Examining the psychological content of digital play through Hedegaard's model of child development

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Abstract

As societies change and digital devices become increasingly a part of everyday life, young children experience new play opportunities (O'Mara and Laidlaw, 2011). A growing body of research has examined the nature of these new practices in both homes and educational settings. However, what has been missing from this research, is an understanding of the psychological content of children's digital play. Much of the available research in early childhood and in gaming design, is based on an assumption that play is biologically determined through stages or categories of play behaviours (Marsh, Plowman, Yamada-Rice, Bishop and Scott, 2016). In drawing upon Hedegaard's (2012; 2014) cultural-historical model of child development, this paper reports on a study of children's participation in preschool activity settings where digital technologies were used, and where new technologies continue to create new conditions for development. Findings show the psychological content of these digital play practices included, new ways of presenting imaginary situations, the use of digital placeholder and virtual pivots for new action, doubleness of thinking in meta-imaginary play situations when digitally skipping in and out of play, and during investigations with digital devices, where the development of new conceptual thinking previously not possible in play, such as magnification, could happen. Through Hedegaard's model of child development and her analytical concept of activity setting, the findings of the present study make a contribution to understanding how digital tools psychologically support children's development.

Introduction

There is growing evidence of the need to better understand the nature of young children's play with digital tools and toys (O'Mara and Laidlaw, 2011). In recognition of this societal need, a number of scholars have sought to broaden the categorization of play to include digital play (e.g., Marsh, Plowman, Yamada-Rice, Bishop and Scott, 2016), to argue for digital play to sit alongside of other forms of play (Edwards, 2013), and for the merging of digital and other traditional forms of play (O'Mara and Laidlaw, 2011). These studies usefully inform understandings about the range of play behaviours shown by children in a range of settings, such as home and preschool. However, missing from this research has been a consideration of what might be the psychological content of digital play (Fleer, 2017).

Vygotsky (1966) theorized that in play children create an imaginary situation, in which children change the meaning of objects and actions to give them a new sense. Play psychologically develops children, as is evident when the child moves from using an object as a placeholder in play, to using the idea of the object to support the play plot, to using words. This conception of development is directly related to the activity setting and the social play practices possible, rather than something biologically inherent in the child. In play, children explore the roles and rules of their community, which Elkonin (2005) has argued changes in relation to societal needs. This sits in contrast with biologically determined stages or categories of play

behaviours, where the child's age is the central criterion for predicting play development (see critique by Vygotsky, 1998).

Digital technologies and digital play are part of contemporary practices that must be understood within the overall cultural and historical development of communities. Historically, play technologies such as the spinning top, provided children with artefacts and actions that together supported their life competences. For example, the actions of the spinning top mirrored those needed for twisting a stick into a stone to produce a spark for fire-lighting. Giving time and resources to children to practice valued societal practices, according to Elkonin (2005), underpins the invention of toys and the related idea of children's play. However, when considering digital technologies, what might digital tablet technologies afford for children's play, and how might this new form of play contribute to the cultural and psychological development of the child?

In drawing upon Hedegaard's (2012; 2014) model of child development, and building upon earlier research (Fleer, 2014a,b; 2017), also informed by Hedgaard's work, this paper examines the psychological content of digital play from the perspective of societal values, institutional practices and the personal motives of children. It is argued that a cultural-historical model of child development, as offered by Hedegaard, supports the study of digital play. It is through the child's participation in the activity settings, where digital technologies are used, that the psychological content of digital play can be studied. In Hedegaard's model, the activity settings and the institution of the preschool are theorized as part of the child's motive orientation and the valued social practices sanctioned by society. In this holistic model, it becomes possible to follow the children's intentions within the imaginary situations generated or supported by digital technologies, across activity settings.

What do we know about digital play?

Although studies point to the unique characteristic of digital devices for affording particular kinds of play practices in group settings, not all software affords these possibilities (Verenikina and Kervin, 2011), as a lot of software is structured and this makes group interaction difficult (Moore, 2014). A great deal of research has looked at children's use of digital devices in the home, particularly studies that survey families, but less attention has been paid to children's group interactions in preschool settings where teachers have an educative agenda and where a range of ways of using digital technologies are evident (e.g., Plowman and Stephen, 2005). Most of the studies undertaken in preschool settings, have focused on teacher beliefs and their pedagogical practices associated with the curriculum (e.g., Palaiologou, 2016), rather than what is the psychological and cultural value of children's digital play.

