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How young children's play is shaped through common iPad applications: a study of 2 and 4–5 year-olds

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ABSTRACT
Digital devices such as iPads are prevalent in children's play from an early age. How this shapes young children's play is an area of considerable debate without any clear consensus on how different forms of play are brought into the iPad interaction. In this study, we examined 98 play activities of children in two preschool settings, featuring 2 and 4–5-year-olds, their play with iPads and non-digital artefacts. Three analytical approaches were used: an index built on a digital play framework [Bird, Jo, and Susan Edwards. 2015. "Children Learning to Use Technologies Through Play: A Digital Play Framework." *British Journal of Educational Technology* 46 (6): 1149–1160. doi:10.1111/bjet.12191], a quantitative description of the index, and a qualitative interaction analysis of children's play. Results show how play with iPads is characterised as less ludic than play with other artefacts, and diverges from the age-typical norms of play. We discuss what these results might mean for children's play in contemporary early childhood settings and for children's learning.

Introduction

Children play with artefacts in the world around them from an early age. What they play with, however, changes across history and between cultures and settings (Lancy 2015). In contemporary developed societies, digital technologies have permeated most areas of human lives in a relatively brief period, and digital artefacts are among the most reoccurring everyday objects that young children play with. Given its rapid expansion, we are just beginning to learn what this means for childhoods in the contemporary setting.

Touchscreen devices, such as mobile phones and tablets, are common technologies today. Their intuitive design and immediate accessibility make them usable by young children (e.g., Rideout and Robb 2020). Only a decade after Apple first introduced the iPad, the preschool/toddler section of the application store has the most downloads of all sections (Hirsh-Pasek et al. 2015). This has 'shifted the landscape of childhood' (Hassinger-Das et al. 2020, 83), bringing touchscreens to the everyday spaces of childhood.

While different sorts of media have been part of children's playworlds in the modern age, from cinemas starting in the early-mid twentieth century, to the advent and spread of home televisions in the 1950s and 1960s (Marsh and Bishop 2014), technologies today are part of children's play in a

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new and intensified manner, where they have become play objects themselves. National reports indicate that children spend increasing amounts of time daily with digital technologies at increasingly younger ages (e.g., Swedish Media Council 2019). Marsh et al. (2020) large sample shows how children aged 3–11 prefer or equally prefer digital technology over non-digital tools. Moreover, digital touchscreen technologies have frequently become a part of the child-minding reality for people (Lovato and Waxman 2016), not least during the Covid-19 pandemic (Sundqvist and Heimann 2021) as people intertwined caretaking, schooling and work in their homes.

What this means for children's learning and development is contentious, with starkly diverging perspectives. On the one hand, digital media and educational research on children playing with touchscreens, tend to view digital play as the same as play with other objects (Marsh et al. 2016). On the other, research from psychology and paediatrics points to the possible detrimental effects on young children due to excessive exposure to digital screens (American Academy of Pediatrics 2011), which according to Singer and Singer (2005) is hampering children's imaginative play.

Parental reports indicate that children are engaging more with screen-based media; both playing with, and learning from, the touchscreen media they use (Swedish Media Council 2019; Marsh et al. 2021; Rideout and Robb 2020). However, the types of activities reported, such as parents playing pacifying white-noise for children at bedtime (e.g., Marsh et al. 2021, 8–9), are outside of standard scientific definitions of play, which foreground children's engagement and focus (Weisberg et al. 2016), play being child-led, children's voluntariness and flexibility toward the activity (Pellegrini 2009) and is associated with positive emotional states (Spinka, Newberry, and Bekoff 2001).

The relation between digital technology and play warrants more empirical investigation of data when children play with technologies to better understand what children actually do when they play with them. Does this shift affect the ways children play (Sahlberg and Doyle 2019; Tremblay et al. 2015), and if so, how? These questions are of critical importance for various fields concerned with children, their upbringing, learning and development, as few studies have reported direct observations on how children play with touch technologies, such as the iPad. Furthermore, if playing with iPads is different from other types of play, we need to know how, to be able to discuss this critically. In this paper, we address these questions to interrogate how children play with and without the touchscreen tablet iPad in two early childhood educational settings featuring two groups; 2 and 4–5 year-olds.

Research on digital and touchscreen play

Research concerning screen use and children is an area of considerable debate with inconsistent empirical results (Heimann, Bus, and Barr 2021). A recent review of the literature (Hassinger-Das et al. 2020) advised more close consideration of contexts, age groups and types of activities that are examined. In their longitudinal study negatively associating screen time with executive functioning between age of 2 and 3, McHarg et al. (2020, 6) suggest that this might be attributed to 'increased screen use replacing activities that are important for cognitive development, such as playing with manipulatives and engaging in imaginative play'. Digital touchscreen technologies imbue the worlds we live in, warranting a critical examination of touchscreen technologies in societal and educational terms (Jewitt et al. 2020). The ways that touchscreens are shaping contemporary play practices are described by Itō (2009) as 'engineered' by the hardware and software that children use.

Scholars have pointed to the sometimes illusory-gap between digital and physical play (e.g., Marsh et al. 2016). Nansen and Wilken (2019) note that touchscreens and other artefacts are often 'circulated around the home' in everyday play activities. Many play activities are simultaneously embedded in both digital and physical space (Potter and Cowan 2020). Arnott (2016) argues for a consideration of the range of artefacts, digital as well as non-digital, that are incorporated into children's play, highlighting the fluidity of children's play today. Studies are documenting some of the potential benefits of play with technologies that are designed for children's development. These studies tend to highlight the leading-edge digital practices, and the creative potentials

of new technologies, and include practitioners who are trained with novel hardware and software, such as smart-toys, AR and VR. While studies of the leading-edge of digital play are important, there is also a need to examine the more common digital play activities of children, as much of children's play with touchscreens is not conducted at this technological leading-edge (e.g., Marsh et al. 2021), rather it is with what is readily available in Appstore or on common channels at YouTube etc. (Rideout and Robb 2020; Hirsh-Pasek et al. 2015).

In sociocultural studies of play, the role of artefact mediation is a key notion (Vygotskij 1978). In this line of theory and research, it is understood that children's play can be shaped differently by the digital and non-digital artefacts of culture (Fleer 2016), as such an artefact can mediate children's play toward being more imaginative or explorative. Pretend, and imaginary forms of play have often been taken as the gold standard for children's playful learning (Lillard et al. 2013). This position has, however, been challenged, for example through the prevalence of children's learning through play with everyday objects (Lillard and Taggart 2019). The study in this paper adds to this important discussion by examining both forms of play in digital and non-digital scenarios. This study responds to the call of Bird and Edwards (2015, 1158) for further research to evaluate their digital play framework building on the distinction between 'epistemic' and 'ludic' play with digital technology, and to 'identify the typical period of time associated with children's play behaviours'.

