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Exploring the affordances of smart toys and connected play in practice

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Abstract

What does children's play look like in the smart toy era? What conceptual frameworks help make sense of the changing practices of children's connected play worlds? Responding to these questions, this article re-frames discussions about children's smart toy play within wider theoretical debates about the affordances of new digital materialities. To understand recent transformations of children's play practices, we propose it is necessary to think of toys as being increasingly media-like in their affordances and as having intricate connections to wider digital material ecosystems. To demonstrate the potential of this conceptual approach, we explore illustrative examples of two popular smart 'care toys'. Our analysis identifies three examples of affordances that smart care toys share with other forms of mobile and robotic media: liveliness, affective stickiness and portability. We argue that locating discussions of smart toys within wider conceptual debates about digital materialities can provide new insights into the changing landscape of children's play.

Introduction

The rise of the smart toy has brought talking dolls, interactive pets and programmable robots into Western children's play worlds. Smart toy manufacturers boast their products – equipped with features such as sensors, speech-recognition and network connectivity – offer new interactive and personalised play experiences. Hasbro's Furby Connect, for example, is an animatronic smart toy with built-in sensors that can be programmed to respond to a user's voice and its environment. The Furby Connect is described by Hasbro as a toy that encourages 'phygital play' – a blend of 'physical' and 'digital' play (Habsro 2018). Smart toys have also become subject to increasing research interest. In Europe, North America and Australia, research into smart toys has focused on data privacy and security (see among others FOSI and FPF, 2016; Montgomery, 2015) and toys in computing education (Manches & Plowman 2017; Öztürk & Calingasan 2018).

This paper contributes to this growing research field by proposing new ways of theorising the smart toy in children's play worlds. Smart toys have significantly transformed how children and toys interact, giving rise to new forms of play that blur boundaries between the material and digital. Though smart toys continue to share many similar traits with traditional toys, often building on existing play categories such as 'care toys' and 'construction toys', we argue that they also increasingly share characteristics with domestic media and computing devices. Toys-to-life (TTL) products, for example, enable communication between toys and other computing devices such as games consoles and tablets. The Skylanders TTL franchise uses NFC (Near Field Communication) technology to share information stored on a toy figurine's microchip with that character's virtual counterpart in the console game. Smart toys can also emulate

the traits of other media devices. For example, as we show later, electronic care toys such as Furbies can encourage and demand attention like mobile phones. As Mascheroni & Holloway (forthcoming) argue, the smart toy increasingly needs to be understood as a digital-material object that transcends boundaries between toy and media technology. We therefore need new ways to talk about and theorise these smart toys as children's play objects.

This paper is a theory building piece that looks to media studies, human-computer interaction (HCI), and science and technology studies (STS) for new ways to conceptualise the smart toy as a media and computing object. We particularly look at two concepts: 'affordances' (Hutchby, 2001), which has broadly been defined as the possibilities for action that arise through interactions between people and objects, and 'digital materialities' (Pink et al, 2016), which has been coined to describe the enmeshing of digital and material worlds. The mobile phone is a good example of a digital material object – as something that digitally communicates with other devices via the internet, Bluetooth and NFC, whilst also being a material device that can be touched and held. To understand how smart toys are transforming play practices, we focus on the digital material affordances that emerge through the interactions of children and toys and locate them in wider media ecosystems. This paper identifies three examples of smart toy affordances (liveliness; affective stickiness and mobility) and, borrowing concepts from literature across media studies, HCI and STS, we demonstrate how different research fields can help to make sense of the digital material affordances that are emerging through the interactions of children and smart toys.

Our analysis demonstrates that bringing theories and concepts from media studies, HCI and STS to bear on smart toy can be highly generative, and we arrive at two principal findings: firstly, that smart toys are part of an 'environment of affordances' (Madianou and Miller 2012) shared with mobile, smart and robotic media. We show how recognising smart toys as hybrids of toys and media technologies opens new possibilities for observing the similar affordances and characteristics that smart toys share with other media, and that this can help extend understanding of these affordances in the context of smart toys. Secondly, we find that the smart toy represents a turning point in definitions of what counts as a toy – sharing some continuities with traditional toys, whilst also creating a new kind of object that requires different conceptual tools that transcend traditional field boundaries.

This article aims to contribute to multiple interdisciplinary fields. It is intended to contribute to with the field of toys and digital play, in that it reframes notions such as imaginative play and connected play through the lens of digital materialities, as an alternate and more productive approach to overcome the duality between the digital and non-digital, the online and offline, the material and immaterial. It is also meant to engage the field of affordance studies and takes smart toys as a further evidence of how affordances should be understood as processual, relational and contingent. Finally, it is intended to contribute to media studies, and especially to mediatization research, in that it explores the continuities and discontinuities in the practice of play, rather than the novelty of the technological features of new smart toys.

