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Rethinking context: Digital technologies and children's everyday lives

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The paper considers different ways of conceptualising the settings in which research takes place into children's everyday uses of digital technologies at home. The terms 'ecology' and 'context' are widely used to describe such settings but may be less appropriate as the boundaries between 'home' and 'technology' become less distinct. The paper traces associations between 'ecology', 'culture' and 'context' and outlines some of the ways in which the increasing omnipresence and invisibility of technologies in the home prompt different ways of both thinking about the research setting and suitable methods for exploring children's everyday lives. Using the Internet of Things as an illustration, it contests default understandings of context and discusses the need to reconsider our use of terminology so that it takes account of the methodological implications and its theoretical provenance.

Keywords: children; context; culture; digital technology; ecocultural; home

1. Introduction: children's everyday lives and digital media at home

This paper starts from the premise that understanding more about young children's encounters with digital media necessitates an explicit consideration of the research setting. It draws attention to the ways in which two key terms, 'ecology' and 'context', are often used by default when discussing the cultures of children's everyday lives, especially in the home, by drawing on several research projects which have focused on young children, their families and digital media. It examines the theoretical positioning of these terms and how this shapes methodological choices, and goes on to suggest that we may need to rethink context now that the boundaries between 'home' and 'technology' are less distinct than they were just a few years ago.

A consideration of different ways of conceptualising the settings in which research into the everyday lives of children takes place starts by looking at the widespread use of the term 'ecology' and its derivation from Bronfenbrenner's ecological model. This leads to a discussion of ecocultural theory, which draws on this model and is described by its proponents as contextualist in orientation. These theorisations were not designed to focus on uses of digital media and their value for conducting research into uses of technology in the home may be partly compromised by the ubiquity, mobility and invisibility of current and emerging domestic and leisure technologies. Common usage implies that context pre-exists as a factor available to take into account when investigating technological practices but I suggest that recent changes in the visibility and omnipresence of technology mean that we need to rethink ecology and context as concepts that are used to describe research settings. Moving beyond the 'flat' representation of ecology which

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still has purchase in discussions of how digital devices are used in the home to a more fluid, emergent and multiscalar understanding of context without boundaries enables us to think differently about the relationships between practices, people and things. These shifting theoretical orientations lead us to rethink the methods we use to understand these spaces. While the primary purpose of these methods may be to illuminate children's encounters with the digital at home, exploiting the affordances of the same emerging technologies that are the focus of study may also create possibilities for collecting data in new ways. I describe some of the approaches that we used in earlier research projects to explore children's everyday lives with technology within a relatively bounded understanding of context but suggest that we may need to consider context anew in light of the rapid emergence of the Internet of Things. I therefore briefly outline some of its characteristics and speculate about some of the changes that may become apparent.

Given its perceived suitability for reflecting the networked nature of digital technologies, this discussion starts by considering the word 'ecology'. Used as both a cultural and a biological metaphor, it derives from the classical Greek *oikos*, meaning house or household. Its etymology is also seen in words such as economy: oeconomy was understood in the eighteenth century as 'the practice of managing the economic and moral resources of the household for the maintenance of good order' (Harvey 2014, 380), with the house envisaged as both an economic unit and as a microcosm of human society. Since the nineteenth century, it has been associated with the biological sciences, alluding to the ways in which a diverse population evolves in concert with its habitat. 'Ecology' encompasses interconnecting temporal dimensions that suggest dynamic adaptation over time, and spatial dimensions that imply physical surroundings, boundaries, networks and relationships.

The power of ecology as a metaphor that connects these temporal and spatial dimensions, has led to use of the term proliferating beyond environmental science to the social sciences. While the Oxford English Dictionary notes its earliest sociological usage in the *American Journal of Sociology* in 1908, in recent years it has been extensively used with a modifier to imply the distributed and interconnected nature of digital technologies in phrases such as 'learning ecology' (Barron 2006), 'cultural ecologies' (Hasse 2015), 'ecology of interactive learning environments' (Johnson 2014), 'ecology of learning resources' (Luckin 2010), 'information ecology' (Nardi and O' Day 2000), 'media ecology' (Postman 2000; Fuller 2005) and 'ecology of games' (Salen 2007). Carrington (2013) also notes the ways in which 'ecology' can be used to represent the ways in which new spaces, practices, technologies and young people interact.