It has been observed how children become inspired by digital play and go on to play with a toy or imaginary play on the same topic (Neumann, Merchant, and Burnett 2020; Potter and Cowan 2020). While studies have documented digital media as part of children's imaginative play, this is often a case of children playing non-digitally with characters, plots or game scenarios (e.g., Marsh and Bishop 2014, 76). What this means is, however, a matter of debate. Some scholars argue that this observation vouches for children's need for non-digital play (Singer and Singer 2005; Sahlberg and Doyle 2019). Edwards (2021) suggests that an understanding of digital play might require new conceptualisations of what play is. While there are benefits to conceptualising contemporary play as blended between digital and non-digital, there is also a need to be comparative examinations of digital play and non-digital play to better understand how children's play is shaped today. In this paper, we do this by examining play with applications on the iPad and juxtapose this with play with other artefacts in two different age groups.

Theory – a digital play framework

This study builds on the digital play framework developed by Bird and Edwards (2015). The framework has its theoretical roots in the Vygotskyan (1978) notion of artefact mediation and the exploratory stages of play following Hutt's (1966) theory of play with objects. From this, Bird & Edwards delineate two distinctive phases of *epistemic play* and *ludic play*.

The epistemic phase is characteristically exploratory in nature. During epistemic play, children typically try things out through object play. In this phase, children gather information and knowledge of the artefacts they play with and emergently use the knowledge gained. In the ludic phase of play, children have typically mastered the objects of play and started to use symbols in a deliberate way. The ludic phase is characterised by children's use or creation of symbols in a novel way, or what is referred to as 'innovative' play. Commonly, this is observed in pretend and imaginary play, such as creative forms of make-believe and sociodramatic pretend play.

The framework of Bird and Edwards (2015) was originally created for children's digital photography and later more widely for digital play (cf. Bird, Colliver, and Edwards 2014). For the purposes of this paper, we have expanded the framework to encompass children's play with artefacts broadly with the aim of comparing digital play with other forms of artefact play. Our use and expansion of the framework is schematically outlined in Table 1, which also give examples of associated play behaviours.

The framework parallels one of the main discussions on the role of pretend play in children's learning and development (Weisberg et al. 2016), and its contested position (see Lillard et al.

Table 1. Appropriation of Bird and Edwards (2015) model for artefact play.

Play phase	Behaviour	Typical artefact use	Examples
Epistemic play	Exploration	Exploring, touching and pressing on a new object	Pressing a new lever on a toy Navigating the ipad menu
	Problem solving	Trying different alternative solutions during explorative play	Trying whether different objects sink or float in water Trying a spinning top on a new surface
	Skill acquisition	Deliberate use of artefacts	Plating a table with toy fruits
Ludic play	Symbolic	Actions towards symbols. Using symbols deliberately	Putting doll to 'sleep' Dressing up as batman
	Innovation	Using symbolic means in a creative or innovative manner	Constructing a nap-time scenario Using toys in imaginary play themes Role-playing and imagining things

2013) through examination of both epistemic and ludic forms of play. We here outline various learning mechanisms traced to both forms of play.

On the phases of play

Several of the phases of play build on each other. Bird and Edwards (2015) highlighted that during play, children go back-and-forth between the epistemic and ludic modes of play (cf. Hatzigianni et al. 2018). The dynamic character of this process is important to underscore as it maps to current theories of play and learning, where an emerging theme is a 'tradeoff' between *exploration* and *exploitation* of information (Gopnik 2020), where exploitation stands for the use of the information already gained. Gopnik (2020) proposes that children navigate this tradeoff when they play, i.e., that children gain knowledge during play that they can then use in the same or the next play session.

The epistemic play phases

The epistemic phase of play starts with children's explorative play, where they try to figure out the functions of objects (Bird and Edwards 2015), as when children engage with novel objects. Children touch, feel, and sensorily explore the world and the affordances of the objects around them through playing with them. When exploring an object, children try out different functions and possible alternative uses of what they are playing with (cf. Hutt 1966). Bird and Edwards (2015) refer to this as a phase of *problem-solving* in which children try different uses of objects. For example, when children start to play with building blocks and try alternative methods of stacking blocks as a tower falls over.

While problem-solving can be understood as children 'simply' solving problems in play and gaining understanding in the process, rather, solving problems is important for plays' sake. Chu and Schulz (2020) have proposed that a central characteristic of play is that children choose *arbitrary problems, rewards and goals* for themselves when playing. Children, moreover, also create problems for themselves during play. If we take a child-stacking block, children knock over the blocks just to be able to try again. A body of literature points to how these behaviours provide children with evidence to causally infer an understanding of the world and objects they play with (Schulz and Bonawitz 2007).

Children use the understanding from exploratory phases in what Bird and Edwards (2015) call the *skill acquisition activity*. Here, children use their knowledge and relevant symbols more deliberately. For example, the child stacking blocks uses their understanding of how to neatly stack them on a flat surface to provide maximal stability. Another type of play that utilises children's acquired skills is play with games. This type of play, however, is distinguishably different from many forms of play by being strictly rule-governed. In Hutt's (1981) taxonomy, games fall between the epistemic and ludic play types.

The Ludic play phases

The ludic forms of play are distinguished by a more elaborate use of symbols than in epistemic play phases. During ludic forms of play, children act towards symbols (such as those on an iPad), or use symbols themselves. The first phase of ludic play is distinguished by how children act with symbols in play. Examples would include children using different appropriate objects, such as sheets, pillows and dolls, to arrange a 'bedtime', or when making the appropriate sounds playing with toy animals or vehicles. This play phase is typical for children in the early preschool years when children start using canonical forms of pretence.

A critical step occurs in children's play when children 'extract the internal affordances of different objects and play with them' (Tomasello 1999, 85). This is a foundational notion in the Vygotskyan rendition of play, where symbolic play is a key theme (Vygotskij 1978). Bird and Edwards (2015) refers to this second phase of ludic play as the innovative phase. What distinguishes the innovative phase is that children not only play using symbols in a canonically but also use them creatively. For example, whereas a child in the first phase of ludic play could play 'shop' using toys and 'selling' them over a play-counter to a peer or adult – play in the innovative phase would entail children creating a store out of boxes or selling imagined items over the play-counter. This phase is typically seen in the later preschool years, where elaborated forms of sociodramatic and imaginative play can occupy children's time and energy.

Methods

Context of study

The Swedish preschool has a long tradition of pedagogy based on child play. A recent overview of Swedish preschool activities observed that an average of 57% of children's time in the preschool is spent in child-led play activities, so-called free play (Åström et al. 2020). This is a high percentage compared to other countries, making the Swedish preschools a good setting for studies of children's play.

Cases and settings

The study features two case studies examining children's playful learning practices and free play. The researcher contacted the city education officials and principals to do field observations at preschools that were using iPads for children's play activities and chose a recommended preschool that after initial interview seemed to fit the project's aims. The first study was conducted in 2015 with a group of 21 children aged 4–5 in a mid-SES area, and the second at the beginning of 2020 (pre-covid-19) with a group of 9 2-year-old children in a low-SES area, both located in different suburbs of Stockholm.

Technology-wise, the 2015 group of children had one iPad that children could use at specified times, such as when waiting for lunch. The 2020 group had two iPads, with at least one accessible for the children throughout the day. None of the teachers and assistants featured in the study described themselves in pre-study interviews as having significant personal interest in technology, apart from using smartphones and tablets for everyday use. This is reflected in the practices of the preschools, which did not use novel educational technology, such as VR, AR, robotics etc. This limitation, however, aligns with the study's goal to examine children's typical play with the most common applications.