In this paper we focus specifically on a sub-set of the smart toy market: the smart care toy. During the 1990s, the Tamagotchi launched as the first popular example of a

smart entertainment toy that 'lived' through its interaction with users, and combined

material mobility with situated practices of digital care and nurturing. Broadly, care toys

can be defined as objects that incite children to engage in the nurturing of an electronic

pet by feeding, watering, stroking, petting, conversing, playing, teaching, chastising or

praising. These pets may be screen-based or animatronic. Smart toys are not necessarily

connected to the Internet, as much as connected toys are not necessarily 'smart' – that is

interactive and responsive to input of various kinds (touch, voice commands, movements

etc.) We focus on two iterations of the smart care toy: the Tamagotchi (from the 1990s)

and the Furby (from 1990s-2010s). This article won't undertake detailed consumer

histories of either objects, as these have already been comprehensively undertaken

elsewhere: for the Tamagotchi see Bloch and Lemish (1997) and for the Furby see Marsh

(2017).

In the following sections we set the scene for current debates in digital material

play and theories of affordances, identifying the need for new conceptual relationships

across fields concerned with media, technology and toys. Our focus then turns to the

specific example of smart care toys from the 1990s to the 2010s, examining how they

provide an opportunity for conceptual synthesis around the notion of affordances,

illustrated through the analysis of empirical material. This paper makes use of material

from recent studies of smart toys and connected play, including data drawn from research

conducted by one of the authors in the UK (Thomson, Berriman & Bragg 2018)[1]. The

purpose of using these data is to provide illustrative examples of how concepts from

different fields of research may contribute to and broaden discussion of affordances in

smart toys research. We also draw on examples from other papers, including Marsh (forthcoming), to further elaborate these points.

Digital materialities of children's play

The rise of smart toys has prompted new theorisations of the materiality of children's play (Marsh, 2017; Thrift, 2003). This paper contributes to these debates by considering how studies of children's play might benefit from engaging with new theorisations of digital materialities emerging within digital anthropology (Pink et al., 2016; Madianou and Miller, 2012). One of the chief characteristics of this anthropologically inspired approach is its attempt to avoid the bifurcation of ontology into separate digital and material realms. Past attempts have been made to avoid this bifurcation by suggestion that the digital and material worlds are mutually shaping – that digital worlds are dependent on a material world (e.g. of hardware and computers) and the digital world influences and shapes the material world. However, Pink et al. (2016) argue that such attempts to avoid bifurcation still frequently result in re-emphasising the material and digital as separate ontologies. In this section we briefly examine some recent conceptualisations of children's play in a smart toy era that have addressed this relationship between the material and digital, including notions of 'connected play' and 'distributed imaginaries'.

Originally conceived by Kafai and Fields, the concept of 'connected play' seeks to capture how connections 'are at the core of digital playgrounds in the twenty-first century' (2013: 2). Kafai and Fields specifically sought to demonstrate how the

affordances of new online play spaces designed for children, such as virtual worlds, gave rise to new forms of social and mediated play. More recently, Jackie Marsh (2017) has expanded this notion of connected play to explore the way that the Internet of Toys (IoToys) creates networks of relationship (1) between children, (2) between children and play objects, and (3) between play objects. Marsh also characterises connected play as taking place along a physical/virtual continuum, enabling smart toys 'to cross virtual- and physical-world boundaries' (2017: 2).

Two further concepts that seek to capture the new digital material ontologies of children's play are Mizuko Ito's (2005) 'technologies of the childhood imagination' and Seth Giddings' (2017) 'distributed imaginaries'. Focusing on the *Yu-Gi-Oh!* media franchise in Japan in the early 2000s, Ito identified two key trends shaping children's play: first, the arrival of new portable and intimate forms of toys and media that could be used anywhere and at any time (including portable games consoles and mobile phones), and secondly, the growth of toy franchises that actively encouraged social interaction between children such as through trading collectables or taking part in competitive play events. Ito describes these toys as spanning 'multiple materials forms' (e.g. video games, trading cards, toys, television programmes) and as constructing new technological imaginaries that pervade children's lives. Nigel Thrift (2003), also writing in the early 2000s, describes this as a shift from toys as 'solitary objects', to toys as 'assemblages' that are 'linked elements of little fantasy worlds' (395).

Focusing on the recent *Pokémon Go* mobile game, Giddings similarly stresses the shift towards distributed forms of children's play across 'media devices and images, physical and virtual artefacts and everyday environmental features' (2017: 61). He

describes how these different elements collectively 'shape, initiate, sustain, and scaffold imaginative play' (2017: 61). He describes this as a blurring of not only digital and material worlds, but also of fantasy and reality. Whilst Ito and Giddings' notion of distributed media assemblages shares much common ground with the idea of connected play, it also emphasises how smart toys are located in wider media ecologies, where the boundaries between toy, media, and advertisement have become increasingly blurred

Both the concepts of connected play and distributed assemblages provide useful ways of characterising the new digital material formations of children's play. Particularly in their recognition of movements towards more connected and relational practices of play. In this paper we seek to further refine these definitions of children's digital play with toys through concepts of 'digital materiality' and 'affordances'. We seek to further bridge discussions around smart toys and digital play, with recent conceptual frameworks in digital anthropology, media studies and the digital humanities. Our aim is to re-conceptualise smart toys as media objects (Mascheroni and Holloway, forthcoming) that are embedded within broader digital materialities where affordances are relationally defined and constituted. Through the notion of affordances, we seek to de-centre the smart toy as a 'solitary object' and instead to explore how smart toys are implicated in processual and relational practices in which child, toy and play culture are co-constituted.

