning as part of a family or community (Rogoff, 2014), with Larry and Jennifer learning together about the learning robot, alleviating the didactic tendencies of formal teaching. As was the case with earlier Internet technologies, Larry and Jennifer engaged in a trial-and-error approach to understanding the potential of the toy (Plowman, McPake, & Stephen, 2008). What is unique with IoToys is that they are new, not only to children but also to adults, thus creating a sense of learning within digitally mediated social worlds (Palaiologou, Arnott and Gray, under

review). The power dynamic typically present between adult and child (Laupa, 1994) is somewhat reduced by Jennifer's lack of knowledge about IoToys. In some cases, Larry's expertise outweighed Jennifer's as she described instances where Larry had to teach her what to do with the IoToy. This sense of expertise appeared *empowering* to Larry, shown through his eagerness to direct and teach other children in preschool. Jennifer's willingness to relinquish control and trust her child in his use of the resource supported this empowering movement.

Case Study 2: IoToys for Empowerment of Changes to Practice.

In relation to technologies and digital devices, discontinuities between home and education contexts are well established. Plowman, Stephen and McPake (2010) alluded to this several years ago when they talked about how different terminology was used to describe technologies at home and in education, using 'technologies' with parents but 'ICT' with practitioners in the education context (so as to marry up with policy terminology). This divide has only widened since 2010 and now encompasses differences in how technologies are perceived and how uses of technologies are scaffolded and supported.

Research has shown that teachers' uses of digital devices are static and controlling and fail to align with playful pedagogies (Palaiologou, 2017, 2016b). Thus, we see the fluid integration of technologies in home lives, alongside more static and bureaucratic incorporation of digital technologies in children's early childhood educational ecologies. Edwards, Henderson, Gronn, Scott, and Mirkhil (2017), suggest that the disparities between home and preschool, in terms of technology, are more to do with the differences in purposes behind technology use. With IoToys, however, we begin to see divergence due to infrastructure and practitioner passivity.

In households, fluid integration relates to a lack of restriction and, potentially, looser Internet-safety protocols, in comparison to more monitored and governed Internet use in education. These restrictions posed challenges for the integration of technologies; practitioners in this study spoke of slow WiFi and dated hardware, resulting in children getting bored and leaving the activity.

With the introduction of IoToys, this anxiety over integrating technology is compounded because practitioners and parents do not feel knowledgeable about how these resources can be used safely. Two of the four settings in this project refused to use one of the hybrid toys and one preschool refused all the IoToys offered because they did not see what more IoToys could offer compared to traditional toys. For example, one of the teachers said: *“They are glued on screens all day, let them play when they come to preschool and have some free time from screens.”* And another one said: *“I cannot see what these toys add to the real toys we have in the class.”*

From the interviews with the practitioners from these nurseries, it became evident that there was scepticism to include IoToys in their daily activities, and the main concern was that IoToys would not support children’s imagination and creativity. They also had concerns about safety; as one teacher said: *“The parents want to know that their children are safe here, so we do not have Internet and no phones are allowed by staff during the day ... we are free of Internet preschool.”* This anxiety not only recreates a passive child agenda but also results in passivity in terms of the adult role in integrating technologies into practice. It widens the divide between children and adults and creates a sense of disconnect within a digitally mediated social world.

In other cases, the tactile adaptive properties of IoToys appeared to alleviate many of these concerns. In one centre the practitioners’ enthusiasm to integrate IoToys into preschool

practice paved the way to present a more interconnected digitally mediated social world for children across both home and education. The following case study presents an example of how the integration of IoToys empowered staff's own self-confidence in integrating technologies into their practice.

Case Study 2: Empowering Changes to Practice

Momentum preschool is a small early childhood centre in a relatively affluent area of Central Scotland; they cater for a maximum of 60 children at any one time. While this may seem like a lot of children, it is relatively small in comparison to new purpose-built Early Learning and Family Centres that are emerging across Scotland that cater for around 90 children, expanding to 180 after the early childhood expansion in 2020. Momentum preschool consists of three smallish rooms, creating a cosy environment.

The staff were enthusiastic about opportunities for new ways of working and were open to the integration of IoToys into their practice. We describe the preschool as *typical* in terms of technology use in practice. They own a small number of tablets for staff and children's use and they have an interactive whiteboard, but technological artefacts did not form a significant part of their play-based pedagogy. They did not have any IoToys prior to the project. When loaned IoToys for this project, they were delayed in their integration because the toys needed to be verified and approved by the Local Authority and the setting's IT department. The IT department also had to install all Apps associated with the IoToy artefacts due to firewalls and restrictions.

Staff's reaction to the IoToys was energetic and enthusiastic. They seemed invigorated by the integration of the resources and the possibilities they offered to engage children. Due to concerns about the possibility of damage to the resources, they did not allow children to use the resources in child-led free play; instead, all IoToys were used during structured activities with practitioners. This also satisfied their Safe Internet Protocols. The staff used the resources with small groups and two boys, Iain and Mark, opted to play with them in every session. On one occasion, the practitioner was observed facilitating the activity for well over an hour, and the activity only ended because it was time for the whole preschool session to end.