In group settings, what we know is that preschool children show engagement with the characters in the software as if they were real, they recycle game talk and animated dialogue (Björk-Willén and Aronsson, 2014), deploy response cries, and use action aesthetics for collaborative action in front of the screen (Aarsand and Aronsson, 2009). O'Mara and Laidlaw (2011) have shown this social dynamic across activity settings in their research. In describing stuffed toys on a rug and a digital tea-set, the fused physical and virtual spaces of a children's tea party was identified. They argue that the "transformation of objects inside the dramatic play seamlessly shifts from the virtual to the physical" (p. 150). Of the relevant literature, it is known that this type of hybridity between play forms is frequently mentioned (e.g., Reich, Korobkova, Black and Sumaroka, 2013), blurring the boundaries of on-line and off-line activities (Mirtes, 2014), and special forms of social practices in virtual environments are reported (Marsh, 2013).

Some have studied social practices of novices entering into virtual worlds in which analyses of spaces are examined, such as, discursive space (proximity, gaze, speech, gesture), screen space (avatar actions and screen meanings), relational space (avatar to avatar), and have found that there are limited opportunities for children to engage meaningfully with each other, and that social exchanges are better off-line (Wohlwend and Kargin, 2013). However, how these social practices develop children is usually not the focus of the research presented.

With the exception of Verenikina, Herrington, Peterson and Mantei (2010) and Björk-Willén and Aronsson, 2014, research primarily describes mediated behaviours, such as, mouse-handling, keyboarding and messaging, and social behaviours, such as, forming friendships (Wohlwend and Kargin, 2013). Verenikina, Herrington, Peterson and Mantei (2010) suggest that motivation, context (relates to everyday life), path (e.g., discovery oriented) and access (e.g., spoken instructions) as key design features for supporting children's development through digital play. In analysing software for its play affordances, Verenikina, Herrington, Peterson and Mantei (2010) argue that more needs to be known about what might be the conditions under which digital play can develop children. More needs to be known about how digital tools support psychological development.

Studying preschools

In this cultural-historical study (Hedegaard and Fleer, 2008), four preschool settings with differing conditions for children's development were researched. Whilst many other activity settings could support children's development, those identified in this study and discussed further below, are only related to digital play.

Research questions: In preschool settings, what do digital tablet technologies afford for children's play, and how does this potentially new form of play influence not only how play itself develops, but also how it contributes to the development of the child?

Study sites: Four preschool sites from the Eastern part of Australia provided the institutional context for the study. Each preschool adopted a slightly different approach and amount of time for introducing and using the digital device that was provided through the research. Common to each of the preschools were the use of a digital device during free play but also for documenting the role-play of well known fairytales, such as the 3 billy goats gruff, as a digital animation. In one of the preschools, the children also had access to a digital microscope that they used to study pond water, samples from the compost bin, and other items such as hair. A summary of study sites is shown in Table 1 below.

How the data were gathering: Two and sometimes 3 cameras were used to capture the digital activity settings of the preschools. One of these cameras was mounted on a tripod and positioned facing the digital tablet, whilst the other roamed freely following the children's attentions within the digital activity setting. A total of 391 hours of video data were gathered. In addition, field notes were made of the digital play sessions and other points of interest related to digital play.

Table 1
Case studies and data gathering overview

Preschool site	Digital video gathered	Period of time	Age range

Site 1	242 h	8 weeks	3.3–4.4 years; mean age of 3.8 years
Site 2	55 h	5 weeks	4.6–5.7 years; mean age of 5.0 years
Site 3	74 h	3 weeks	3.3–5.3 years; mean age of 4.2 years
Site 4	20 h	4 weeks	4.0–5.2 years; mean age of 4.5 years

Holistic analysis: Hedegaard's theory of child development framed the study so that a holistic analysis could be undertaken. Vygotsky's (1966) conception of play was used to guide the analysis of the digital play for psychological content. The concepts of motive orientations and demands as introduced by Hedegaard (2014), supported the analysis. In preschools, teachers have specific goals in mind when creating the conditions for learning and development. Children are expected to be oriented to these goals (Hedegaard, 2014, p.2). In capturing the digital play in the different activity settings, the study sought to examine what new demands the digital technologies were making upon the children in preschool settings. In drawing upon Hedegaard's (2014) analytical concepts of motives, demands and activity setting, greater insights into the psychological content of digital play was possible.

