«– That’s how much I can do!»

Children’s Agency in Digital Tablet activities in a Swedish Preschool Environment

Petra Petersen
Doctoral Candidate, Department of Education, Uppsala University, Sweden
petra.petersen@edu.uu.se

ABSTRACT
This study explores children’s agency in respect to the relations constituted between the participants’ interaction and the design affordances of digital tablets.

The findings underscore the importance of taking into account how the participants’ interaction interplays with the affordances of the touch screen, the portability of the tablet, and the use of pictorial modes within applications, that in turn contributed to children’s agency within the digital tablet activities. The findings highlight both children’s agentive use of multimodally organized resources and how an understanding of children’s agency may be expanded, through the use of multimodal approaches including the Design for Learning framework.

Keywords
preschool, ICT, digital tablets, agency

INTRODUCTION
In a globally developing world, and in a future society where creativity and innovation are valued, children’s ability to display agency using a multitude of modes may have to be reclaimed (Kress, 1997). This study aims to add to the knowledge about children’s agency using digital tablets, applying a Design for Learning approach (Selander & Kress, 2010), answering the questions: What are the relations between the participant’s interaction and the digital tablet’s affordances, and how do these relations affect children’s agency?

In this article, the concept of children’s agency refers to children’s active participation and ability to act in a certain situation (Corsaro, 2006; Selander & Kress, 2010:99). In line with this, children are seen as being able to act independently and make choices on their own. Children’s agency also depends on social structures, questions of responsibility and on how familiar the children are with the situation (Selander & Kress, 2010). Building on the notion that children are active producers of culture (see e.g. Corsaro, 2000), I wish to extend the understanding of children’s agency. In line with Kress (1993, 2003) and Selander and Kress (2010), I argue that children are constantly agentive producers of culture, but that this is not always recognized, when the children...
are using *modes of representations* such as images, sounds and corporal communication. The linking of a multimodal, design theoretical approach (Selander & Kress, 2010; Kress, 1997; Kjällander & Moinian, 2014) with interactional approaches (Corsaro, 2000; Martin & Evaldsson, 2012; Heath & Hindmarsh, 2002; Mondonada, 2007) will be proven fruitful when exploring the relations between the participants interaction and the affordances of the digital tablets and how these affect children’s agency. Thus the concept of *affordance* is used in this article to describe the interplay between the children and the environment and how different possibilities and obstacles form in the meeting between environment and man (see Gibson, 1979). The central argument made is that a specific object’s affordance is always subject to the meaning people make of it and the affordance is also dependent on social and cultural surroundings (Selander & Kress, 2010). In the use of the concept of affordance, *both* the environment and the different objects and materials in it, *and* people’s use und understanding of these, influence the affordance that emerges (Gibson, 1979). The emerging affordances interplay with children’s agency by posing both possibilities and constrictions (cf. Gibson, 1979). The preschool environment, and the resources used there, provide the children with particular affordances, where the children are, for example, more or less able to use them without the help or interpretations of a teacher.

The data is drawn from video ethnographic research of children between the ages of one and a half and five in three Swedish preschool groups. Two contrasting instances of everyday activities, in which the children used digital tablets, were selected in order to analyze children’s agency in relation to different applications’ affordances. A multimodal, design-oriented approach (Selander & Kress, 2010) was combined with videoethnographic research (Heath & Hindmarsh, 2002) in the analysis of video recording and screen recordings of the digital tablet screen, focusing on children’s agentive use of multimodally organized resources.