Data collection

The data collection is summarised in Table 2. The first author of the paper conducted video recordings in both cases. Recordings were done with one roaming camera to capture children's actions and interaction when playing with artefacts and with minimal interference to children's play. Multiple play interactions could be captured, but the researcher sometimes had to select a play

Table 2. Summarisation of projects and collected data for the project.

Preschool case	2015	2020
Days of observation	7 days	11 days
Primary data	Around 6 h play-based activity recorded.	Around 9 h of play-based activity recorded
Supplementary data	Field notes; Around 100 photos of environments, artefacts, activities etc.; Interviews with teachers.	Field notes, Around 250 photos of environments, artefacts, activities etc.; Interviews with teachers.
Children age	4–5 years	2 years
Children no.	21	9
Educator no.	3	2

interaction to follow due to the mobile nature of children's play; most often this meant following the initially recorded play activity, or where one play activity evolved into another. This approach captured a wide range of play activities and while all children have been recorded in play, some children have also been recorded more than others due to more frequent attendance and levels of play activity.

To capture multimodal data, a camera angle was chosen where children's bodily actions could be recorded. This became even more relevant in activities when children played with iPads, where the use of their hands and touch actions played a key role.

Sampling of play activities

We sampled play activities from the data sets featuring children's play with artefacts, either non-digital or digital iPad in both the 2015 and 2020 case groups. A total of 98 play activities were sampled from the data for analysis. These were distributed as 39 (17 digital) from the 2015 case featuring 4–5 year-olds and 59 (20) in the 2020 case featuring 2-year-olds.

In the study, especially in the 2020 case with more adult involvement, there were instances of play where teachers were involved (e.g., teacher-led or guided play). Notably, these instances are excluded as they are outside of the scope of this paper's research aim focusing on children's solitary or peer-play (i.e., with no or negligible adult involvement).

Materials and applications

The preschools had a range of non-digital materials available for children to play with. As common for Swedish preschools, a relatively large part of the day is allocated to children's free-choice play activities, where children can choose artefacts and activities available in playrooms at the preschool. A fuller array of the artefacts is presented as part of the results.
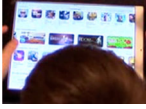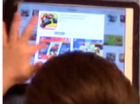
During iPad play, the groups chose from different applications available. The applications most used are shown in Table 3. The applications are listed by frequency of use in the data. The most popular applications are featured with a screenshot from the interface. Notably, the study not only features applications on the iPad that children played with in the study and also assesses how children play with the iPad menus and features such as the camera more generally.
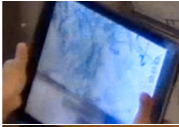
Analytical procedure

In the study, we aimed to capture the overall characteristics of children's play and maintain descriptive detail from the case ethnographies. We employ three analytical approaches: *an index of play activities* following the theoretical play framework, *a quantitative description* of the play types, and *a qualitative ethnographical description* of children's play interaction. The three analytical approaches used are described next.

Table 3. The most used applications during the project, descriptions and user interfaces.

2015 case	Application	Type of application	Screen interface
Major applications used	Hanna & Henri	Characters in interactive story with 'pedagogical minigames.	
	Heroes of the city	Movies with interactive games.	
	Mumin – hur gick det sen? [Moomin – what happened next?]	Moonmin story game where children have to interact with the screen and move iPad to navigate the story.	
	Appstore	Visiting Appstore to try new games/features.	
Minor use			
	Natti Natti HD	Interactive bedtime game.	
	Camera	Playing with the iPad's camera function.	
	Menu (explorative)	Trying different functions and applications.	
2020 case	**Application**	**Type of application**	**Screen interface**
Major applications used	Tripp trapp träd [Tripp trap tree]	Interactive world with games and creative/explorative features, such as a 'kaleidoscope'.	
	Firework application	Sensory/creative application for tapping and dragging movement to create effects.	
	Camera	Playing with the iPad camera/taking photo.	
	Menu (explorative)	Exploring/trying menu/different applications/email/Web browser.	
Minor use			
	Babblarna [The Babblers]	Application with popular children's characters, interactive movies and game/quiz.	
	YouTube	Looking at/clicking videos of interest at children's YouTube.	

Indexing of play activities

We operationalised Bird and Edwards (2015) digital play framework to create an index of artefact play activities. Initially, the first author coded sequences and presented these for collaborative assessment with the research team. Using our theoretical interpretation of the framework the 98 play activities with video allocation information were sorted following discussions among the research team into a sheet with corresponding play phases. During indexing the play activities, if an activity sometimes appeared to be borderline to the index code, it was further discussed to reach a consensus decision on its classification. Some of the in-between activities are discussed in the qualitative section.

Most of the indexing could be done unproblematically from the video data, while a few cases required more in-depth discussion among the team. For example, if a child's use of symbols in play was a sign of acquired skill (epistemic) or a sign of ludicity. In some cases, multimodal transcriptions and further examination were used to assess the video material (see Data Availability Statement).

Quantification of the play index

To enable an overview of play types that children engaged in, the results of the indexing of play activities are also described numerically. The results of this analysis are displayed as charts, and a table of complete numbers is provided in the supplementary material.

Qualitative descriptive analysis

Descriptions of the video data from 98 of the children's play activities were generated. Detailed analysis of the video data showed how children used various modes of playing; not only that play with the artefacts were physical or symbolic, but also that children used non-verbal communication to express themselves in play. For example, young children can pretend play with minor verbal language, e.g., making sound to a toy train or 'swoosh' their hand in the air depicting an airplane. In the paper, descriptions and some selections of examples from the video ethnography are included. An expanded analysis of the multimodal nature of play interaction in the data is accessible through the link in the paper's data availability statement link to Harvard Dataverse.

Results

The index of children's play activity

Table 4 presents the index of play activities, where a short description accompanies each indexed activity.

These results evidence the different characteristics of play in non-digital and iPad situations. It suggests a dominance of epistemic play in the iPad activities and a dominance of ludic play in non-digital play. To further capture this variability, and to assess the overall character of children's play, we quantified the categories of the index.

Quantitative descriptions of children's iPad and artefact play

By using the mapping of play activities in the index, the sum of the play categories was calculated. The numbers are displayed in the charts in Figure 1. In the charts, a line has been drawn between epistemic and ludic play phases to clearly illustrate the balance of the epistemic and ludic play phases in the illustration of results.

The quantitative data descriptions show the pattern in children's play, of less ludic and more epistemic play with iPads. The children in both case studies engage relatively more often in ludic play when they play with other artefacts than the iPad.

Notably, the children in both groups spent most of their play activities engaging in ludic play when playing with artefacts other than the iPad. In addition, the younger children engaged in more activities of symbolic play when playing with other artefacts than the iPad, and the older children engaged more with innovative types of play. The lack of innovative ludic play should be noted. Here we provide more qualitative detail of the play categories to support a fuller discussion of the results.

Table 4. The index of play activities.