Despite one practitioner being a self-confessed novice with technology, a hybrid game caught her attention and she became emphatic about using it in practice. She was animated in her expressions during the game, becoming very excited, which created a 'draw' for other children. The children themselves became similarly animated and enthusiastic about the play experience (shown in Fig. 4, below).



Figure 7.2: Engagement with a hybrid toy

As they played, the practitioner asked prompting questions for the children to help them progress with the game and children engaged in mathematical discussions. When making decisions about how best to balance the animals, they talked, successfully, about the size of the various objects and whether smaller uneven objects would be able to balance a larger object on top. They talked about environmental terminology, such as endangerment, as they tried to keep their beast creations alive and discussed physical elements as they talked about land versus sea animals.

When interviewed about the resource, the practitioner spoke about children's engagement with both physical tactile resources alongside the virtual world, and the ability to consider numeracy and literacy throughout as they created hybrid animals on the platform and followed their scores. She spoke of a route to engage boys, specifically, with mathematical concepts, as she said, "The thing I'm finding, you are engaging boys more, because it's appealing to the boys. The boys don't want to sit at a table and do maths activity with sorting activities, but they don't realise how much maths activities they're actually getting out of that [hybrid game]."

What was striking about this episode was not only children's active engagement and fascination with the resource, but the practitioner's interest in it, too. For a practitioner who previously avoided technologies, this hybrid game empowered her to embrace children's digital lives and transcend the fluid digital learning across the child's social world. She spoke about how the tactile pieces, and not just the screen-based media, were appealing to children

of this age group and supported more traditional forms of play. In a sense, the tactile nature of the resource provided a foundation to justify children's play with technologies.

She went on to speak about the interaction involved with IoToys both between practitioners and children – describing how she was able to ask children questions throughout, which prompted their scientific thinking – but also between child and technology. The children were simultaneously engaged with a virtual world and became immersed, so much so that two children chose not to play the game because the animals died if the children failed to stack the pieces quickly enough. Here we begin to see an extension of Rogoff's (2008) interpersonal plane and evidence of the ecology of the exosphere and the ecology of the social world, i.e. the child's interactions and relationships with others *and* with IoToys.

The practitioners used these resources on the same day that children's parents were invited to the preschool for Stay and Play sessions. Children eagerly dragged their parents over to the play area to show them the game. Similarly, because the resources had been sent home with children and subsequently utilised in practice, the parents were becoming increasingly aware of the type of technologies used in the preschool and, vice versa, the practitioners were beginning to understand digital lives at home. The gap across contexts in this social world was narrowing through an empowered practitioner's enthusiastic integration of IoToys.

Creating empowering digital spaces across eco-communities.

One of the defining characteristics of IoToys is their complexity. They are built around complex software and hardware, without which their interactivity and multidimensional nature would not exist. It is this complex system of interaction packaged in tactile machines, which separates IoToys from traditional analogue learning resources, and to a large extent from screen-based media, which has dominated the children and technology market for decades. This complexity requires adults to support children with the devices and for

children to support each other. In a study about construction technologies versus traditional Froebelian construction toys, Arnott and Duncan (under review) detail the need for children's familiarity with technologies in order for children to embrace the potentiality of these resources. The same is true for children and adults with IoToys. Adults spoke of both the need to invest time in learning to use IoToys and how play progressed along with their familiarity. The practitioners and children learned together as equals in the process.

What we saw across the study settings was both Craft's (2013) discussion of passivity (in centres that did not want to integrate some of the IoToys) and empowerment as Scottish children, parents and practitioners embraced the opportunities that IoToys offered. In the Scottish examples, adult involvement was not aimed at *protecting* children from the suggested dangers of IoToys; rather, adults appeared to be learning alongside children about how best to use these complex devices. This sense of the unknown for practitioners and the realisation that IoToys were about exploration, discovery, tinkering and 'learning by doing' provided the foundation to justify children's own exploration with technologies. When the confidence in the child's capabilities is there, we can see children's attempts to support each other, as can be seen by Emily and Aaron in an English home context.

Case Study 3: Scaffolding

Aaron (9 years) approaches Emily (3 years and 5 months) who is playing with a hybrid learning game, using the tactile pieces without using the App (at this stage, Emily has not made the connection that the pieces can be linked with the APP) and asks her if he can join her. They start playing together. Aaron sets the tablet in position and chooses the App by explaining to Emily how it is played. Then together they choose which puzzle they will make and they play.



Figure 7.5: Scaffolding with a hybrid toy

Aaron: Let's start! Ok, you start first.

Emily: [Takes the pieces and starts while Aaron points to the tablet image. She places the first three pieces of the puzzle and starts looking at the tablet, but she struggles with the smaller one and she cannot find how to fit it.]

Aaron: The other way, yes! The other way! Pick up the purple one first ... no the purple one, this is the orange one, look [pointing to the tablet].

Emily still struggles to find out how the piece will fit so the puzzle will be complete and Aaron is asking her whether he can help her. Takes the piece and completes the puzzle. Looks at Emily and applauds her with his hands.