What was learned from the study

The findings are presented in relation to first, the digital play practices that created new conditions for children's development, and second the psychological characteristics of digital play found that appeared to give new possibilities for developing children. Segments of data, as exemplars of the findings, are also provided throughout this paper, and where relevant, are referenced to previous research that has been informed by Hedegaard's analytical and methodological work.

The activity settings where the digital devices were introduced gave rise to new play practices that are discussed under the following three headings:
1. Digital devices in free play settings (re-play)
2. Digital animation
3. Digital devices for investigating

New play practices

1. Using digital devices in free play periods
Two examples of children's play practices during free play periods follows. A fuller theoretical discussion can be found in (Fleer, 2014a,b, 2017). In the first example, Anamika films her play players using a digital tablet, and in the second example Elin films camping play.
> *Bath play:*
> *It is free play time in the preschool. Three children are bathing dolls in one small plastic bath tub. Anamika picks up the digital device and begins to film the other two children. She holds the device so that it captures mostly the two children's faces, and includes some of the bathing actions with the dolls that they are each washing.*

Anamika then turns the device around and the children watch on as she re-plays what she has captured on the device. The two children eagerly huddle around the device, look on, smile and laugh at what they are observing on the screen (Site 3).

The availability of the digital device allowed Anamika to film her friends playing. Although she cannot capture her own participation in the play, she was able to use the digital device to document the play, and in so doing create a digital placeholder of the play (Fleer, in press), which the other children could re-view. In the next example, Elin also films her play partners.

> *Camping play:*
> *Three children are in the outdoor area during free play time in the preschool. The children are playing a camping game. Set up in the outdoor area is a tent. The children have made a camp site, and are busy preparing food for cooking. According to the teacher, the children have been playing camping for several weeks. Elin picks up the digital device and films their camping play. On this day, one of the players (JJ) is absent from preschool. The teacher has suggested to Elin to do this, so that she can show to JJ the play that he has missed out on.*
>
> *On the following day, JJ, and the three children who were playing camping, view the photographs and digital video of the camping play on the device. The teacher invites the children to talk about the play, but mostly the children view what is on the screen, and the teacher comments on what can be seen in each video clip. The children view the video eagerly and look closely at each video clip* (Site 2).

In both examples, the the children document their play. They immediately, or on a subsequent day, view their play. The children experience a form of re-play. In essence, the children are filming their imaginary play situation. They are documenting virtually their imagination in action. In this way, the digital device supports the children's play. It acts as a placeholder of their play, which potentially allows the children to make the rules, roles and actions visible to themselves and to each other. The teacher narrating the children's play actions whilst viewing the video, is another way the rules, roles and actions of play are made conscious to the children.

In filming each other, the children potentially need to think consciously about the objects and actions to be filmed or photographed. The digital device gives new possibilities for children because the children can re-view their imaginary play. In many respects, this has the possibility of a doubleness of thinking about their play (Fleer, in press). Similar to Vygotsky's example of two sisters who role-play being sisters, and make conscious the rules and roles associated with sisterhood, video and re-playing imaginary play, also makes conscious the rules and roles associated with the imaginary situation of camping or bath play. This is a new practice for children that affords new ways of acting and thinking about their play (see also Fleer, 2017).