**BACKGROUND AND PREVIOUS RESEARCH**

In the field of human-computer interaction (HCI), a wide range of studies are concerned with the interplay between people and digital resources (see e.g. Jaimes & Sebe, 2007), where the design and the affordances of computer games, for example, are investigated in light of how people use and interact with the digital interface (see e.g. Sundar, Bellur, Oh & Jia, 2013), web-site designs (see e.g. Porat & Tractinsky, 2011) and game/application design (see e.g. Day, Abow & Salber, 2009). Studies in HCI are mostly conducted on older children, students and young adults and, notably, these studies usually involve stationary computers and laptops, not digital tablets in particular, even if some new HCI research investigates digital tablets and other devices with touch screens (see e.g. Jorritsma, Prins & van Ooijen, 2015; Motamedi & Choe, 2015), as well as other digital resources such as movement-based computer games, and underscores the importance of embodied interaction (see e.g. Jorritsma, Prins & van Ooijen, 2015; Motamedi & Choe, 2015), as well as other digital resources such as movement-based computer games.
However, the field of HCI lacks focus on educational settings. When it comes to research on digital resources that does focus on educational fields, such as studies on ICT in school and preschool settings, this research also to a great extent involves stationary computers and laptops (see e.g. Gee, 2003; Plowman & Stephen, 2003; Plowman & Stephen, 2007; Björk-Willén & Aronsson, 2014). A general view is that it is important to examine how digital resources are used in an authentic environment (Skantz Åberg, Lanz-Andersson & Pramling, 2014; Aarsand & Aronsson, 2009; Björk-Willén, 2010) and considering this, it is crucial to examine specifically digital tablets where they are used in preschool. Since the properties of digital tablets differ in some degrees from other digital resources, such as stationary and laptop computers (Nilsen, 2014:6; Kjällander & Moinian, 2014:11), previous research concerning the use of specifically digital tablets in educational settings is focused upon in the following section.

A rapid expansion of the use of digital tablets in educational settings

In recent years, many Swedish preschools and schools have started to use digital tablets. 141 out of 290 Swedish municipalities reported that they have ongoing projects involving digital tablets in schools and preschools, based on self-reported information (retrieved from http://www2.diu.se/framlar/egendator/). In Sweden, no survey has been done mapping out how common the use of digital tablets is among children in preschool, but a recent report shows that small children’s use of digital tablets has multiplied in just a couple of years and in 2015, seventy-nine percent of two to four-year-olds, and eighty-four percent of five to eight-year-olds in Sweden have access to digital tablets at home (Statens medieråd, 2015). Kjällander and Moinian (2014) show in their study that the authority balance between children and teachers shifts when Swedish preschool children start playing with, and redesigning, digital tablet activities. The children are not simply consuming the media made accessible in the digital tablets, but through play they position themselves as producers (Kjällander and Moinian, 2014:28–29). Partly contradicting these conclusions, Nilsen (2014) found that teachers play an important role when children engage in digital tablet activities in preschool, but that the teachers and the children often have different objectives. The children wanted to play games, while the teachers have a didactical, learning aim, but that the so-called «educational apps» failed to be just that (Nilsen, 2014). Couse and Chen (2010), however, describe digital tablets as «a viable tool to offer young children for representing their ideas in the early-childhood classroom» (Couse & Chen, 2010:95). Wallén Hillström (2014) found in her study that children use both vocal and embodied ways to interact with each other and to develop different access strategies, while using digital tablets in Swedish preschools.

1. Computer games where you use your body movements to engage in the game, e.g. Kinect, Wii etc.
In their study, Kjällander and Moinian (2014) use the concept of agency, but most of the research made on children’s use of digital tablets is focused on children’s learning of, for example, language, literacy and mathematics. A study conducted in a Norwegian preschool shows that an intervention using a digital tablet with two applications, in a language learning and literacy practice session, led to «valuable activities for language learning and literacy practices» (Sandvik, Smørdal & Østerud, 2012:204). Many of the studies made on children’s use of digital tablets are intervention studies, before-and-after tests, or interviews (see e.g. Lin, Shao, Wong, Li & Niramitrnanon, 2011) involving older children in elementary school, high school and university, for example Bush and Cameron (2011), Garcia and Friedman (2011), finding that the digital tablet can be a useful tool for learning. Garcia and Friedman’s (2011) study shows that university students using an application about 9/11, get better results in the after-test than the group of students only given the possibility of reading texts about the same subjects. Jahnke and Kumar (2014) discuss the importance of teachers’ didactical design, in the use of tablets in elementary school, in a study based on classroom observations and interviews with teachers.