	Total number of play activities indexed = 98			
Case study	2-year-olds		4–5 year-olds	
Epistemic play	n = 34 Touchscreen n = 17 Other total = 18		n = 20 Touchscreen n = 11 Other total = 9	
Exploration	Touchscreen (n = 5)	Other artefacts (n = 7)	Touchscreen (n =)	Other artefacts (n = 1)
	Pressing and dragging touchscreen surface during video Trying to make the iPad upright using the stand Navigating the iPad application menu Moving iPad to frame photo using Camera Using the ipad enclosed in case	Collecting stones and pebbles Collecting cones Trying levers on toy Trying instruments Dropping different objects in water Filling bottle with water Using cups to move water	Trying a new application from Menu Navigating youtube Exploring level selection in a new game from Appstore Trying games in a new language setting (e.g., *Hanna & Henri*)	Touching and exploring a new spinning top
Problem solving	***Touchscreen (n = 6)***	***Other artefacts (n = 4)***	***Touchscreen (n = 2)***	***Other artefacts (n = 5)***
	Zooming in to view, and using the pinching movement to zoom out when viewing images Browsing and selecting item of interest through Menu (videos, pictures, applications) Several children using *Tripp, trapp, tree* navigation together Flipping the camera function to use the selfie-camera Trying to enter iPad with passcode Trying to use tablet with camera to the ground	Trying different sounding rattles against each other Collecting and Sorting toys Trying objects buoyancy during water play Trying different tower constructions with duplo	Trying motions such as dragging in interactive story Trying a new use of iPad (tilting) needed in the *Moomin* game.	Trying spinning top on a new surface Trying new objects as spinning top (wheel, board) Making and trying different paper-planes Trying objects on scale in household area Trying a new toy
Skill acquisition	Touchscreen (n = 6)	Other artefacts (n = 7)	Touchscreen (n = 5)	Other artefacts (n = 3)
	Imitating a dance from YouTube-video Utilising function in an interactive *Tripp, trapp, tree* function Using iPad Camera to 'save' drawing Using the Camera function successfully (target in frame and using capture button) Rhythmically moving the iPad to music on YouTube Steering fireworks and changing colours in *Firework* application	Building and using train by putting pieces together Using books, flipping through all pages Using toy with shapes Constructing stable Duplo towers from earlier trials. Building towers from bricks Using toy functions with several buttons Plating toy-fruits on table	Finding music of liking on YouTube Using dragging motions to move forward in interactive story Using movements to clear levels and problems in *Heroes of the City* Going through *Hanna & Henri* stories at speed to enter more interesting parts of story Choosing games and levels in *Heroes of the City*	Showing teacher and researchers new moves with spinning top Using throws to increase paper planes' flight distance 'Duelling' with spinning tops
Ludic play	*2 year olds* *n = 25* *Touchscreen total n = 3* *Other n = 21*		*4–5 year olds* *n = 19* *Touchscreen n = 6* *Other n = 13*	
Symbolic	*Touchscreen (n = 3)* Browsing and selecting emojis (in writing mode) Naming characters featured in *The Babblers*	*Other artefacts (n = 16)* Pretending to parent a doll Pretend bathing a toy duck	*Touchscreen (n = 6)* Discussing which character in *Heroes of the city* to 'be'	*Other artefacts (n = 5)* Dressing up as Batman Preparing toy store with appropriate object (such

(*Continued*)

Table 4. Continued.

		Total number of play activities indexed = 98		
Case study	2-year-olds		4–5 year-olds	
Epistemic play	n = 34 Touchscreen n = 17 Other total = 18		n = 20 Touchscreen n = 11 Other total = 9	
Exploration	Touchscreen (n = 5)	Other artefacts (n = 7)	Touchscreen (n =)	Other artefacts (n = 1)
	application Creating patterns using the tablet buttons and camera in *Tripp, trapp, tree* creative function	Pretend bathing a monkey Pretending to drive car Making 'cho-cho' sound while moving train. Driving car making 'beep-beep' honks Pretendedly slicing toy-fruits to give friends. Doing household roles with peers Pretendedly making food in household area Putting stuffed animals 'to sleep' Dressing up with ethnic typical clothing Having 'nap' with doll Taking doll for 'drive' in car seat Feeding dolls and having nap-time with them Setting table and having toy-pizza slices Making toy-horse trot and jump	Searching and downloading new games of interest from Appstore Identifying with characters in game Using clothes in *Hanna & Henri* dressing-up game Imitating characters from game Beating game levels at speed	as replica bills in register) Moving a doll in doll-house Re-enacting scenarios from animated series Using toy characters in castle
Innovation	Touchscreen (n = 0)	*Other artefacts (n = 5)* Collecting cones to 'feed' a squirrel potentially living in the wood Utilising doll stroller and bed to play night-time Mark-making on whiteboard Making/decorating a 'house' out of tent Drawing with water, verbally imagining what takes shape	*Touchscreen (n = 0)*	*Other artefacts (n = 8)* Cooperatively creating new spinning tops to enact scenarios inspired by animated series Role-playing Robin Hood with hangers as arrows and shooting imaginary arrows Constructing a fort and play world scenario for toy characters Making tiger sound to initiate chasing game with friend Using plastic plant as a tree, transforming it in to a 'crab' by turning it Discussing objects and how to use them while playing store Role-playing being a spinning top Crafting new types of spinning tops with unique form

Notes: The 98 play activities are sorted with a short description by the two cases and are divided by touchscreen (iPad) play and play with other (non-digital) artefacts. The activities are sorted by the phase described by the theoretical framework (Epistemic or Ludic) and into the corresponding stage. The number of play activities in each column is shown, as well as the total number of activities in each phase.
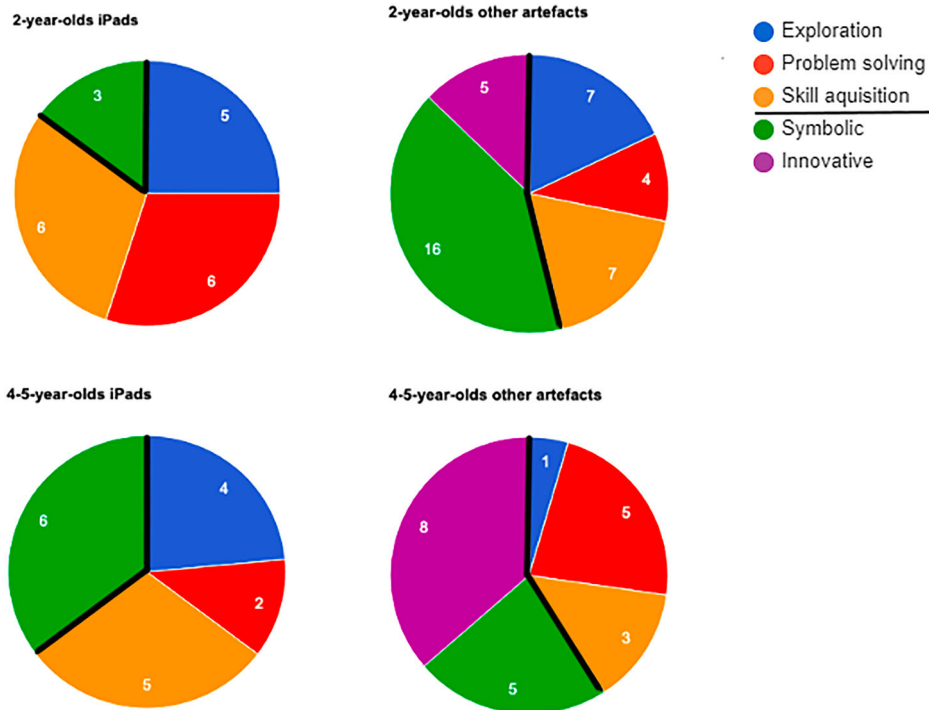
Figure 1. A pie chart of the distributions between phases and stages of play from the index analysis. Each stage is represented by a colour, a line is used to divide epistemic and ludic play phases for clarity.