Aaron: You did it! Well done!

In this instance Aaron is empowered by scaffolding Emily's confidence to extend her play with the pieces of the hybrid game from the non-digital space (Emily was playing without the App) to a digital space (Emily plays with Aaron scaffolding her with the App).

In further episodes (not presented here) Emily starts playing on her own with the same hybrid game, using it as an IoToy. From within a social-ecological paradigm (Fig. 1), we can see that Aaron (exosphere in Emily's play) supported her to understand the digital space (social world) and when Emily played alone later (ecology of self) her play with the hybrid game pieces was entangled between digital and non-digital. Compared to a more traditional technology which is screen-based, IoToys, because of their interactive nature, facilitate the entanglement of digital and non-digital and children utilise them as part of their play repertoire, as we have shown in all three cases.

When technologies are embraced and accepted as part of children's everyday lives, we begin to see empowered digital spaces, where the whole social world learns together. The children's and adults' understandings are treated equally, as they bring together their varied expertise. When Larry began using the programmable floor robot his mother explained:

"I was working it manually and he told me we had to download an app to work it from the tablet. I thought he was confused with the learning robot but he was right! [emoji of monkey covering eyes]" (Practitioner Interview, Momentum Preschool)

The power divide between adult and child is narrowed because the adults are no more expert than the children in using the device. By accepting the notion of learning together, parents and practitioners can create empowering digital spaces across social worlds.

Concluding Thoughts: The Internet of Toys; Changing Childhood and Cautioning Against the Recurrent Moral Panic

Over the last few decades, deficit style debates about the role of technologies in early childhood (e.g. Palmer, 2015) had somewhat appeared to have plateaued. While concerns about Digital Childhoods were still evident in the popular press and in the media, in research spheres, the discussion had moved beyond *whether* children should engage with technologies

to *how best we can support children* to engage with technologies. The realisation that technological developments are inevitable and going to feature in children's lives and futures has driven forward pedagogical discussions about how technologies feature in early childhood practice; for example, discussions of Guided Interaction (Plowman & Stephen, 2007), A Digital Play Framework (Edwards & Bird, 2015) and Digital Pedagogy (Fleer, 2017) emerged. We even reached a point where technologies were not as often held accountable for children's social development (or lack thereof) and, instead, appropriate reflection and consideration were given to supporting the framing of children's technological experiences. In essence, we were entering a period of *acceptance* of technologies as supportive of multi-modal practices (Yelland & Gilbert, 2017), affording opportunities for new forms of symbolic play and engagement with STEM at young ages.

In the last 3–5 years, however, the increased production of IoToys, that are now part of children's everyday experiences (Mascheroni and Holloway, 2017), has (re)aroused new/recurrent concerns about digital childhoods. The intermittent moral panic that has been voiced around Radio, Television, ICT and Screen-Based Media has now been somewhat resurrected for IoToys. While concerns over screen-based media in the late 2000s focused on the potential reduction in children's 'real' play, the concern for IoToys is to do with online safety and the datafication of childhood. In essence, we have arrived back at the deficit model of Digital Childhoods and debates about the appropriateness of technologies (specifically IoToys) are at the forefront of research and practice.

In this chapter, our empirical evidence, in combination with our theoretical frame, suggests that digital childhoods are messy, multifaceted, multi-modal and ultimately complex. With the onset of IoToys, the digital lives of young children cannot be compartmentalized across

various bounded systems. As our data show, IoToys (as new technology still developing) are creating a synergy between the digital and the non-digital (entanglement, as in Fig. 1).

Similarly, children's interactions *with* IoToys and with other children *around* IoToys are inseparably linked across the individual, the interpersonal and the community (Rogoff, 2008) in digital and non-digital spaces. For practice, this means that a complex approach to supporting and framing children's digital lives is necessary, one which has a balanced and nuanced interpretation of the agency of IoToys in children's lives. If we are to stay true to now long-established sociological perspectives on childhood, which see children as capable and competent, then this agenda needs to transcend the digital realm. A moral panic and deficit model around IoToys, as described above, will ultimately be unhelpful in a rapidly changing child-consumer market. A passive child approach (Craft, 2013) will only hinder the child in learning to safely navigate this unfaltering progression in contemporary life.

We must facilitate children's empowerment with IoToys, by respecting children's own agency and trusting that, with the right framing and guidance, children have the competence to drive forward their digital lives in a responsible, safe and creative manner. This cannot be achieved in isolation and children cannot be expected to shoulder the burden of this learning journey alone. *Framing and guidance* to support children as part of their digital lives are the crucial factors on this journey. Such framing need not be didactic but can take the form of informal learning where children learn by *observing and pitching in* (Rogoff, 2014). Framing and guidance must be foregrounded as we learn, *together*, about how best to integrate IoToys into our social worlds. However, in order to achieve that, we need to move away from the tyranny of "anxieties" and the "panic" over divisive ideologies around technology in early childhood education and embrace them critically as offering another resource empowering potentialities in children's lives.

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