**Digital resources and children’s agency**

Most research so far in the field of children’s use of digital resources investigates children while gaming, using laptops or TV games (see e.g. Linderoth, 2012), not digital tablets. When exploring children’s interaction in a digital environment, Kjällander (2011) concludes that the pupils are designing their own digital Social Science material using computers (Kjällander, 2011). Klerfeldt (2007:118) states that children’s agency in digital activities is made possible if teachers refer to digital resources as «mediational means,» see children as active actors, and give them access to the resources. At the same time, children can be excluded from being influential participators if teachers view the computer as belonging only to the adult, power-exercising world. Björk-Willén explores both children’s and computer games’ agency and states that there is constant activity between the children as well as between children and the computer game (Björk-Willén, 2010). Ljung-Djärf (2004) concludes that a computer’s design is not very supportive of children’s cooperation, since one child is holding the mouse, thus is the owner of the situation (Ljung-Djärf, 2004:127).

Some of the applications used by children on a digital tablet can be seen as forms of computer games. There are a number of studies concerning learning when playing computer games, some of which state a positive effect on learning (see e.g. Gee, 2003). The term *edutainment* is sometimes used to describe how education and entertainment go hand in hand when playing computer games or so called serious games (see e.g. Linderoth, 2009). However, some researchers point out problems with these alleged effects, stating that playing some computer games does not necessarily require learning, but rather persistence and time (Linderoth, 2012).
In this study the theoretical approach of Design for Learning (further explained in the following section), has been used, where computer games are seen as potential resources to didactical design, depending upon the design of the game itself and its usage (Selander & Kress, 2010). This study also proposes an alternative to the media coverage of children’s use of digital resources where much focus has been on «risks» in online safety (see Dunkels, 2010 for a critique).

Agency from a multimodal, design-oriented view

Research focusing on children’s agency has been brought forward in the area of childhood studies, highlighting different perspectives on the concept of agency (see Corsaro, 2011 for an overview). For example Rainio (2010) describes three different discourses on agency: Agency as a culturally and socially distributed process; agency as access to an agentive position, as used by the post-structuralist movement; and agency as mediated development, as used in sociocultural theory. In this sense, children’s agency can be described as «a socioculturally mediated capacity to act» (Martin & Evaldsson, 2012:54).

In this study, the concept of children’s agency is used to describe the children’s participation and ability to act in a certain situation (Corsaro, 2011; Selander & Kress, 2010:99). In line with Kress (1997), I also use the concept to highlight children’s ability to act on their own and to make choices in the world, as well as to exercise a relative independence. In a preschool setting, this can be exemplified by children being able to use, for example, digital resources without the help and support of or interpretations made by their teacher. Children’s agency also depends upon their understanding and familiarity with the situation and with different cases of action, as well as upon social relations of power and questions of responsibility. In recent years, children have been given more responsibility for their own learning and new digital resources enable children’s independence from the physical space of the classroom, printed educational materials, and the teacher’s control (Selander & Kress, 2010:100–101).

I want to extend the notion of children’s agency, by building on the understanding of children’s actions as «interpretive reproduction» (Corsaro, 2000), where «children are not simply internalizing society and culture, but are also actively contributing to cultural production and change» (Corsaro, 2000:92). As an expansion of this idea I argue, in line with Kress (1993, 2003) and Selander and Kress (2010), that children use what is at hand, to make representations, such as drawings or sound effects that are always new, and never copies. In this way, the children are designers (Kress, 1997; Kress & Selander, 2010). As I see it, children are constantly producers (Corsaro, 2011) of culture, thus agentive, but from an adult point of view this is most often recognized when the children use representations which can be understood by adults, such as speech or written language (cf. Kress, 1997:2003). How children use modes other than the verbal mode to act as agents in the world has been recognized by some researchers...
like Løkken (2000), using a phenomenological method. She shows how children use their bodies and voice resources to express themselves, for example in a «glee concert» where young children simultaneously and rhythmically smack their hands on a table while «singing» using vowels, or when they have a «mattress reunion», where they use their whole bodies to communicate a sense of togetherness. This can be compared with the studies of Walldén Hillström (2014) and Björk-Willén (2010), showing how children use their bodies to organize their participation around the screen. Others take into account material artefacts (e.g. Corsaro, 2000) and/or multimodal resources, in interplay with spoken or written language. Leijon (2015, forthcoming) puts particular focus on the physical learning environment and its influence on the participants’ agency. For example, the digital technologies used in higher education classrooms, typically a laptop computer and a projector, play major roles in relation to both teachers’ and student’s capacity to act as agents, and these technologies can both support a teacher’s design and restrict it (Leijon, 2015, forthcoming). Building on these findings, I will show how a multimodal, design-oriented approach as developed by Selander and Kress (2010) (see also Selander & Kress, 1997; Kjällander & Moinian, 2014), may be used to explore children’s agency in relation to the affordances linked to digital tablet activities. Of particular interest here is how children use different representations in many modes to act in ways that can be called agentive (Selander & Kress, 2010). Based on this theoretical approach, children will be interpreted to act as agents in many different ways, not only when using verbal language, but also when they grab the tablet and walk away, or when they press the home button to exit an application. Visual and corporeal, or embodied, modes of communication are taken into account, as well as verbal representations, in line with the findings of Martin and Evaldsson (2012), for example, who draw on interactional, multimodal perspectives. Interactional approaches (Corsaro, 2000; Martin & Evaldsson, 2012; Heath & Hindmarsh, 2002; Mondada, 2007; Walldén Hillström, 2014) are in this study combined with the use of a multimodal design-theoretical approach (Selander & Kress, 2010; Kress, 1997; Kjällander & Moinian, 2014), to be able to take into account both how the participants’ interaction relates to the different affordances of digital tablets and how this affects children’s agency.