Affordances

For Pink, Ardevol and Lanzeni, digital and material worlds are 'not separate but entangled elements of the same processes, activities and intentionalities' (2016: 1). Their

approach, which draws on a combination of anthropological theory and design theory, views digital materialities as emergent within everyday practices (2016: 2). For them, 'digital materiality refers to the making and to what emerges […] not [to] a state or quality of matter' (2016: 10). For example, the way the same object may be used and re-purposed in different contexts. In this respect, digital materiality is about the increasing 'porosity' of the elements that comprise our world that lead to a dynamic and constantly shifting ontological landscape. A further characteristic of this digital material ontology is its relational approach to media technologies. In this relational perspective, single objects are de-centred as their purpose and meaning cannot be severed from wider assemblages. Madianou and Miller's (2012) concept of the 'polymedia' environment exemplifies this relational co-existence of media technologies, characterised by collective rather than discrete ontologies. They describe this ontology as one where: 'each individual medium is defined in relational terms in the context of all other media' (2012: 170). It is also an ontological perspective that shifts emphasis away from the individual affordances of media technologies and instead looks towards 'an environment of affordances' (Madianou and Miller, 2012: 170) in which people, platforms and affordances are relationally connected.

First elaborated by Gibson (1979) within ecological psychology and popularised by Norman (1988) in design and HCI studies, the notion of affordances – broadly defined as the possibilities for agency opened up by a material artefact – has been widely used across a range of disciplines as a way to overcome the theoretical impasse between technological versus social determinism. It is an analytical tool that accounts for both

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how technologies shape, without determining, users' engagement and, vice versa, how users make sense of, appropriate, negotiate and even resist technological functionalities in their practices. However, notwithstanding, or precisely because of its popularity, critiques have lamented that the notion of affordances has been overused and misused, and eventually turned into 'a blunt analytic tool, in need of sharpening' (Davis and Chouinard, 2016: 246).

Hutchby understands affordances as both functional and relational: 'functional in that they enable (and also constrain) the engagement in some activity; they shape the conditions of possibility associated with an action. Relational, in that they may differ for one object in different contexts, or between different species' (Hutchby, 2014: 87). In other words, the functional aspect of affordances, as a set of possibilities for action, is always socially and culturally situated, and variously actualised through material and social contexts. Whilst in Hutchby's (2001, 2014) definition affordances are recognised as the process that mediates between the functionalities of a technological artefact and their enactment in situated social practices, its relational and processual nature is often overlooked by others and reduced to one of the two poles of the interaction as shown by Evans et al. (2017). In their analysis of multidisciplinary articles which adopted an affordances perspective, Evans et al. identified inconsistencies in the use of the term and pointed to theoretical and methodological flaws which conflate affordances with either technological features or the outcomes of the human and technology interaction. Moreover, they emphasise the variability of affordances: rather than being binary features that a technology may possess or not, affordances are 'a relational link among the object, user and outcome' (Evans et al., 2017: 40) that necessarily operate through gradations.

Davis and Chouinard explain how affordances operate 'at the intersection of artifacts, actors, and situations' (2016: 245) through requests or demands, and by allowing, encouraging, discouraging or refusing users' practices. *Requests* guide and orient users' engagement with the artefact towards certain outcomes. Affordances as *demands* have a more binding and constraining effect, since they set the circumstances that condition the use of an artefact. While demands and requests push users, the mechanisms of *encouraging*, *discouraging*, *refusing* and *allowing* refer to the object's responses to processes of social shaping, that is to users' negotiations of the possibilities for agency opened by an object. Artefacts vary in the degrees in which they allow certain lines of action on the part of the user, or, instead, force lines of action. The diverse mechanisms, though, are conceptually related – that is, they take on meaning in relation to one another (Davis and Chouinard, 2016: 244). Affordances as processual and relational, Davis and Chouinard argue, are also always contingent and situated in the specific interaction between one user and the artefact: 'how artifacts request, demand, allow, encourage, discourage, and refuse is always relative to the subjects who engage said artifacts, and the structural position in which the subject-artifact relationships are embedded' (Davis and Chouinard, 2016: 246).