2. Digital animation

As might be expected, a range of ways of creating digital animations arose across the preschools in this study (see also Fleer, 2014b). In each case, the children re-created into digital format, a familiar fairytale, such as the 3 Billy Goats Gruff. The children made a play scene, using objects and plastic or stuffed replicas of the characters, which they used to re-tell the story. The children placed and moved the objects, in order to re-play the storyline, whilst photographing movement in each scene, which collectively produced a series of photographs that could be brought together as an animation of the fairytale. But for this to be achieved, a

great deal of teacher and child discussion within the context of the digital device and set of the fairytale was needed. For instance, in this first part of the example that follows, the children are guided to conceptualise the set of the 3 Billy Goats Gruff fairytale they have been role-playing previously.

> A small table is set up in the corner of the preschool during free play time. Opposite this table is a theatrical set of the 3 Billy Goats Gruff. Miniature plastic goats, a wooden bridge, that had been made by the children on a previous day, are used in the set. An adjoining table has further resources for the children.

> Harriet their teacher, sits awkwardly near the table where the digital device is located. She is viewing the screen of the digital device, as the children come and go during free play time. The screen set up in camera mode is facing another table 1.5 meters away that has set up a scene for the 3 Billy Goats Gruff. The children stand directly behind the device so that they can view through the screen the display of the 3 Billy Goats Gruff. Using self talk, the teacher sets up the device ready for the children to take photographs.

> Three children settle in front of the screen looking to the image of the 3 Billy Goats Gruff display. Harriet the teacher asks, "What do you think about that arrangement? What's missing do you think?". Nicola stands in front of the display, and David says "Nicola" in an irritated tone. The teacher asks Nicola to move. Harriet says to the children who have arrived to see what the group is doing, "David is looking at this to see what needs to change before we start making a movie". The children look intently. Harriet offers, "Water?" to which the children's facial expressions light up. "Is there anything at that table [or resources nearby] you could use for water?". The children immediately move over and inspect the table. Harriet asks, "Where would you put the water in the set?". David picks up a blue cloth and Harriet asks, "Can you put it where you think it belongs?". David immediately goes over the the 3 Billy Goats Gruff set, placing it as he says, "Down there". The teacher affirms this. David moves the cloth, changes the size, whilst others look on through the screen. Harriet and the children wait patiently, as David continues to fold the cloth. Harriet says, "How do you need it to be?". As David works, the children chat generally, whilst looking through the digital device at David and the set, as he finalises the scene. Harriet invites the children to consider, "I wondered if the troll is going to sit on that bridge or under that bridge near that water?" David says, "Near the water". Harriet invites David back to the digital device by saying, "David come back and look before you start. Is there anything else that needs to go under there?". Seaweed is offered by Selena. Is there anything over there that could be seaweed?" Could that be seaweed for our water?" asks Harriet. David puts the seaweed cloth he has chosen as seaweed over the whole bridge, and the children laugh as Harriet says, "Now the bridge is invisible. Where has it gone?". The children laugh as they look through the digital device at the scene that David has created. Harriet asks, "Can you do a test to see if the goat can stand on the bridge?".

Harriet draws David's attention to the objects and resources available, which then act as placeholders for arranging the set of the fairytale of the 3 Billy Goats Gruff. But what is different to Vygotsky's original conception of play, is that all the children participating in the activity setting, are each viewing the set they are creating through the digital device. The collective goal is to set up the play, not as something the children act out by taking on a role, but rather, the children are setting up the dramatic scene of the fairytale in order to create a

movie (digital animation) on the digital device. In addition, the children notice when Nicola gets in the way, messing up the image of the set shown in the digital device (see also, Fleer, 2017 for other case examples). The children look to Nicola and back to the device, and then continue to observe the set primarily through the device.

In the imaginary situation of setting up the set for the 3 Billy Goats Gruff, the children use plastic objects for the characters, but they also draw upon an auxiliary device to support them with re-telling the storyline. The teacher used a storyboard of the 3 Billy Goats Gruff as a tool to help the children, as is shown in the first part of the observation below, followed by the teacher signalling how much the objects need to be moved before they are photographed.