2.   Bronfenbrenner, ecology and 'strange situations'

An influential source of the metaphor in the areas of developmental, educational and social policy research has been Bronfenbrenner's description in *The Ecology of Human Development* (1979) of a system of interdependent environments that exert influence directly and indirectly on the child's experience. The introduction to the book stated that the theoretical perspective was new in its conception of the interactions between the developing person and the environment, famously describing this 'somewhat unorthodox concept' of the ecological environment as a 'set of nested structures, each inside the next, like a set of Russian dolls' (1979, 3).

From a twenty-first century perspective, it seems curious to think that attending to the immediate context of the child and how this relates to broader social and cultural contexts was a significant departure from earlier ways of thinking about child development in the UK and USA. But, as Bronfenbrenner (1977, 513) pointed out, research in this area had previously focused on experiments involving 'situations that are unfamiliar, artificial and

short-lived'. In support of this view, he made reference to a survey of more than 900 studies of child development published in three prominent research journals between 1972 and 1974 that found that the vast majority reported on research undertaken within an experimental paradigm in a laboratory rather than focusing on places where we might routinely expect to find children at ease. Just eight per cent drew on observational studies. He concluded that much of contemporary developmental psychology '*is the science of the strange behavior of children in strange situations with strange adults for the briefest possible periods of time*' (1977, 513, original emphasis). He then went on to attend to the need for methods that combine naturalistic observation with rigour, claiming that what was needed was 'examination of multiperson systems of interaction' that were not limited to a single setting but 'take into account aspects of the environment beyond the immediate situation surrounding the subject' (Bronfenbrenner 1977, 514).

His renowned model of the ecological framework of human development addressed this methodological problem. By featuring concentric circles with the child or learner at the centre, embedded in the microsystem of home, family, health services and school, it emphasised the child's experience but moved outwards through the mesosystem and exosystem to take account of less direct influences. At its outer reaches, the macrosystem included cultural belief systems and ideologies. Although Bronfenbrenner continued to refine and critique the model over three broad phases throughout his lifetime, its visual representation did not change dramatically, despite the two-dimensionality of the 'bull's-eye' diagram providing only a limited depiction of the three-dimensional nested nature of the dolls. The diagram has been much cited and modified and remains powerful in shaping countless studies that examine the influence of the environment on children.

In *Ecology of the Family as a Context for Human Development* (1986, 723) Bronfenbrenner described the ways in which intrafamilial processes are affected by conditions beyond the family and are, in effect, 'once removed'. He illustrated this by describing how the parent's place of work, a setting in which the child rarely spends time and which is distant from their home, nevertheless influences the child because the workplace (the exosystem in this model) can affect the wellbeing of the parent. The model was further finessed during a third phase of theoretical development. Published after his death, this described the four principal components of process, person, context and time (known as the PPCT model) and the dynamic, interacting relationships among them. This marked a transition from the earlier version that focused on the role of the environment in shaping development to a new 'centre of gravity' (Bronfenbrenner and Morris 2006, 794) which gave more attention to the role of processes such as parenting and other forms of interaction in the immediate environment.

I have described Bronfenbrenner's work here because the customary use of the term ecology and the concept of context as a set of influences surrounding the child are strongly associated with the model described in *The Ecology of Human Development* (1979). The longevity of its appeal means that the terminology has reached well beyond the boundaries of developmental psychology from which it emanated, so perhaps it is not surprising that, according to Tudge, Mokrova, Hatfield, and Karnik (2009), it is often mis- or re-interpreted when appropriated by different disciplines. While terms such as microsystem or exosystem are referenced less frequently, the overall metaphor of concentric circles of influence surrounding a child persists and is so compelling that it is even implied in the commonplace notion of child-centredness. Rosa and Tudge (2013) comment that too many researchers refer only to the earlier version and seem to be unaware of the later modifications in the PPCT model that gave more emphasis to family interactions in proximal processes as well as acknowledging the mutually interacting nature of the influences of the individual and context.