However, many studies fail to capture the contingent and situated nature of affordances and adopt the term only to describe 'situated patterns of usage' as if they were inherent and universal properties of a technology (Costa, 2018: 3), overlooking the ethnographic variety of uses-in-context. According to Costa (2018), this shortcoming characterises much contemporary research on social media, in that it assumes the affordances of platforms are separated from their social context of origin, and that

therefore they are universally valid. Costa gives the example of how the concept of 'context collapse' on social media (the overlapping of previously distinct social networks) is a Western rather than universal affordance of Facebook and similar platforms. Costa frames affordances as a socio-technical achievement susceptible to variations across space and time and argues for a focus on affordances-in-practice: 'the enactment of platform properties by specific users within social and cultural contexts' (2018: 11). Affordances are the result of countless, reiterated human and technology interaction (Costa, 2018; Vincent, 2015) and, are therefore, potentially durable. Socially and culturally situated, affordances sediment in social practices, materialities and time. They hinge on processes of social legitimation through which they are rendered socially acceptable, desirable and even normative (Mascheroni & Vincent, 2016).

We believe that a definition of affordances as relational, processual, and therefore contingent and variously actualised in practice, would help overcome the duality of objects and subjects (Costa, 2018) and the duality between the digital and the material (Pink et al., 2016) alike. This will enable us to think of the affordances of smart toys as shaped in constantly unfolding relationships between toy and child, and to explore the continuity and discontinuity of affordances across changing iterations of care toys. The following section explores how this approach might be realised in practice in the context of smart toys, demonstrating how affordances emerge through digital-material play. Drawing on literature on affordances from across a diverse range of fields, these sections seek to develop new forms of conceptual language for articulating the affordances of smart toys. The affordances described below are intended to be indicative rather than comprehensive, and primarily aim to demonstrate the potential of an approach to smart

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toys that is attentive to the wider cross-disciplinary landscape of affordances research. Our examples are also intended to show the synergies between discussions in smart toys and other areas of research – demonstrating that affordances are not specific to objects but rather emerge in broader landscape of smart robotic and media technologies.

The Affordances of Smart Care Toys

In this section we reflect on three affordances of smart care toys: their liveliness, affective stickiness and portability. We consider how engagement with wider theoretical scholarship in media studies, STS and HCI might help us to make sense of these affordances, and provide examples of what analysis of these affordances might look like in practice using data from different studies.

Liveliness

The first affordance of smart toys we consider is liveliness. Since the 18th century 'automata' and other mechanical toys have often been characterised by their ability to seem to simulate life without apparent human control (Peppe, 2002). Smart toy manufacturers have built on this legacy, using animatronic technology to create pets (based on real and imaginary creatures) that appear to act autonomously and independently of their user (Bloch and Lemish, 1999; Turkle, 2006; Marsh, 2017). Smart care toys like *Hasbro's* Furby and *Spin Master's* Hatchimals use animatronic technology to perform sounds and movements that encourage children to treat their toy as a 'living' object to be played with and cared for.

As discussed in the previous section, affordances are relational and processual in character – involving constant work between the toy and user. This is particularly apparent in the case of liveliness which is dependent on a child's willingness and desire to explore and test the boundaries of the toy as an in/animate object. Though many smart toy manufacturers seek to convey a sense of animation and liveliness in their care toys, through design features such as bodily movement, facial expressions and vocal sounds, we contend that liveliness is not solely a product of design, but rather is contingent on children's imaginative explorations of subject/object boundaries. In STS and HCI, the liveliness of technology has often been explored as a feature of human-machine relationships, particularly robots and other animatronic technologies (Haraway, 1997). In this section we draw on recent discussions of human-robot relationships (Suchman, 2011; Zhao, 2006) to reflect on how 'liveliness' emerges as a relational affordance between children and animatronic care toys.

For Shanyang Zhao (2006), behaving in a 'human-like way' has become an important benchmark for social robots of all types. For social robots to be successful at forming relationships and engaging in meaningful interactions with humans, they must draw attention away from their artificiality. This is epitomised in computer science by the Turing Test whose benchmark for a successful robot is whether it can convincingly pass as a human. Whilst the trend in robotics has been to create convincing 'humanoid' machines, smart care toys have rarely attempted to resemble humans or other animals. Most assume the form of 'cute' creatures that bear only a passing resemblance to real animals (e.g. the Furby is described as owl-like). Their liveliness instead emerges through, what Turkle describes, as an 'evocation of life' (2006) – an imitation of life-like

speech and movement that invites children to imagine and treat a toy as a living object. Researching children's interactions with computers in the 1980s, Turkle noted the way that children would consider computers 'alive' if they appeared to display intelligence or autonomous thought. Reflecting on the changing role of technology in children's lives some thirty years later, Turkle notes how the smart toy has marked a shift in how children evaluate the liveliness of a machine. Rather than assessing computers based on intelligence, children have instead begun to assess whether their computer toys feel and can convey convincing emotional expression.