Qualitative descriptions of children's play

2-year-old Group

With iPads. With the iPad, the 2-year-old group of children's play was predominantly epistemic. In the material, there was plenty of exploration and problem-solving behaviour, such as trying out different functions, menus and the camera, and learning how to use those functions as well as choosing applications.

Children made deliberate use of the iPad and its functions, characterising the skill acquisition stage, where they adeptly used the touch interface in their play with the applications. This happened when using interactive stories and creative applications (e.g., when creating patterns in *Firework* application or successfully taking a photo). There were also instances where children used the iPad cooperatively during peer-play – an example being the children sitting in a circle playfully navigating in *Tripp Trap Tree* together – synchronising their tapping to move forward together.

There were a few instances of immediate ludic play, characterised by children deliberately using symbols on the iPad, such as when 'writing' messages using emojis. In Figure 2, a child playing with and exploring the iPads e-mail application composing an e-mail using different emoji icons, pressing them and writing a line of symbols.

There were no instances we classified as innovative ludic play, either based on children's on-screen behaviour or on the verbal and multimodal interaction between children. Also, we did not observe innovative ludic play in play adjacent to the iPad play sessions that the iPad play could have inspired. While children used applications with content that can be seen as creative, they did not create new symbolic meanings when playing in these instances. Rather, the children were using applications in a canonically designed way, bounded by manipulating the symbols on the touchscreen.

There were no instances that we classified as innovative ludic play, either based on children's on-screen behaviour or on the verbal and multimodal interaction between children. Also, we did not

**Figure 2.** Child 'writing' an e-mail using emoji icons.

observe innovative ludic play in play adjacent to the iPad play sessions that could have been inspired by the iPad play. While children used applications with content that can be seen as creative, they were, however, not creating new symbolic meanings when playing in these instances. Rather, the children were using applications in a canonically designed way, bounded by manipulating the symbols on the touchscreen.

With other artefacts. During artefact play, there was play with objects in ways that can be predicted for this age group. The children collected artefacts and tried out objects, either in exploratory or trial-and-error play, such as building Duplo's or trying the floating properties of objects in water. This was also done in elaborate ways, as when children used acquired techniques to construct towers successfully or using toys in deliberate ways, e.g., playing with trains on rails or 'driving' a toy car.

Ludic play is characterised in this group by a growing interest in pretend play. For example, playing with dolls, walking them in strollers and pretending bedtime. Most pretend play is done in a canonical fashion, such as playing household using the play stove, tables and 'serve' plastic food
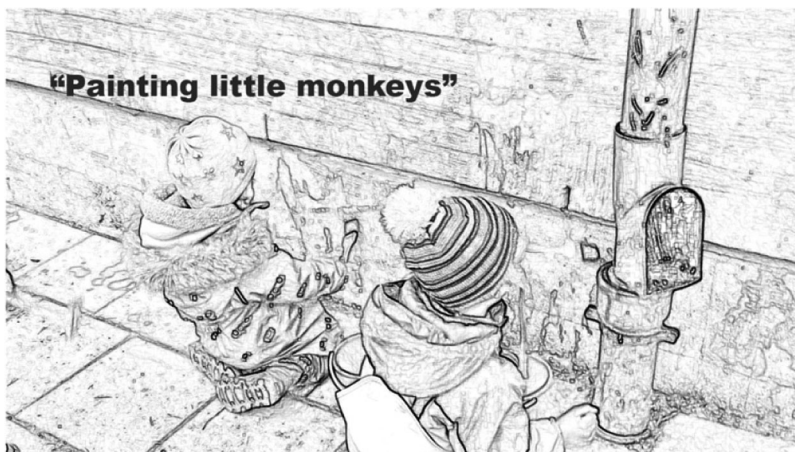
Figure 3. Two children are making marks with water on a wall using brushes, later imagining it being monkeys portrayed.
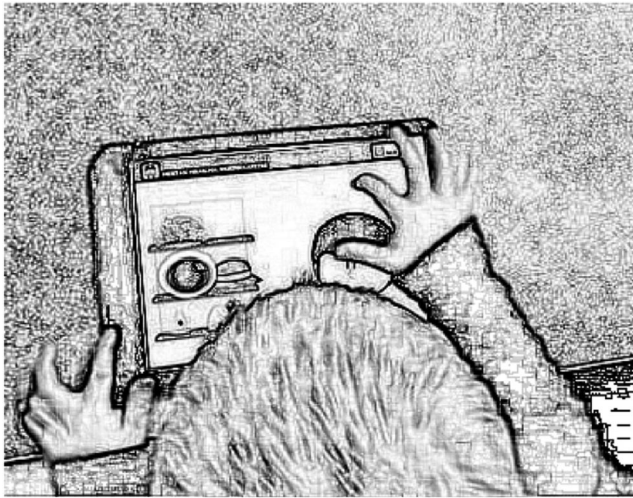
Figure 4. Child rapidly dressing a character in the game to move on in the interactive story.

to peers. There were instances of children playing in ludically creative ways and using symbols innovatively. Examples include children pretending a tent was a house or imaginatively pretending a monkey on a wall when 'painting' translucently with water outside, as in Figure 3. Here, a girl and boy painted on a wall while making watermarks. The girl rhythmically sang 'painting little monkeys' (using rhyme scheme from 'Five little monkeys' song), which spurred the children into painting imagined monkeys on the wall.

4–5 Age group
With iPads. In the 4–5 age group of children playing with the iPad, some play could be classified as exploratory when children tried new games and encountered new problems, like when a game requires tilting or less-common iPad movements. However, the children's play was fuelled by acquired skills, and they routinely chose games they already knew. This enables children to master games or interactive stories where they can move up in levels or to a new story by using mastered skills.

A large portion of the analysed examples was distinguished by children's play in the stage of skill acquisition. At this point, children know the iPad's different touch actions and the games in detail. This was noticeable as children cleared stages or problems in games with considerable speed. For example, the child in Figure 4, tapping buttons on the iPad's touchscreen, quickly dressed a character in the story game *Hanna & Henri* and moved onto the next level in the game where the character moves through a wood.

No data was classified as innovative play. We observed one instance *approaching* this stage when children proposed to 'be' a character featured on the screen in *Heroes of the city* later play, although this was not actually enacted. There were some instances in the ethnography where children played with themes or characters that are featured in digital media (children playing Batman, Robin Hood, Beyblades), but this was not observed in conjunction with the iPad play.