3.   Culture, context and contextualist approaches

Most studies of children's everyday lives at home have moved a long way from the 'strange situations' of the experimental methods challenged by Bronfenbrenner, but his legacy prompts those of us with an interest in studying how everyday routines and practices intersect with digital technology to pay particular attention to how we think about context. Even in Bronfenbrenner's revised models we find that culture, which is understood as shared value and belief systems, is positioned within the macrosystem or the outermost circle. Although he was at pains to emphasise the bidirectionality of influences, there remains a sense that culture is separate and distant rather than situated and embodied.

An ecocultural approach starts from Bronfenbrenner's iterations of the ecological frameworks of human development but addresses this peripheralisation of culture by emphasising the ways in which it is partially created within the home, educational setting and local community rather than being distinct. Also known as cultural-ecological theory (Tudge and Hogan 2005; Tudge 2008), the defining features of ecocultural theory were a focus on children, families and parenting, often informed by cross-cultural analyses of developmental psychology (Weisner 1984; Bernheimer, Gallimore and Weisner 1990). Its lineage from Bronfenbrenner can be traced directly, although as ecocultural theory has become influential in different disciplines there has been a corresponding loosening of the link from its origins. For instance, recent examples that make reference to an ecocultural approach include studies of the educational goals of German Turkish marginalised youths (Eksner 2015), self-concept among indigenous young people in Mexico (Esteban-Guitart, Borke, and Monreal-Bosch 2015) and identifying progressive and traditional views within childcare providers in the USA (Tonyan, Mamikonian-Zarpas, and Chien 2014).

Tudge and his colleagues are the principal proponents of ecocultural theory, with *The Everyday Lives of Young Children* (Tudge 2008) a fascinating cross-cultural (Brazil, Estonia, Finland, Kenya, Korea, Russia and the United States) study of three-year-old children, parenting and the cultural groups in which they live. Tudge often describes ecocultural theory as contextualist but claims that this does not mean that context is the main explanatory variable. Theories that fit within a contextualist paradigm, he explains, 'have at their heart the "stuff" of everyday life, the everyday dramas, events and activities in which individuals participate, by themselves and with others' and they 'take seriously the complex interconnections among individual, interpersonal and contextual aspects of development' (Tudge 2008, 73). Elsewhere, he describes the contextual level 'by which I mean not only the proximal context of the setting itself but also the broader sociocultural context' (Tudge 2000, 109) as an analytical factor that contrasts with the individual level. According to Tudge, Brown, and Freitas (2011), the two most prominent contextualist theorists are Vygotsky and Bronfenbrenner who, despite their differences, each see development as the result of interaction among activities, individual characteristics and the changing contexts in which the activities occur.

As van Oers (1998, 476) points out, different concepts of context arise from different ways of conceptualising the nature of surroundings, settings or locales. This, in turn, means that interpretation of the links between context and culture will be understood differently. Michael Cole published *Cultural Psychology* (1996) as a response to what he saw as an over-emphasis on cognitivism. As the title to chapter five makes clear, this was about 'putting culture in the middle' in contrast to culture being located in the outer macrosystem of Bronfenbrenner's model. Cole outlines three different ways of thinking about context. The first is context used as a synonym for *situation*, often seen as separate from the object of study. Context as *surrounding* is most clearly exemplified in Bronfenbrenner's concentric circles, with the research focus typically on what's seen as 'in the middle' and cultural factors considered as peripheral. These two uses tend to be undifferentiated by researchers and are the most prevalent. Cole's suggested

alternative draws on the Latin (*contexere*) for weaving together or connecting. When the metaphor of *weaving* is applied to context, he suggests, it cannot be reduced to that which surrounds. 'It is, rather, a qualitative relation between a minimum of two analytical entities (threads), which are two moments in a single process' (Cole 1996, 135).