Both Zhao and Turkle provide important ways of situating children's smart care toys in debates about social robots and the growth of interest in making machine's 'life-like'. However, how is liveliness relationally achieved as an affordance between children and smart care toys? Whilst a smart care toy can possess an array of 'life-like' features, we need to look to the social-material relationships between children and smart toys to understand how this affordance is achieved in practice. Lucy Suchman's (2013) work on human-robot relationships, from a feminist STS perspective, provides one possible framework. Suchman describes the encounters between humans and robots as 'entity-making practices' in which boundaries between subject/object and sameness/difference are relationally negotiated. Drawing on Donna Haraway's concept of 'becoming with', she describes how the material entanglements of humans and robots involve 'configurations [that] differently corporealize the bodies of persons and robots through their embedding in particular spaces, stories and intra-active encounters' (2011: 133). For Suchman, humans and robots are co-shaping of liveliness. The human enlivens the robot through interactions (e.g. talk or play) – causing the robot to perform liveliness. In turn

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the robot, through its life-like features and action, will provoke the human to test its liveliness.

Liveliness, then, can be seen as co-realised by child and toy, with each animating and enlivening the other through their interactions. The robot invites, incites and 'encourages' (Davis and Chouinard, 2016) the child to recognise its sociality, often through calls (vocally, but also through gestures) to play. The child in turn engages in play practices that test the robot's liveliness – configured and mediated through the child's own sense of what an animate object can and should be.

Children's testing of the liveliness of robot toys are evident in several research encounters. 7-year-old Saffron[1], for example, experiments with her Furby to push the robot toy's 'life' to its limits. Saffron responds to the Furby's repeated calls for food by engaging in feeding practices that she knows will cause the Furby to lose its teeth:

Saffron: If he gets a boiled egg his teeth will come out, see.

Or to be sick and poo:

Saffron: Now he's going to the loo, I wanna see if he does some poos, he did it.

Saffron engages in co-producing the liveliness of the Furby through playing with its life-like features (of feeding, losing teeth, toileting), but she also tests the boundaries of the robot toy's liveliness by repeatedly forcing it to demonstrate its life-like features on demand. Whilst the Furby dutifully demonstrates its qualities as a living object, Saffron's

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[1] In an interview in Thomson, Berriman & Bragg (2018), Saffron identified a Furby as one of several objects important in her play, which also included a large container of Moshi Monster figurines and a collection of teddies and dolls.

experiments – and her predictions of how it will respond – underline the way that she is able to tease out and assert the limits of the 'life' of the object.

Jackie Marsh's (forthcoming) analysis of two children's reactions to the 'life-like' features of Furbies similarly underlines how the liveliness of smart care toys is configured through practices of differentiating human-like from non-human. Marsh describes how Amy, who is two years and eleven months old, treats the liveliness of the Furby as an invitation for playful interaction in ways analogous to Saffron. Supervised by her mother, she experiments with feeding the Furby different items, working out what it likes and what makes it sick. Amy and her mother also address the Furby with masculine pronouns, referring to the toy as 'he'. In another research encounter, Marsh describes meeting Angela, aged two years and two months, and her parents. Rather than seeing the Furby's liveliness as inviting play, Angela and her parents find the toy to be a source of 'unease' and 'anxiety' – with its rolling eyes and strange noises read as 'creepy'. Due to Angela's fear of the toy, they eventually sell it.

Marsh characterises these two different reactions to the Furby as 'anthropomorphic' and 'uncanny'. The anthropomorphic encounter is one in which the robot toy's liveliness is recognised as human-like in quality. The uncanny encounter, however, is one in which the liveliness of the robot toy is read as 'simultaneously familiar and alienating' (forthcoming: 7). However, rather than treat these as two distinct classifications of a robot's perceived liveliness, we might instead read them as diametric points along a continuum of children's negotiation of subject/object and human/non-human boundaries. As Suchman describes, '[the] robot sits provocatively on the boundary of subjects and objects, threatening its breakdown at the same time that it

reiterates its founding identities and differences' (2011: 133). In Saffron's case, we can observe the slipperiness of the subject/object boundary. Whilst her interactions with the Furby invest it with anthropomorphic qualities (he can "sleep", "poo", "eat"), she simultaneously recognises it as an uncanny object which exhibits machine-like reliability or 'calculability' (Bloch and Lemish 1999) in response to her demands for it to perform. Here we can see how this boundary making practice involves a constant process of mutual becoming (Haraway, 2008) in which the Furby's liveliness is repeatedly evaluated as Saffron's familiarity with the range and limits of that liveliness grows.

To what extent is this liveliness an affordance exclusive to robots and smart toys? And does liveliness have historical precedence in the affordances of more traditional toys? On the one hand, liveliness can potentially be attributed as an affordance of any human-object relationships where boundaries between subject/object are challenged. Toys have particularly been imagined and played with as animate objects (Kuznets 1994) even without the capacity to autonomously move, speak or respond. In this respect, we can look to relationships with more traditional toys – such as dolls, action figures and teddy bears – as a way of exploring how liveliness is configured in different material assemblages of child and toy over time. However, the particular life-like performances of smart care toys, and other robot toys, are nonetheless important and distinctive in the production of the liveliness of the smart toy. As we describe in the next section, these functions are often designed to give smart toys new forms of agency that 'demand' rather than 'request' children's interaction (Davis and Chouinard, 2016).