> On prompting by Harriet, the children look at the storyboard they have created of the 3 Billy Goats Gruff story. Harriet says, "See that picture over there", to which Sean responds, "Yep".
> Harriet: "See number 1".
> Sean: "Yeah".
> Harriet: "We want to move the goats. See how the picture up there, number 1, it has all the goats on one side.
> Sean: "Yep".
> Harriet: "So we move the goats over here (pointing to the set). Can you move the goats?".
> Sean: "Yep".
> As Sean moves the goat, Selena looks closely through the digital device at the set, and at how Sean is moving the objects.
> Harriet: "OK Sean, press this one (pointing). Sean Watch. What do we do now? Do we want this photo (pointing at the screen to view the whole set)? Are we happy with it to start here?".
> Sean: "Oh. Hang on" (as he looks closely at the screen, then moves the goat in the set).
> Harriet: "Press the camera. That's right. We want the start of the story, and the little goats starts on the bridge" (pointing to the storyboard).
> The photograph of the first scene in the fairytale is captured on the digital device. In order to move to the next scene in the story, Harriet invites the Sean to consider, "Which one is the little goat?". Sean goes to the set and picks up the small goat. He places it on the bridge. Harriet says, "Now press that one, press that one, and press that one". That's right. As Harriet says, "Now move the goat" Sean predicts what to do next and simultaneously moves the small goat in the set. After moving the goat, Sean immediately returns to the digital device, predicting the need to take the next photograph. This is punctuated by Sean by asking Harriet if she is ready for taking the next photograph, "Are you ready Harriet?". The other children who are observing Sean, watch intently through the digital device. Sean and Harriet together motion how much the small plastic goat should move before a photo is taken. Harriet supports this process by saying, "A bit further. Good. Let's have a look in the new frame". Sean then takes the photograph. Harriet says, "Now move the goat". Sean asks, "Is that.. (motioning through action). Harriet says, "Bit closer". Sean then asks again, "Harriet are you ready?", to which Harriet sums up what they are doing, "You have to move him about this far (gesturing 2 cms)". Harriet moves over to the set to show the distance of 2 cms, and in so doing is now in front of part of the set. Sean signals to Harriet, "Harriet I can see your jacket". Harriet says, "So if you can see my jacket, don't take the photo. Wait until you can't see me". The goat falls, and the children laugh. Then Sean puts back the goat. Harriet suggest that blue tac is needed to secure the goat. (RB 15).

Staging the play as an animation was a new way of thinking about role-playing the fairytale. In reproducing the story line in digital form, the children had to technically and socially engineer their play space, so that the right scene for each part of the story line was correctly sequenced using the objects. This finding has also been noted in previous research (Fleer, 2017). The storyboard supported this process, a pedagogical strategy used by teachers with older children (see Hoban, Loughran and Nielsen, 2011). This also meant that other children or the teacher could not be standing in the way or have their hands in the scene being photographed. Further, the children needed to consider the overall effect of the moving objects by determining how far to move the goat, so that the animation worked. The teacher had a key role in supporting the children's collective imaginary situation. The plastic objects used to produce a digital form of the play, created a new type of placeholders in the process of capturing the storyline of the 3 Billy Goats Gruff. Creating an animation of an imaginary situation is a new practice for children. The teachers reflected upon the new activity setting that was introduced through the use of the digital device.

> KT: The thing is that it is not so much that they can touch, or they can feel about it, but the thing is that they can share with everybody [collective is signalled through hand gesture]. So it is one of those multi-media products that they are making… so when they are doing box construction, when building, they say, "See here, this is my product". But [signalling with hands] it is in the iPad, if you turn it off, you can't see it.

> Harriet: So when you turn it off, you can get it back. So that they can see what they have been doing. So it helps children to stay in touch with what they have been doing. They can see something, that is not a concrete product that they can handle. But they can see what they have been involved in, this is a record of it, a lasting impression of the story they have created, it's not a book, it's a new format to show what it is that they have been in.

> KT: It is iPad, slowmation [digital animation], it is that pitch, of what they have been doing, that we can show others, but it does not exist in a concrete form, I am not handling it (RB 31E).