With other artefacts. The older group was less occupied with epistemic play that can be classified as exploratory. Children engaged in problem-solving play as they constructed and tried out new objects, such as when creating spinning tops or paper planes, often challenging themselves to make bigger spinning tops or farther flying paper planes.

The children were in a phase of pretend and imaginative play that was characteristically ludic. They played different roles, such as pretending to be Batman, policemen, or going to the store.
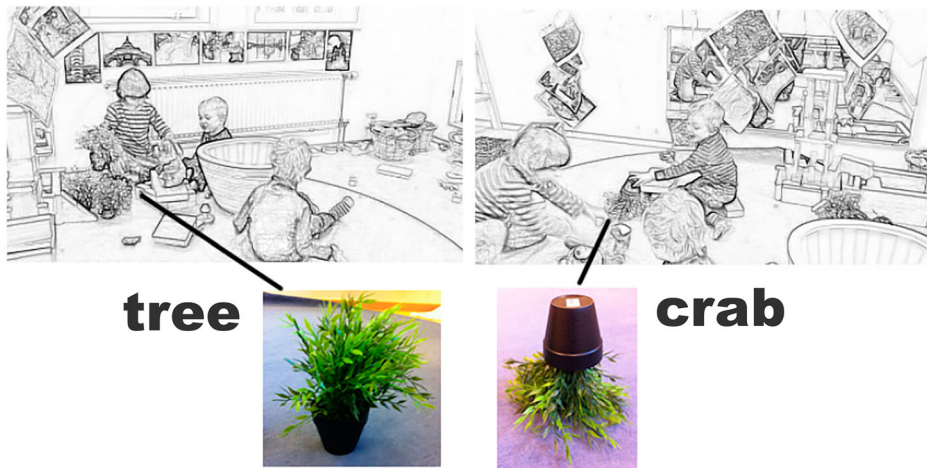
Figure 5. Children playing imaginatively with plastic plants in the playroom.

It is noteworthy that children not only performed canonical pretend play but also imaginatively created scenarios, such as playing Robin Hood with imagined arrows or having objects symbolically standing in for others. Sometimes children even changed the symbolic meanings of an artefact during an episode of play.

This is exemplified in Figure 5, taken from a play episode featuring two children using the preschool's decorative plastic plants in their play. First, the plants were imagined to be trees in a wood, that their teddy-bear had to walk through. Later during the play session, the children transformed the plants into 'crabs', attacking the teddy bear by flipping the plant upside-down. Examples like this one, highlight children's ability to play ludically with symbolic and physical affordances and extract symbolic affordances of items for play (Tomasello 1999). We found no type of equivalent scenario of this kind of play during the iPad play sessions.

Discussion

Differences in character between play with iPads and non-digital artefacts

There has been a surge in the literature promoting various lines of thought that conceptualise digital play as only negligibly different from other or more 'traditional' forms of play, either as part of the artefact ecology play things (Arnott 2016; Marsh and Bishop 2014). The results presented in this paper diverge from that conceptualisation of play. Our study findings point toward differences between iPad and non-digital artefact play, and evidence that children do not play with touchscreens as they would any other object. Instead, touchscreen devices influence children's play in particular ways (cf. Itō 2009), with the overarching result that iPad play is more about epistemic forms of play and less about the innovative forms of ludic play. This adds an important aspect to the fundamental discussion of the importance of imaginary forms of play for children (Lillard et al. 2013).

The results presented in this paper show that iPad play is overall more epistemic than play with non-digital artefacts. As this study also featured popular applications, as well as how children play with the iPad's features, the understanding of this holds critical importance. Considering the state of the field, the results also suggest that children's play with iPads may be directed in ways that are currently not well recognised by parents (Marsh et al. 2021; Rideout and Robb 2020), educators (Neumann, Merchant, and Burnett 2020) and not yet fully explored in the research literature where there has been growing consensus on creative forms of iPad play (Marsh et al. 2021), and that all forms of play also appear in digital play (Bird and Edwards 2015).

The character of iPad play

The results of this study show that children's play on iPads diverges from the age-typical norms of play for both age groups. What this means has to be critically evaluated. This study contributes to this by providing observational data and analyses examining the varying influences that iPads have on children's play, which has been requested from the scientific community (e.g., Bird and Edwards 2015; Hassinger-Das et al. 2020). The study is limited and other work is needed to further explore our results, test the use of Bird and Edwards (2015) digital play framework, and explore the extent to which they hold true for other age groups, settings, technologies and applications.

One should not, however, equate a tilt toward epistemic play to be inferior to imaginative forms of play (see Lillard and Taggart 2019). There could, we argue, be benefits to epistemic play with iPads, for example, that children show considerable skill using iPads and various applications. These are possible to trace to mechanisms of learning through inference during play (Schulz and Bonawitz 2007), common to exploratory object play (e.g., Gopnik 2020). In this way, iPad play can be comparable to what children do when stacking blocks or making spinning tops. It may be that the iPads intuitive design may even enhance this type of learning providing immediate responsiveness and feedback. This is suggested by how effortlessly even the younger children of this study navigated and used the iPad. Similar to children learning through trial-and-error, for example, when learning to build Lego, while gaining skills in the process. We see an analogy with how the children in this study play games and interactive stories, repeating the games and their levels numerous times until mastery. Here, there are important counterparts in iPad and non-digital play.

A key significance of the study's findings is the less-ludic character of iPad play. This result goes against some of the findings in the literature showing creative potential of children's iPad play (e.g., Bird and Edwards 2015; Marsh et al. 2021). We suggest the difference between the findings of this study and previous studies may be attributed to the latter's focus on studies that are concerned with types of leading-edge technologies and applications. There is currently a research focus on what technology *can/could* do for children and their play given the right support. However, here we point to the need to empirically observe how children usually *do* play with iPads, as children often play without advanced materials and social support. We argue this is vital to avoid a widening gap between the creative potentials of digital play for the minority, and the in-situ everyday shaping that happens in the majority of children's play practices with the commonly accessible applications readily available (cf. Marsh et al. 2020). Hypothetically, there is no reason why, for example, the older group would not want to continue playing the characters from *Hanna & Henri*, or that the younger group of children would not create sounds or imaginative gesturing playing with the popular *Firework* application. However, in the ethnographies examined in this study, this does not seem to come to fruition.

Thus, the lack of pretend play and other innovative forms of ludic play needs to be critically discussed in terms of the potential causes and implications of this lack. A fundamental notion of play is its child-directed nature, spontaneity and the possibility to set completely non-functional goals and rewards (Pellegrini 2009; Chu and Schulz 2020). While iPad applications could potentially foster some of this, applications typically have a defined set of goals featuring symbols to be manipulated in a determined fashion. This precludes aspects of play, especially innovative-ludic play, where plays' arbitrariness lets children create goals, play-themes and imagine symbols during play.