Affective Stickiness

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Another affordance that is a characteristic of smart care toys is what we call 'affective stickiness'. The concept was originally developed by feminist media researchers Jette Kofoed and Jessica Ringrose (2012) in their interpretation of cyberbullying. Drawing on Deleuze and Guattari (1987), they understand affects to be the products of encounters which entail processes of mutual positioning and subjectification. Here, we adopt and adapt an affective view to describe how the affordances of smart care toys can be understood as relational affective processes which glue certain affects to certain inanimate (the toy) and animate (children) bodies. In other words, we claim that affective assemblages emerge from the interactions between children and smart toys, which re-position and re-configure distinctions between the material and the immaterial, the digital and non-digital, inanimate and animate as blurred and indistinct. Within the entanglement of the digital and the material typical of smart toys, children become emotionally attached to their toys in profound and novel ways.

We find Kofoed and Ringrose's analogy of stickiness useful in two respects. First, their description of how affects cling and 'stick' to bodies over time chimes with our understanding of affordances as sedimented through the ongoing interactions of humans and technology (Costa, 2018; Vincent, 2015). In this respect, affordances can become habitual and ingrained so long as the relationship between human and technology is maintained. Secondly, and more closely connected to our interest in smart care toys, repeated interactions can lead children to form emotional attachments with their toys (Kahn et al., 2006) and therefore one of the affordances of these objects is their 'affective stickiness'.

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One could argue, though, that the affordance of affective stickiness is not peculiar to smart toys. Indeed, children also personify and project emotional qualities onto their stuffed pets and dolls. However, what is novel here, and what configures affective stickiness as an affordance, is the mechanism through which smart toys 'demand' (Davis and Chouinard, 2016), rather than simply 'allowing' or 'encouraging', an emotional attachment. Robotic pets and dolls are 'affective' social robots 'designed to interact with humans on an emotional level' (Zhao, 2006: 408). In other words, emotions have been engineered into these robots to evoke users' responsiveness (Vincent, 2015). These toys simulate human interaction and trigger particular emotional responses in the user, who feel a desire or urge to take care of them. This compulsion to nurturing and meeting the demands of the toy is what according to Turkle (2006) distinguishes 'relational artefacts' like social robots from 'transitional artefacts' such as stuffed pets and dolls, and configures a new relational encounter. Traditional transitional objects allow children to project meanings – the desire to be fed, cleaned, in a word nurtured – onto the pet or doll and thus develop an emotional bond to such objects. By contrast, relational artefacts are 'decidedly more active', as Turkle (2006) puts it, or demand care – as we would put it – by signalling their needs through various forms of notification – sounds, words, movements of the eyes and body, etc. 'In the move from traditional transitional objects to contemporary relation artefacts, projection gives way to engagement' (Turkle, 2006). While projection is led by the child, engagement appears to be oriented and pushed by the technology. By this, we do not mean that the interaction, and the associated relational affects, is totally controlled by the toy's affordances. That is, we are not suggesting that smart toys determine children's playful practices. Even demands (Davis and Chouinard,

2016) take shape only through interaction, but resisting and rebuffing such demands implies ending, at least temporarily, the interaction. We draw on our empirical evidence around the Tamagotchi and the Furby to illustrate this point further.

The Tamagotchi is emblematic of how an affective, compelling relationship is formed, between the child and a toy that eventually dies if its demands are not met – that is, when children fail to provide them with 'virtual care, when necessary, in the form of sleep, a regular supply of food and drink, washing, play, teaching, scolding and medication' (Bloch and Lemish, 1999: 284). Fourteen-year-old Aliyah[2] well describes how the requirements of the Tamagotchi were binding and even mandatory, if one wanted to keep the Tamagotchi alive and grow into an adult:

Aliyah: My Tamagotchi died. But basically, there was, you had to be kind of responsible, I think there was like this, you had to be responsible, you had to like look after this animal, and you had to give it food and stuff like that and it would die if you never took care of it, and then mine died.

By saying that users needed to behave in a responsible way and take care of the Tamagotchi, Aliyah does not only capture what was the perceived educational value of Tamagotchi as sanctioned by parents – namely, 'teaching responsibility' (Bloch and Lemish, 1999: 286). She also points to the way the Tamagotchi pushed users towards a moral responsiveness. The insistent beeping of the Tamagotchi, recalling the user to

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[2] In Thomson, Berriman & Bragg (2018), Aliyah selected her Tamagotchi as an object that was representative of her past, which she had kept in a memory box despite it having been broken for several years. She selected her mobile phone as a favorite object in the present.