These examples illustrate how digital tools and plastic objects can act as placeholders in children's play. Digital animation as a digital product of their play, creates new opportunities for the children to think consciously about the storyline, the image/set being photographed, and the audience who is viewing the animation in digital form. The activity not only supports Vygotsky's conception that children use objects, actions and words to act as placeholders in imaginary situations, but also the digital animation of a well known fairytale makes conscious the need for placeholders. Without placeholders, it is not possible to re-create the fairytale as planned by teachers. Considering the play set, the play storyline, and the need to capture these as digital images (with no one in the way), foregrounded to the children not only a new play practice, but the concept of audience. The idea of an audience was a new type of demand on the children. In studying the new demands on children, as suggested by Hedegaard (2012), new developmental conditions become evident. In taking the child's perspective, the demands on the children, to take account of an audience appeared to make conscious the need for quite specific placeholders and actions to support the digital presentation of their play.

3. Documenting during investigative play

The study found that the digital tablets were also used in one preschool to support children with their inquiries and scientific investigations. Through using Hedegaard's conception of activity as an analytical concept, the study found that the children could use the digital device as a pivot for magnification. The device enabled the children to locate an insect on a plant, and then to increase its size on the screen. Magnification was not only possible it could be directly controlled by the children during their inquiries. The experiences with the digital tablets gave the children many opportunities to explore magnification across activity settings. The children used the digital tablet to photograph organisms found in their outdoor area, so that a detailed account of the outdoor wild life could be recorded. For instance, the children used a digital tablet to photograph and later examine closely the content of their compost bin. The tablet acted as a digital placeholders for their investigations. The digital device made it possible for the children to think more about the science dimensions of their outdoor world.

A digital microscope attached to the digital device was also used by the teacher and children, and this gave the opportunity for the children to look closely at the soil samples collected from the compost bin and the pond water samples collected from their outdoor play area. Once again, magnification was consciously explored through using these digital tools. For example:

> Four children and their teacher are gathered around a table. They are looking at a digital microscope. One of the children, Chantelle looks to the new object in a curious manner and the teacher noticing says enthusiastically, "It's a digital microscope." Simon says, "What does it do?", to which the teacher repeats with pronounced curiosity, "What **does** it do? You will find it's got a light…" Alex interjects and says, "Guess what! It actually makes little things called stuff (pausing and then with arms outstretched says), bigger". The teacher responds by saying, "That's what we are going to find out" (RB043 131206).

Imagining the idea of magnification as a concept was actively supported. For example, during interviews, one teacher discussed inviting the children to be inside a drop of water (giant plastic bubble) and putting on an enormous basketball shoe (shoe size 50) noting, "If we think about how large some of these things are (shoe, giant bubble to represent pond water), and how small it is to fit in there (child inside these props), that's part of thinking and experiencing what it's like to be really tiny" (RB011 131113 Max 10HV1).

The use of the digital tablet for generating animations and for supporting scientific inquiries, show how digital tablet technology can act as a digital placeholder for children's play and as tool for investigation. Further, through the reviewing of the images created by the children, the device acted as a virtual pivot in play, because children had the possibility to consciously consider aspects of their play, and to revisit their recorded digital play. This builds upon previous research (Fleer, 2014). In this way, the digital technologies can support the development of children's play. The technologies afford a range of new play practices not yet extensively reported in the literature (Fleer, 2017). Although other ways of using the technologies are possible, particularly when gaming apps are introduced or used in other contexts, such as homes, what was found through this study was 1) play could be digitally documented, and 2) digitally supported affordances gave new possibilities to children for investigating and conceptualizing a microscopic world not easily visible. Together, digital technologies created new practices in the preschools through the use of digital placeholders and virtual pivots, thus constituting new forms of play practice for the children participating in this study. How these new play practices support children psychological development is now considered in the next section.

The psychological dimensions of digital play

In drawing upon Hedegaard's analytical concepts of transitions for studying the activity settings from the perspective of the children and teachers, it was found that children's digital play appeared to support the psychological development of children because children transitioned from one field to another (Zaporozhets, 2002) aided by the digital device. Theoretically, the children had the possibility of crossing the boundaries between what they could concretely experience and observe in front of them, and what they captured as virtual representations that they could review immediately or later. This conceptualisation would appear to be in line with those studies that have noted a fusing of virtual play and real world play. The digital device appeared to allow for the transition of some aspects of the children's play and reality that have not been previously studied.