4. Context and children's everyday lives: some methodological challenges

Illuminating the interactions between children and technology was not a major concern for Tudge or Bronfenbrenner so the theorisations of ecologies and contexts outlined earlier were not developed for this purpose. In any case, the utility of these concepts is more evident if digital devices are an identifiable presence in the research setting. In the UK, the days when the technology was easily recognisable as the telephone on a table in the hallway, the television in the corner of the living room or a computer perched on top of a desk, all tethered by cable to the electrical socket or phone point, have gone. So have the days when the functions of these various technologies and the ways in which humans interacted with them were easy to discern. We have long understood the human, the material and the setting to be intertwined in complex ways (e.g. Silverstone 1994; Cole op. cit.), but this is easier to untangle if the technology is visible. The boundaries between 'home' and 'technology' are now less distinct so, in terms of Bronfenbrenner's model, the devices that may once have been thought of as being located within the microsystem are distributed across the concentric circles from the child at the centre to the outermost realm of the macrosystem.

Some of the considerations raised by thinking about culture and context have emerged from several projects (e.g. Plowman, Stephen, and McPake 2010; Plowman et al. 2012) involving children aged from three to five and their encounters with technology at home. Three of the methodological challenges we confronted were: how can we (i) glimpse the everyday lives of families, (ii) observe play, given its spontaneity, whether technologically mediated or not and (iii) understand more about what we have variously described as the contexts or ecologies of children's lives within and beyond the home? The case-study approach that we adopted enabled us to gain some understanding of children, families and technology as interactants in domestic spaces. Our interest was in illuminating the processes and environments that support learning, broadly conceived; the longitudinal case-study approach involving multiple visits enabled us to take into account not only children's physical and emotional changes but also changes in the home settings and the ways in which caregivers' previous experiences and attitudes influenced both their own and their children's activities.

4.1. The 'where of method'

The principle underpinning our studies could be distilled as: 'the home is the place where young children in the UK typically spend most of their time, so cultural values are generated, modelled and transmitted primarily through the family and the households in which they live'. Guided by this proposition, the methods needed to take account of the social and cultural importance of the home, but also of its environs. The family home is the primary setting for the studies of children's encounters with digital media that inform this discussion but the concept of home is also open to various interpretations. More than a physical setting, the concept of home is also produced through the activities and interactions of those who live there.

As Anderson, Adey, and Bevan (2010) remark in their discussion of the 'where of method', place cannot be separated from what 'takes place' within and beyond it. In other words, place is an active agent in the research encounter and the home is more than just the place where we choose to conduct interviews or observe children at play: it is enmeshed in the everyday, and constitutes the very subject of interest. This seems obvious, as it is difficult to think about how else, other than

spending time in the settings, one would conduct such research. However, perhaps for reasons of limited resources, some researchers use other approaches: Bloch's (1989) study of young children's play at home used phone calls to parents, asking them to report on their child's play rather than observing it first-hand, and it is not unusual for studies of children's encounters with digital media at home to rely on telephone or online parental report (e.g. Rideout 2014).

At the time of our earlier research, we saw ecocultural theory as a way of framing our interests as it is concerned with the interactions between people, settings and artefacts, how they link to typically occurring activities and the belief systems, attitudes and practices which permeate family life and how these material and immaterial resources or influences both recreate and transform the culture of which they are part. Tudge (2008, 89) asserts that an ecocultural approach

> forces researchers to pay simultaneous attention to aspects of the individuals who are the focus of the study, aspects of the context (immediate, cultural, and historical), and (most important) to the actions and interactions going on between these individuals and the social partners, objects, and symbols that play important roles in their development.

Even without including digital technologies, this is a challenging task and the emphasis on the ways in which these factors and others interact within 'oikos', or the household, required us to adapt or improvise research methods in combination with more established methods such as observation and interviews. Tudge concludes that, broadly interpreted, ethnographic methods are most suitable as they focus on, and try to understand, what occurs naturally within the cultural context; we adopted a constellation of approaches because no single method could take account of everything we wanted to include.