her/his nurturing responsibilities, can be argued to project upon the child the subject position of the mother responsibilised as 'the self-for-others' (Johnson, 2014). Moreover, these intermittent yet continuous notifications, by tethering children to the demands of the affective social robot, produce another subject position that is usually associated with the affordances of mobile communication – and namely the affordance of 'perpetual contact' (Mascheroni & Vincent, 2016) – and that Turkle (2008) names the 'tethered self'. Affective stickiness as an affordance includes the binding force of 'anywhere, anytime' availability of mobile communication, especially of instant messaging applications such as WhatsApp. Especially notifications on WhatsApp that indicate when the receiver has received and read the message, push children and teenagers to respond in real time for fear of missing out and failing to conform to reciprocal expectations and social norms that govern interactions within the peer group (Mascheroni & Vincent, 2016). Similarly, the interview with seven-year-old Saffron well illustrates the 'always on' dimension of affective social robots: prompted by the researcher to pick her favourite toy at the beginning of the interview, she interacts with her Furby for while – 'wakes him up', 'feed him with some grapes' etc. As the conversation with the researcher continues, she talks about other toys, especially her Barbies, but the Furby demands constant attention by playing various sounds. At some point, Saffron notes:

Saffron: *The Furby's asleep now.*

Researcher: *Furby's asleep, he is asleep isn't he?*

Saffron: *A huh.   'Cause he gets tired and for a few minutes and then he goes to sleep.*

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The Furby goes into a sleep mode but 'wakes up' again after a while and starts giving off noisy signals again. The constant attachment that Furby and Tamagotchi demand is no different from the emotional attachment that users develop in relation to their smartphones in that it elicits 'electronic emotions' (Vincent and Fortunati, 2009), that is emotions created and lived through interacting with machines. The outcome of such reiterated emotional interactions is a relationship in which the technological artefact becomes natural and, in the case of the mobile phone, also a taken for granted and socially legitimised always-on presence (Mascheroni & Vincent, 2016; Vincent, 2015).

The comparison with the affordances of mobile communication through the notion of electronic emotions leads us to untangle another mechanism through which affective stickiness operates as an affordance. Beyond demanding nurturing and care, affective social robots such as Tamagotchi and Furby also 'allow' (Davis and Chouinard, 2016) for electronic emotions prompted as a result not only of the reiterated interactions with the devices, but also of the reiterated mediated interactions with intimate others through such a device. The device, then, becomes the repository of personal memories and affects. Aliyah well explains how the Tamagotchi is still carefully conserved in her memory box since it embodies the relationships with her primary school friends:

Aliyah: Hmm, it reminds, I would say it reminds me of my old friends, like since we moved here I haven't talked to any of them, so I would say my old friends from where we lived before, so yeah, I'd say that.

This is consistent with the understanding that affordances demand and require but also allow, encourage, discourage and resist. Aliyah's words, however, also lead us into the final affordance of smart toys that we would like to address in this paper, that is, its portability.

Portability

The last affordance of smart care toys that we address is their material and symbolic portability. The miniaturization of smart care toys – of the Tamagotchi for example – is associated with its affective stickiness: 'the fact that the Tamgotchi is a miniaturized toy and can therefore be easily held and transported seems to be of great importance in its ability to elicit feelings of affection' (Bloch and Lemish, 1999: 289). Being so small that it can be held, carried around and attached to the body 'encourages' (Davis and Chouinard, 2016) the practice of nurturing and, hence, the development of a sense of intimacy with a virtual pet and an emotional bonding to the material artefact.

However, we would like to focus here on the portability of smart care toys in a more genuinely social sense: as tools for children to negotiate group boundaries and belonging. Bloch and Lemish have previously noted that children would physically gather around Tamagotchis at school to compare their caretaking behavior, but also to sanction their belonging to a group on the basis of being 'socially attuned to and with access to current trends' (1999: 290). Interactions with peers through smart care toys becomes part of the wider meaning-making processes through which children construct,

negotiate and legitimate their belonging to peer groups. Sociologist Allison Pugh described the outcome of such peer interactions around material culture an 'economy of dignity': 'children collect or confer dignity among themselves, according to their (shifting) consensus about what sort of objects or experiences are supposed to count for it' (Pugh, 2009: 7). Aliyah's account of the place of the Tamagotchi in her life as a seven-year-old epitomises the practices through which artefacts and experiences are transformed by children and re-invented as 'symbolic tokens to vie for dignity' (Pugh, 2009: 218). Aliyah wanted a Tamagotchi for her birthday to claim dignity and confirm her belonging to the group: '*at the time there was, everyone had it and it was really like a big thing, and if you didn't have it was kind of weird so*'. She also describes the symbolic labour around the Tamagotchi – that is, how the material portability of the Tamagotchi allowed for its re-use in competitive status seeking behaviour:

Aliyah: Yeah (laughs). To be honest it was like, everyone would get it to show off, how it told you how good your life is and stuff like that, and then, obviously, mine wasn't really good because mine died, but everyone else's was like, really high and every one would get it in to show off how long it would last for.