Children in both study settings played with a range of applications that could be categorised as 'creative', but in the observed play sessions, children's play did not measure up to the creative and innovative play. This discrepancy is a concern if software designers want to create applications conducive to ludic facets of children's play. Here, educators, designers, and, not least children, need to work together with advancements that could make iPads a more fruitful part of children's play. If ludic play is less common across play with iPads, it could pose a possibility for developers to make

future tech and software that fosters more ludic elements that engage children's fantasy in different ways. Nevertheless, this paper has, also pointed to positive learning potentials from epistemic play with iPads (cf. Lillard and Taggart 2019; Schulz and Bonawitz 2007), which can be further used. Before claims that children play with iPads just like any technology, or that iPads foster creative play is taken as the state of the digital play – we, with this study, call for a closer examination of how children play when playing with iPads across a range of applications. While the study features a limited number of applications, they are nonetheless popular part of the ecology of things that children play with (cf. Arnott 2016).

Physical and digital play

In the literature, there is a clear trend of play conceptualisations highlighting the fluid nature of children's play in a world inhabited by both digital and physical artefacts (Arnott 2016; Hatzigianni et al. 2018; Potter and Cowan 2020). While this study's framing separated iPad play from non-digital artefact play, the lack of mixed forms of play in the play activities of this study was also noted. In the study's cases, children did not fluidly go between iPad play and other play. While play sessions feature characters and themes from children's media, there are no instances where children seamlessly switch between iPad and non-digital play.

Limitations and future directions

We point to a need for more empirical studies of how children play with iPads (both commonly used applications, complemented with studies featuring leading-edge technology), to gain a complete picture of contemporary play. Continuing the call of Edwards (2021) for a new theoretical understanding of digital play. We suggest a spectrum of theoretical and disciplinary lenses is needed to capture the specifics of children's play with digital technologies and how this differs from other types of artefact play. We need to understand how children play with technologies and applications at different phases of development. This is of pressing concern, as children spend an increasing amount of time playing with devices such as iPads and results should be of interest to parents and educators. This line of inquiry can offer actionable insights for software and game designers who want to promote innovative ludic play elements that could be extended into games and stories and use epistemic play elements when fit. Such an ongoing dialogue is valuable as it would be a part of shaping the lives of children growing up today.

Further research is needed to understand the overall patterns of children's play and what it means for childhood and children's development. A set of results point to the fact that children are spending a decreasing amount of time in unstructured free-play activities (Tremblay et al. 2015). If children's play time has moved to the iPad, and this play is less ludic, the consequence may be that children are engaging significantly less in ludic play forms than decades ago. There needs to be wider scholarly attention to what this could mean, as a move toward more epistemic play is not a lesser form of play (see Lillard and Taggart 2019). This study's extended digital play framework has indicated some of the learning mechanisms associated with epistemic play activities. Future studies should examine more iPad applications and technologies to map how children play today.

When reviewing the literature, it is notable that there are many small-scale studies of leading-edge technological activities and potentially a theoretical bias toward an understanding that highlights creative potentials with iPads. In this study, we have tried to counteract this by using and expanding a framework to analyse children's digital and non-digital artefact play (cf. Bird and Edwards 2015). While studies of leading-edge technology show great promise, it is important to avoid an overly optimistic assessment of children's play with technology. The findings in this paper and the promise of a diverse discussion of children's play in the digital age warrant an intellectual space that can encompass both concerns of the age-atypical play that the iPads carry (e.g.,

Sahlberg and Doyle 2019) as well as the forward-looking observations of technological promise and potentials of creative, innovative play with iPads (e.g., Marsh et al. 2016). We suggest this can create a fertile ground for a wide-ranging discussion of children's play as it is today, and help to shape its future.

Conclusions

Digital touch technologies have, with the expanded use of the iPad and similar devices, become a major part of many children's everyday worlds and their play spaces. Unsurprisingly, there is uncertainty around what this means, as in a relatively brief period of time, it has introduced an array of new options in terms of the number of devices and applications to choose from. As researchers, we hold a critical role in the ongoing navigation that children, parents and childhood educators face due to this. While there are now bodies of literature that point out both the disadvantages and potentials of children's iPad play, this paper returns to the importance of empirical grounding of such claims in observations of children's everyday play with digital technology and the need for critical examination.

This has led to results that diverge from some current trends in research on children's digital play and have presented these results as part of an interdisciplinary research dialogue. If we are to understand the wide-encompassing phenomenon of children's play, we have to consider a range of results and effects that different artefacts may have on children when they undertake play. We point to the need to consider the ludic character of children's play, what it is and what distinguishes it, and to what extent it can be used in the technologies available today and potentially point to design features for more play-supportive technologies of the future.

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References

American Academy of Pediatrics. 2011. "Media use by Children Younger Than 2 Years." *Pediatrics* 128: 1040–1045. doi:10.1542/peds.2011-1753.

Arnott, Lorna. 2016. "An Ecological Exploration of Young Children's Digital Play: Framing Children's Social Experiences with Technologies in Early Childhood." *Early Years* 36 (3): 271–288. doi:10.1080/09575146.2016. 1181049.

Åström, Frida, Eva Björck-Åkesson, Madeleine Sjöman, and Mats Granlund. 2020. "Everyday Environments and Activities of Children and Teachers in Swedish Preschools." *Early Child Development and Care*: 1–16. doi:10. 1080/03004430.2020.1754209.

Bird, Jo, Yeshe Colliver, and Susan Edwards. 2014. "The Camera is not a Methodology: Towards a Framework for Understanding Young Children's Use of Video Cameras'." *Early Child Development and Care* 184 (11): 1741– 1756. doi:10.1080/03004430.2013.878711.

Bird, Jo, and Susan Edwards. 2015. "Children Learning to Use Technologies Through Play: A Digital Play Framework." *British Journal of Educational Technology* 46 (6): 1149–1160. doi:10.1111/bjet.12191.

Chu, Junyi, and Laura E. Schulz. 2020. "Play, Curiosity, and Cognition." *Annual Review of Developmental Psychology* 2: 317–343. doi:10.1146/annurev-devpsych-070120-014806.

Edwards, Susan. 2021. "Digital Play and Technical Code: What New Knowledge Formations Are Possible?'." *Learning, Media and Technology* 46 (3): 306–319. doi:10.1080/17439884.2021.1890612.

Fleer, Marilyn. 2016. "Theorising Digital Play: A Cultural-Historical Conceptualisation of Children's Engagement in Imaginary Digital Situations'." *International Research in Early Childhood Education* 7 (2): 75–90.

Gopnik, Alison. 2020. "Childhood as a Solution to Explore–Exploit Tensions." *Philosophical Transactions of the Royal Society B: Biological Sciences* 375 (1803): 20190502. doi:10.1098/rstb.2019.0502.

Hassinger-Das, Brenna, Sarah Brennan, Rebecca A. Dore, Roberta Michnick Golinkoff, and Kathy Hirsh-Pasek. 2020. "Children and Screens." *Annual Review of Developmental Psychology* 2 (1): 69–92. doi:10.1146/annurev-devpsych-060320-095612.