Accordingly, we enlisted some of the digital technologies that were being used by the families as a way to gain insights into children's lives within and beyond the home, including leisure time at the houses of friends and relatives, and the use of mobile devices in waiting rooms and restaurants or when travelling. As screen-based technologies privilege the visual mode, so did the approaches we adopted. We developed the mobile phone diaries (Plowman and Stevenson 2012; Plowman 2015) to address the first and third challenges indicated above (i.e. to glimpse the everyday lives of families and understand more about children's lives within and beyond the home) during the period 2008–2009 when most of the 14 families participating in our case studies had a mobile phone with a built-in camera. Eleven families responded to a prompt six times during the day by sending us a photo of their child aged three or four with a text message explaining who they were with, where they were and what they were doing. This enabled us to access information about the rhythm of the children's lives and their encounters with technology in places as diverse as in the car, at the shops, football or a gardening centre and in various rooms at home.

Prompted by the second methodological challenge of finding a way to observe play without undermining its impromptu nature, we gave low-cost video cameras to four families to record instances of play with a games console and an interactive toy during a one-week period (Stephen, Stevenson, and Adey 2013). This enabled us to avoid asking children to play on demand and to develop our understanding of the ways in which digital devices were integrated into family life. Video analysis demonstrated that caregivers, and in some cases older siblings, contributed to young children's engagement with the technologies through a range of multimodal interactions. The emotional and behavioural consequences of the children's frustration at their limited operational competence or disagreements with siblings over competitive elements of the games were revealed in ways that were not available to us on standard research visits as they would have been more carefully managed in our presence.

Another example, using a more recent digital device, involved the use of a chestcam (a small bodymounted camera held in a harness) in research exploring the ways in which apps in six families with children aged between one and five were integrated into play (Marsh et al. 2015). Although the movements of the two children wearing the chestcams meant that the quality of the images was suboptimal, the recordings provided us with an appreciation of the ways in which an app could stimulate imaginative play that encompassed both traditional toys and the screen-based content. The ways in which boundaries have blurred between children's online and offline play, or between 'virtual' and 'real' worlds, have already been identified (Marsh 2010; Plowman, Stephen, and McPake 2010; Edwards 2013) but this approach also demonstrated that, contrary to beliefs that screen-based media are responsible for sedentary behaviour, the children's play was physically active as they frequently left the device to search for the toys that they wanted to involve in their imaginative interactions. As with the examples above, it is unlikely that a researcher would be able to observe these practices without the aid of technology. In each case, the digital or non-digital objects with which the children interacted were identifiable and context could be defined in a fairly straightforward manner: in the first example, it encompassed all locations encountered by the child between about 09:00 and 17:00 hours over three separate days. In the second and third examples, context was composed of spaces within the home.

5.   Context, technology and interaction

However, perceiving the functionality or location of technology has become more difficult now that it is not only omnipresent for many families but also increasingly invisible. While the ways in which technology enables remote interaction have been comprehensively studied in the past, the emergence of the Internet of Things impels us to consider new ways of conceptualising both the technology and context. The embedded nature of the Internet of Things means it can be imperceptible and so it remains an abstract notion, even though it is manifested in 'things' or material objects.

The Internet of Things has the capacity to link a body or a thing that has been tagged with unique identifiers to send and receive data over a network without any apparent form of interaction or mediation. Sensors on enabled objects generate data that can be received and interpreted by a network of interacting 'things' via the cloud, giving rise to incalculable intelligent networks that do not rely on active human input. This connectivity does not need to be via standard digital devices such as phones, tablets or laptops so it is less obvious than previous forms of networking and blurs the boundaries between physical and digital worlds in new ways. Currently, one of the most familiar manifestations of the Internet of Things is a controller that can be used to adjust household central heating from remote locations. This is identifiable because it is clearly a digital device, but mundane or inconsequential objects that have been digitally tagged with tiny readable chips with embedded computing and networking capabilities may not be perceived as part of a digital network. For instance, a child hugging a digitalised teddy bear at home can be unknowingly sending biometric data such as heart rate and temperature to health professionals or to their parents' mobile phone via sensors embedded in the toy.