Whilst the Tamagotchi represented seven-year-old Aliyah's favourite object, the smartphone is the material object which fourteen-year-old Aliyah is most attached. This is no coincidence, as the engagement with both the materiality and the symbolic value of the Tamagotchi has also been observed in the literature on mobile communications and children. One relevant point emerging from the field of mobile communication is that material and symbolic portability are mutually constitutive. Indeed, the multi-dimensional portability of mobile phones – as a three-way process involving the mobility

of the user, the mobility of the device and the mobility of the content (Cooper, 2002) –
sets the conditions for the socially situated meaning-making practices through which
teens negotiate their belonging. The mobile phone has been used as a significant
repository of personal information and an identity-making device (Caron & Caronia,
2007: 105) through which teens claim dignity and status within the peer group. In using
the mobile phone as symbolic resource for identity formation in the context of face-to-
face interaction, teens re-signify the model of the phone, its decoration with cute cultural
icons, the mobile phone address book – especially the number and status of the
individuals in the list – as well as the history of text messages and their call logs into
markers of status and identity (Green and Haddon, 2009; Ling, 2004). This is not
dissimilar to how the material and digital Tamagotchi was converted into a symbolic
token to 'show off' and claim the dignity to participate in the group on an equal footing.
So, identity and belonging are a fundamental outcome of portability as an affordance.

Ito also elaborates on the creative use of toys in the setting of everyday social
interactions and suggests a second level at which the material and symbolic portability of
smart care toys plays out and unfolds as part of the wider media mix that characterises
contemporary peer cultures. She emphasises the hypersociality of contemporary popular
culture, to describe both how sociality is augmented by complex networks of 'peer-to-
peer ecologies of cultural production and exchange' (Ito, 2005: 3) and how everyday
imagination around popular culture artefacts is a site of generative cultural production.
Imagination as a social activity has been expanded thanks to the pervasiveness of
'portable and intimate technologies' of play (Ito, 2005: 1-2).

We could refer to this second outcome of portability as 'distributed imagination' (Giddings, 2017), to describe the way in which children's imagined worlds are emergent and co-created as socio-technical achievements (Giddings, 2017: 60). Giddings emphasises the social dimension of affordances that are always located within socio-technical assemblages or, in other words, digital materialities.

Conclusion

In this final section we reflect on how concepts of digital materiality and affordances contribute to new understandings of children's play in an era of smart toys.

One question raised at the beginning of this paper is how the digital material transformation of toys has remediated (Bolter and Grusin, 1999) the ontological status of toys and its affordances. In other words, are there tangible distinctions between more traditional toys (e.g. soft toys and dolls) and smart toys? Our analysis suggests that whilst new smart toys do share some affordances with traditional toys – for example, in the way they invite imaginative play, practices of care, and affection – these have been augmented by the new sets of affordances that bear closer resemblance to mobile media (portability, affective stickiness) and robotics (liveliness). This augmentation of the affordances of toys has led to a shift in the dynamics between child and toy in which play practices that were previously 'requested' or 'encouraged' are now 'demanded' (Davis and Chouinard, 2017). Consequently, we suggest that combining new concepts of digital materiality and affordances can contribute to understanding the continuities and discontinuities of what counts as a toy. In studying the affordances of smart care toys, we suggest there is value in locating these and other smart toys within the shared 'environment of affordances'

(Madianou and Miller 2012) of other mobile media and technologies. We propose that this presents new opportunities for treating the smart toy as a hybrid object, which transcends traditional boundaries between toy and media and whose affordances can increasingly be traced within the emerging digital materialities of media technologies.

Conceptually, this paper has demonstrated the value of a relational and processual notion of affordances in the study of smart toys. This has enabled us to de-centre both the child (Spyrou 2017) and the smart toy (Costa 2017; Pink et al. 2016) to focus on the mediatory work of affordances within the context of digital play. We have reflected on how affordances are relationally "actualized and enacted" (Costa 2017) between children and smart toys, but also how affordances mediate the parameters of action and agency. This has enabled us to see how child and toy become enmeshed in relational practices of co-becoming (Haraway 2008) where each act on the other in a "shifting choreography of […] lively objects and obliging subject" (Suchman 2011: 129) mediated by affordances. We propose that attention to affordances can provide the field of children's toy and media cultures with crucial insights into the relational and processual configuration of children's digital material play.

Acknowledgements

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[1] These examples are drawn from a qualitative longitudinal study (2013-14) on time and technology in children's everyday lives (see Thomson, Berriman & Bragg 2018). The study used a range of qualitative longitudinal, digital and multimodal methods to study children's lives across different temporalities (intensive and extensive rhythms) and spaces (home/school, public/private). Throughout the study, a central focus was the role of digital technology in mediating children's everyday experiences, including toys and domestic media devices. The study's sample comprised two groups of children: six aged 7-8 years who had previously participated with their families in a longitudinal study of motherhood (2005-10), and eight aged 10-15 years who were newly recruited for the Everyday Childhoods study