We know from El'Koninova (2002), that particular forms of behavior are encrypted in fairytales, where the structure supports the psychological development of children. For instance, the border between children's reality and emotional experiencing of the story and the emotional anticipation of the plot yet to unfold. The digital device and the apps used by the children and teachers in this study, appeared to also be encrypted with the possibility of digitally skipping in and out of play (Vygotsky, 1997). This is in line with Verenikina, Herrington, Peterson and Mantei's (2010) research which shows how different types of apps afford different imaginative play possibilities.

Using the digital device in free play settings with an animation app gave the possibility of a doubleness of thinking (Kravtsov and Kravtsova, 2010; Vygotsky, 1966) by children about their play. That is, there appeared to be a meta-imaginary situation because children could be both above the play thinking about the audience (e.g., as a digital animation) or positioning themselves as the audience of their own play (re-playing) whilst simultaneously being inside the play living the play. A further example of a doubleness of thinking was noted when children used the digital device and app for taking photographs and video of their play. Children's play could be consciously considered through re-playing and re-viewing what they had captured at that moment or on subsequent days to share with others. This gave a new play possibility and new ways of thinking about their play. This psychological dimension of digital play has not been discussed in the literature.

A further finding related to a *doubleness of thinking* was in the context of investigating. The digital device when used for investigating appeared to also create a new kind of psychological condition for the children. The investigations with the digital devices allowed for a *doubleness of thinking*, because the children could see in real terms the organisms in their environment, but could also magnify them, and magnify aspects of their world not easily seen with the naked eye. The digital device allowed for new ways of thinking previously not possible. Magnification created a paradoxical representation for children because they could digitally observe a contradiction – something small or non existent whilst at the same time virtually enlarging what was in front of them. Theoretically, the children could overcome this contradiction through conceptualizing what they were doing as magnification. In this study, this was not a form of magic or pretense, but rather as an action of engaging in digital magnification.

During the process of digital magnification, the children appeared to be initially *emotionally* engaged, and then over time anticipating what might be observed – in a similar way to how

fairytales are emotionally experienced through emotional anticipation. Zaporozhets (2002) has suggested that *emotional anticipation* has an important psychological role in children's development. In this study, the initial moments of exploration, and later their anticipation, were highly motivating. When magnified images were revealed to the children their responses were visually charged with emotions. These emotionally charged experiences created the conditions for further exploration of the outdoor area, where children imagined their anticipated finds in relation to what they would see magnified on the digital device.

The children and teachers found the process of magnification - making the unobservable world visible - very exciting and motivating. El'Koninova (2002) has argue that the function of *emotional anticipation* is to support development. In this study it was found that the different digital activity settings, supported *emotional anticipation* in different ways. In the activity setting of the digital microscope, *emotional anticipation* appeared to help the children deal with the contradictions of seeing and not seeing what was in front of them. During the process of making an animation of a fairytale, viewing and photographing the anticipated scene and narrative, children made conscious the virtual world and real world by creating the story and by being the audience. Children were emotionally anticipating the different dimensions of the storyline supported through using the storyboard as an auxiliary device when making the animation. Zaporozhets (2002) has argued that "emotions are a special form of reflection of reality" (p. 60), and this could be viewed as a "special kind of *emotional cognition*, during which the subject reflects reality in the form of emotional images" (p. 60; original emphasis). The digital device and the children's actions and comments appear to support this. In many respects, the digital device did act as a placeholder of these 'reflections of reality' as forms of magnified images. Children could view in situ, but also could video record and photograph the results of their investigation, which could then be reviewed later. This is a different conceptualisation from what exists in play research (e.g., Goncu, Jain and Tuermer, 2007; van Oers, 2013), as well as how digital play has been discussed in the literature (e.g., Moore, 2014; Marsh, Plowman, Yamada-Rice, Bishop and Scott, 2016; Verenikina and Kervin, 2011).