Although unaware of it, children and parents already encounter products that feature some of the characteristics of the Internet of Things in hybrids of toys and gaming such as the best-selling Activision Skylanders, Disney Infinity and Lego Dimensions. Known as toys-to-life products, a digital link is created between the on-screen game and the physical objects of the figures (typically superheroes, characters and toy vehicles already familiar to children from films, television shows or console games) which have unique identifiers. Once placed on a wireless portal or pad, the figures appear to come to life in the storyworld portrayed on the screen. Children's interactions

can generate data based on when, where and how often they have interacted with individual toys. Combining this data with other information available from the internet-connected portal, such as the user's personal details, means that a detailed picture of a child and their co-players can be transmitted. The 'context' of play can be the living room, with a focus on the screen or the carpet on which the figures are typically lined up available for tangible play, but it could also be the home of a friend who's borrowed one of the figures to play with on a system in their own home.

The more that digitally augmented objects are able to capture children's interactions with everyday things, the more these objects are able to build a comprehensive picture of children's day-to-day lives, much in the same way that companies capture data about adults' lives from their online interactions (Manches et al. 2015). The three examples of children's encounters with digital devices described earlier operated on a domestic scale and relied primarily on qualitative methods which privilege observation, enabling researchers to gain insights about practices and to make sense of context from readily analysable visual data. In contrast, future iterations of the toys described above, or other Internet of Things-enabled devices or wearables that children may encounter, are likely to be more intelligent, to transmit other forms of data and to have less visible means of interaction. In the case of the mobile phone diaries described earlier, for instance, it would not be necessary to ask parents to send a text message explaining where they were, who the child was with and what they were doing as the device would be able to provide this information by means of context-aware sensors. The potential for generating large quantities of data on location, movement, time and interactions with other people and things has given rise to new techniques for analysing large-scale data and may prompt the need for different researcher skillsets and multiscalar forms of analysis appropriate for notions of context that have been stretched beyond observable locales. The Internet of Things has the potential to disrupt how we interpret and interact with our physical environment because it already makes possible the long-predicted disappearance of the digital device.

Such an outcome has been forecast for many years and raises the question 'If the device disappears, what does that mean for its context of use?' Weiser's (1991, 94) groundbreaking article 'The Computer for the 21st Century' published in Scientific American 25 years ago opens with the lines 'The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.' Weiser demurred from the idea of personal computing contained in the single visible desktop box of his time, saying that his goal was for computers to vanish into the background. His vision has still not been fully realised. He had described computing 'pads' many years before the introduction of iPads in 2010, suggesting that they would be a failure if they had to be carried from place to place and that they should be more like scrap paper that can be grabbed and used anywhere.

5.1.   *Context revisited*

In 'What we talk about when we talk about context', Paul Dourish (2004) draws on phenomenology and human–computer interaction to theorise context as a relational property that arises dynamically from the activity. Thought of like this, context is not so much a matter of representation, as illustrated so clearly in Bronfenbrenner's model, as of interaction: 'Context isn't just 'there', but is actively produced, maintained and enacted in the course of the activity at hand. … ' [It] isn't something that describes a setting; it's something that people do' (Dourish 2004, 22). This emphasis on context as interaction has similarities with the approach taken by Heritage and Clayman (2010) in their studies of language in social settings, including doctor–patient consultations and jury deliberations. They describe the two dominant ways of conceptualising context as the 'bucket' and the 'yellow brick road'. According to the bucket theory, context is a vessel that

encloses or contains interaction; the social interactions that occur do not alter the surrounding bucket because it is a separate entity.