Hatzigianni, Maria, Athanasios Gregoriadis, Ioanna Karagiorgou, and Sofia Chatzigeorgiadou. 2018. "Using Tablets in Free Play: The Implementation of the Digital Play Framework in Greece: Tablets in Free Play in Greece." *British Journal of Educational Technology* 49 (5): 928–942. doi:10.1111/bjet.12620.

Heimann, Mikael, Adriana Bus, and Rachel Barr. 2021. "Editorial: Growing Up in a Digital World - Social and Cognitive Implications." *Frontiers in Psychology* 12: 4329. doi:10.3389/fpsyg.2021.745788.

Hirsh-Pasek, Kathy, Jennifer M. Zosh, Roberta Michnick Golinkoff, James H. Gray, Michael B. Robb, and Jordy Kaufman. 2015. "Putting Education in "Educational" Apps: Lessons from the Science of Learning." *Psychological Science in the Public Interest* 16 (1): 3–34. doi:10.1177/1529100615569721.

Hutt, C. 1966. "Exploration and Play in Children." Paper presented at the Symposia of the Zoological Society of London, England.

Hutt, Corinne. 1981. "Toward A Taxonomy and Conceptual Model of Play." In *Advances in Intrinsic Motivation and Aesthetics*, edited by Hy I. Day, 251–298. Boston, MA: Springer US. doi:10.1007/978-1-4613-3195-7_11

Itō, Mizuko. 2009. *Engineering Play: A Cultural History of Children's Software. MacArthur Foundation Series on Digital Media and Learning*. London: MIT Press.

Jewitt, Carey, Sara Price, Kerstin Leder Mackley, Nikoleta Yiannoutsou, and Douglas Atkinson. 2020. *Interdisciplinary Insights for Digital Touch Communication*. Cham: Springer International Publishing. doi:10.1007/978-3-030-24564-1_1

Lancy, David F. 2015. *The Anthropology of Childhood : Cherubs, Chattel, Changelings*. Cambridge: Cambridge University Press.

Lillard, Angeline S., Matthew D. Lerner, Emily J. Hopkins, Rebecca A. Dore, Eric D. Smith, and Carolyn M. Palmquist. 2013. "The Impact of Pretend Play on Children's Development: A Review of the Evidence." *Psychological Bulletin* 139 (1): 1–34. doi:10.1037/a0029321.

Lillard, Angeline S., and Jessica Taggart. 2019. "Pretend Play and Fantasy: What If Montessori Was Right?'." *Child Development Perspectives* 13 (2): 85–90. doi:10.1111/cdep.12314.

Lovato, S., and S. Waxman. 2016. "Young Children Learning from Touch Screens: Taking a Wider View." *Frontier Psychology*, doi:10.3389/fpsyg.2016.01078.

Marsh, Jackie, and Julia Bishop. 2014. *Changing Play: Play, Media and Commercial Culture from the 1950s to the Present Day*. Maidenhead: McGraw-Hill Education.

Marsh, Jackie, Jamal Lahmar, Lydia Plowman, Dylan Yamada-Rice, Julia Bishop, and Fiona Scott. 2021. "Under Threes' Play with Tablets." *Journal of Early Childhood Research* 19 (3): 283–297. doi:10.1177/1476718X20966688.

Marsh, J., K. Murris, D. Ng'ambi, R. Parry, F. Scott, B. S. Thomsen, J. Bishop, et al. 2020. *Children, Technology and Play*. Billund: The LEGO Foundation.

Marsh, Jackie, Lydia Plowman, Dylan Yamada-Rice, Julia Bishop, and Fiona Scott. 2016. "Digital Play: A New Classification." *Early Years* 36 (3): 242–253. doi:10.1080/09575146.2016.1167675.

McHarg, Gabrielle, Andrew D. Ribner, Rory T. Devine, and Claire Hughes. 2020. "Screen Time and Executive Function in Toddlerhood: A Longitudinal Study." *Frontiers in Psychology* 11. doi:10.3389/fpsyg.2020.570392.

Nansen, Bjorn, and Rowan Wilken. 2019. "Techniques of the Tactile Body: A Cultural Phenomenology of Toddlers and Mobile Touchscreens." *Convergence: The International Journal of Research Into New Media Technologies* 25 (1): 60–76. doi:10.1177/1354856518815040.

Neumann, Michelle M., Guy Merchant, and Cathy Burnett. 2020. "Young Children and Tablets: The Views of Parents and Teachers." *Early Child Development and Care* 190 (11): 1750–1761. doi:10.1080/03004430.2018.1550083.

Pellegrini, Anthony D. 2009. *The Role of Play in Human Development*. New York: Oxford University Press.

Potter, John, and Kate Cowan. 2020. "Playground as Meaning-Making Space: Multimodal Making and Re-Making of Meaning in the (Virtual) Playground." *Global Studies of Childhood* 10 (3): 248–263. doi:10.1177/2043610620941527.

Rideout, V., and M. B. Robb. 2020. *The Common Sense Census: Media use by Kids age Zero to Eight, 2020*. California: Common Sense Media.

Sahlberg, Pasi, and William Doyle. 2019. *Let the Children Play : How More Play Will Save Our Schools and Help Children Thrive*. New York: Oxford University Press.

Schulz, Laura E., and Elizabeth Bonawitz. 2007. "Serious Fun: Preschoolers Engage in More Exploratory Play When Evidence Is Confounded." *Developmental Psychology* 43 (4): 1045–1050. doi:10.1037/0012-1649.43.4.1045.

Singer, Dorothy G., and Jerome L. Singer. 2005. *Imagination and Play in the Electronic Age. Imagination and Play in the Electronic Age.* Cambridge, MA: Harvard University Press. doi:10.4159/9780674043695

Spinka, M., R. C. Newberry, and M. Bekoff. 2001. "Mammalian Play: Training for the Unexpected." *The Quarterly Review of Biology* 76 (2): 141–168. doi:10.1086/393866.

Sundqvist, A., and M. Heimann. 2021. "Digital Media Content and co-Viewing Amongst Swedish 4- to 6-Year-Olds During COVID-19 Pandemic." *Acta Paediatrica*, doi:10.1111/apa.16090.

The Swedish Media Council. 2019. *Småungar och medier [Young children and media].* https://www.statensmedierad. se/rapporter-och-analyser/material-rapporter-och-analyser/smaungar–medier-2019.

Tomasello, Michael. 1999. *The Cultural Origins of Human Cognition.* Cambridge: MA: Harvard University Press.

Tremblay, Mark S., Casey Gray, Shawna Babcock, Joel Barnes, Christa Costas Bradstreet, Dawn Carr, Guylaine Chabot, et al. 2015. "Position Statement on Active Outdoor Play." *International Journal of Environmental Research and Public Health* 12 (6): 6475–6505. doi:10.3390/ijerph120606475.

Vygotskij, Lev Semenovič. 1978. *Mind in Society : The Development of Higher Psychological Processes.* Cambridge: Harvard U.P.

Weisberg, Deena Skolnick, Kathy Hirsh-Pasek, Roberta Michnick Golinkoff, Audrey K. Kittredge, and David Klahr. 2016. "Guided Play: Principles and Practices." *Current Directions in Psychological Science* 25 (3): 177–182. doi:10.1177/0963721416645512.