These new psychological conditions afforded through digital play were made visible through Hedegaard's conception of activity setting, demands and motives, as well as Vygotsky's conception of play, a doubleness of thinking and Zaporozhets (2002) conceptions of emotional imagination. The key psychological dimensions noted in this study, and which build upon previous research (Fleer, 2014a,b, 2017, in press), were illuminated through the analytical concept of activity settings as discussed by Hedegaard (2012). The unique psychological characteristics of digital play found in this study can be theorized as:
1. New ways of presenting
2. Digital placeholder and a digital pivot for new action
3. Meta-imaginary situation
4. Being simultaneously in and out of digital play
5. Digital tools for investigating their world

New ways of presenting: The digital presentation serves the role of acting as a new presentation of the play object (e.g., digital rather than the plastic figures of the 3 Billy Goats) (Fleer, 2014a) and action (e.g., goats crossing the bridge in digital format; camping play) (Fleer, 2017).

Digital placeholder and a digital pivot for new action: What is captured on the digital device can act as a digital placeholder of the role-play. Digital presentation can serve the role of acting as a new form of the idea of the object or action. A digital tablet can act as a cultural

device (e.g., an iPad and slowmation), where the object of the activity can change the meaning of the action (e.g., practicing the narrative to successfully make the animation), (re-play - filming the play to show to others). In this sense, the digital tablet and app can together serve as a virtual pivot to support the new play practices of digitally animating play (Fleer, 2014b; 2017).

Meta-imaginary situation: In meta-imaginary situations, the children appeared to think about the overall narrative of the play (camping play; fairytale) whilst also considering the scene they were creating from the perspective of the audience who would later be viewing their animation of the play (camping play or fairytale) (Fleer, in press).

Being simultaneously in and out of digital play: By following the children's intentions, the making of an animation seemed to generate the need for the children to be both inside the narrative while also being outside of the narrative as the audience. This psychological dimension of digital role-play has not been discussed in the literature and emerges as a new area of further inquiry in future research (Fleer, 2014b).

Digital tools for investigating their world: The digital device enabled children to capture aspects of their everyday life not visible with the naked eye. This allowed children to consider the concept of a microscopic world and magnification. Children could bring this to their imaginary play. The real organisms and the imaginary situation could be captured and consciously manipulated on the digital device and in play – creating new conditions for children's development (Fleer, in press). Digital tablets are a new kind of platform for developing play and for the cultural development of the child.

This theorization is summarised in Table 2 below.

Table 2
The unique psychological characteristics of digital play

Psychological characteristics	Elaboration
1. New ways of presenting	The digital presentation serves the role of acting as a new presentation of the play object and action.
2. Digital placeholder and virtual pivots	What is captured on the digital device can act as a digital placeholder of the role-play and the digital tablet and software can together serve as a virtual pivot to support new play practices.
3. Meta-imaginary situation – for digital animation activity setting	A meta-imaginary situation captures in digital form the overall narrative of the play where audience is introduced as a new characteristic of an imaginary situation.
4. Being simultaneously in and out of digital play	Digital animation generate a need for the children to be simultaneously inside the narrative while also being outside of the narrative as the audience.
5. Digital tools for investigating their world	The digital device enabled children to capture aspects of their everyday life not visible with the naked eye, thus supporting new ways of conceptualizing their everyday world.

Conclusion

Digital technologies and digital play are part of contemporary practices that must be understood within the overall cultural and historical development of communities. By studying the social practices that give meaning to the objects and actions in digital play, greater understandings about the essence of digital play can be determined. These practices put new demands upon children, and through this, create new conditions for children's development. Hedegaard's model of child development provides a framework that can capture this fast moving area of digital play. Her theory allows researchers to capture the possibilities afforded for young children as they engage in digital play, even though the tools continue to change as the technologies develop. Through following the child's intentions in the various activity settings in preschools, where new digital play practices are afforded, it is possible to understand the new demands placed upon children as a result of changes to societal conditions and values.

Hedegaard's model of child development gives researchers a conceptual framework for continuing to study children's play practices in ways that respect the perspective of the child, whilst also studying the institutional practices, societal conditions and values of particular cultural communities - even though these interrelated areas are in constant motion. This paper has not only documented the essence of digital play, as it currently conceptualized in relation to what is afforded by the technologies, but it has shown the conceptual power of working with Hedegaard's cultural-historical concepts for understanding the new digital conditions of children's lives.

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