The image of the yellow brick road comes from the Beatles' film *Yellow Submarine* (which, in turn, is based on the road in the film of the *Wizard of Oz*). As the Beatles step forward, a yellow brick road appears under their feet and it is the action of walking that forms the route on which they are travelling. This way of thinking about context nicely visualises the ways in which context unfolds and is constantly changing. Context and activity are not discrete; the yellow brick road does not pre-exist, but emerges dynamically from interactions with the environment. Context is 'the project and product of the participants' own actions' (Heritage and Clayman 2010, 21) and is being continually created and enacted. It is 'something that people do' in Dourish's phrase but it is also increasingly becoming something that digital technologies do, with the resultant loss of agency that implies. In such scenarios, made possible by the Internet of Things, human agency may be decentred and our interactions and behaviours may change in fundamental ways. As Kallinikos, Leonardi, and Nardi (2012, 11) put it, materiality, technology and agency are not any longer distinct and separable but 'they mingle in an indissoluble bundle of iterative or recursive relations that removes human agency from the centre stage, making it just one more force among the dance of forces that express and govern social life'. Thinking about children's technological practices within these sociomaterial terms requires new models or frameworks for conceptualising this space and establishing the demarcations of what is and what is not context when digital devices are 'reworking, mediating, mobilising, materialising and intensifying social and other relations' (Ruppert, Law, and Savage 2013, 24). Concepts of context influenced by Bronfenbrenner imply boundaries that may no longer exist and leave unresolved the problem of where culture is located. Cole's (1996) concept of context as weaving or connecting may have more purchase and has some resonance with Weiser's concept of disappearing computers that 'weave themselves into the fabric of everyday life until they are indistinguishable from it'. Traditional research methods may not be sufficient for understanding culturally located human–digital interactions when technology is both agentic and shaped by and embedded in the everyday.

6. Everything and the everyday

This more protean understanding of context means that the researcher, as well as the child or family, becomes decentred, making available only partial views that will inevitably shape what is available for interpretation or what we can know of a research setting. It is hard to imagine how dynamic, interactional concepts of context, such as those described by Dourish or Heritage and Clayman, could be captured in a diagram with the simplicity of Bronfenbrenner's in which the concentric circles represent context as external to, and surrounding, the child and imply a vantage point hovering over, and looking down on, this child-centred microcosm. If only we were able to find the right viewing platform and gain the right perspective, it seems to suggest, then we might be able to organise all our data so that it contributes to an illusion of completeness, perhaps by metaphorically placing it within the correct circles.

Weisner (1984, 335–336), an influential voice in the development of ecocultural theory, articulated this desire for a literal overview that captures nearly everything or, at least, 'the sociocultural environment surrounding the child and family'. Writing in 1984, he describes an imaginary satellite that is positioned to audio and video record children's daily routines as a means of achieving this, with the recorded data including how far they venture from home, who they spend time with and the characteristics of the household or domestic group. In Weisner's scenario, it would be possible to assess children's discourse and interaction from the recordings, with children and adults adding to the interpretation. As in the examples taken from our studies of children and technology provided earlier, this craving to capture context routinely leads to the use of video

to record activity as it is generally believed to represent the complexities of settings more accurately than other, non-visual, methods and it appears to lend itself to contextualist attempts to capture the big picture (Plowman and Stephen 2008). A modern equivalent of Weisner's ambition might be based on drone technology that would provide large quantities of searchable visual data by covering, both literally and metaphorically, a lot of ground.

After all, as Horton and Kraftl (2006) note, an interest in the everyday is, at first glance, an interest in *everything*. The problem we confront is that in trying to describe everyday life the researcher imposes a unity of meaning that risks giving a distorted sense of how all this is experienced from the child's or parent's point of view. In doing so, it smooths over the contingencies and messiness of family life in the interests of neatly encapsulated sets of 'findings' that appear to have been found readymade, rather than created by the researcher from a partial understanding of a setting. As researchers, we may want to be like the omniscient narrator of fiction who knows the thoughts of all the protagonists or to have the power of Haraway's (1988, 581–582) 'god trick' of 'seeing everything from nowhere'. Hultman and Lenz Taguchi (2010) understand this as an 'anthropocentric' gaze that creates a kind of 'humanocentrism'. In their discussion of photos of children taken for a research project they describe how the material in the pictures (such as sand or a climbing frame) became 'merely a backdrop' for the children's actions and competences and how this had led them to realise how hard it was to shake off 'liberal humanistic notions' of the centrality of the child.

A decentring of the individual is essential for Taylor, Pacinini-Ketchabaw, and Blaise (2010, 81). They critique Piaget and, implicitly, Bronfenbrenner's model of human development by insisting that

> the notion of the autonomous individual child perpetuated by child development theory is not only an illusion, it is also a grossly inadequate conceptual framework for responding to the challenges of growing up in an increasingly complex, mixed-up, boundary blurring, heterogeneous, interdependent and ethically confronting world.

The dangers of focusing on the social world to the exclusion of the non-human are also discussed by Hultman and Lenz Taguchi (2010) and restated by Taylor, Blaise, and Giuni (2013, 49) in their exploration of a post-human landscape that 'repositions childhood within a world that is much bigger than us (humans) and about more than our (human) concerns. It allows us to reconsider the ways in which children are both constituted by, and learn within, this more-than-human world'.

Actor Network Theory, the concept of assemblages or complexity theory have attracted some researchers as a way to engage with these issues (Carrington 2013; Bond 2014), whereas both Dourish's (2004, 22) concept of context as 'something that people do' and Heritage and Clayman's, which is based on spoken interaction, promote human-centred visions of context. Regardless of which theorisation seems to be most meaningful for a specific study or an individual researcher, there remains the problem of deciding which data can help us to reveal the various interactions between people, places and things when we are researching children and digital interactions. Ethnographic approaches are promising, but have typically relied on observation which may be less revealing if we cannot see the boundaries of human and technological interaction and there is a danger of collecting and trying to interpret an overwhelming volume of data.

As researchers with an interest in digital technologies in the home, we require approaches that describe dynamic situations in such a way that we can account for the evanescence of family life. The three examples given earlier (the mobile phone diaries, the self-recorded video and the chestcam) provided ways of circumventing the need for participant observation but also gave participants some control over data by editing or deleting material they did not want to share. Researchers are likely to continue developing techniques that correspond with

technological changes so methods may become increasingly invisible and ubiquitous, from the examples of data generated by the Internet of Things and drone technology to self-generated biometric data from wearable devices or lifelogging that combines data from many sources, such as social media and fitness trackers. The consequences of these changes and the increased digitisation of data amplify existing concerns about surveillance and data storage and security.

In the same way that Bronfenbrenner reacted against the perceived narrowness of the 'strange situations' in which much research of his time was conducted, we may come to see that our current interpretation of context is too restrictive if we are interested in naturalistic studies of children's use of technologies within and beyond the home. The problem is one of knowing where to draw the boundaries. The extension of the Internet of Things into the entanglement of digital devices encountered by families and domestic life means that the notion that a researcher would be able to 'capture' these interactions within a definable, bounded context of a home that is digitally augmented and extended is unrealistic. More fluid ways of collecting and analysing data that take account of digital technologies that are increasingly immersive, miniaturised, embedded and mobile, and with the power to generate enormous amounts of data, will require new analytical skills and forms of representation, but they also open up opportunities to exploit the affordances of the same emerging technologies to make possible new ways of collecting data.

Savage (2013, 4) cautions us against defining our times in terms of the digital with 'epochal' claims and Taffel (2015) reminds us of the dangers of the rhetorics of novelty and progress. By drawing attention to the increasing omnipresence and invisibility of technologies in the home and the ways in which this may make understanding and representing the research setting as a context more complex I risk being open to these charges. While predicting digital futures can be hazardous, toys and games are likely to increase the convergence of children's online and offline play through more elaborate hybrids of virtual and real worlds in which all objects leave a digital trace and the screen interface becomes redundant. The key characteristics of invisibility, mobility and ubiquity will extend notions of agency, alter definitions of interaction and make concepts of context open to more scrutiny.

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