In this article, I wish to add to research on children’s use of digital tablets and children’s agency, using a multimodal, design-theoretical approach, further explained in the following section.

A multimodal, design-oriented approach on children’s agency and affordances of digital tablets

In this study a multimodal, design-theoretical approach has been used. The concepts of agency, multimodality, design and sign-making are used to analyze the data and to help answer the research questions.
Design for Learning is a multimodal design-theoretical approach on learning and knowledge-making (Rostvall & Selander, 2008:11), where the concepts of sign-making, design and multimodality are used to describe the process of learning, in an attempt to merge the fields of a didactical and a social semiotic perspective (Kress, 2010; Kress & Selander, 2010:20). That people use a wide range of modes to communicate, for example, spoken language, pictures, written language, gestures, bodily movements, three dimensional objects, color, glossiness, etc. (Kress, 2003; Kress, 1997) becomes apparent when studying children’s use of digital tablets. It also becomes exposed that these modes have different possibilities for representing different things, as well as limitations (Kress, 2003:12–13; Kress, 1997:29). Spoken and written language, which in the western world have been favored (Kress, 1997) above other modes, are often not in the foreground in digital tablet applications. Instead modes such as pictures, music, moving images, etc. are used in the design. The applications are a part of the resources at hand, which children use as designers. The preschool setting and the environmental conditions, as well as the didactical design of the teachers, are also part of the design of the activity (Selander & Kress, 2010).

Understanding of the digital tablets’ design and the applications’ affordance – what is possible to be done with a certain mode (Selander & Kress, 2010) – becomes crucial for understanding children’s agency in relation to their use of digital tablets. For this purpose, I draw on the concept of affordance as defined by Gibson (1979), who has also inspired Selander and Kress (2010). The concept of affordance, as a noun, was coined by Gibson (1979) to describe the possibilities and limitations that the environment and different objects in it offer people (and animals). The concept of affordance always depends on both environment and man, or animal; «It implies the complementarity of the animal and the environment» (Gibson, 1979:127). Here Gibson offers an alternative to a dualistic view of body and mind, or where mind and matter are dichotomies: «But, actually, an affordance is neither an objective property nor a subjective property; or it is both, if you like» (Gibson, 1979:129).

Affordances have different possibilities as well as disadvantages, where the written language mode, for example, is more apt for some expressions, while the pictorial mode is more apt for others (Kress, 2003:3, 10). The concept of aptness, is in this article used to describe how children choose between, and combine the modes most fitting, or most apt for communicating something (Kress, 1997). Affordance is always set in a social and cultural environment (Selander & Kress, 2010), and the affordance of a certain object is therefore always submitted to the subjective meaning people put into it. Considering that this study is carried out in preschools where most of the children cannot yet read or write in a traditional way, it becomes interesting to investigate the relations between the participant’s interaction and the digital tablet’s affordances, and how these relations affect children’s agency.
METHODOLOGICAL APPROACH

This study is part of the community-based research project «Digital Tablets and Learning Sequences in a Swedish Preschool Environment» and was carried out in three different groups, in three different preschools in a culturally and socio-economically diverse municipality, involving children aged one and a half to five. Each group, consisting of fifteen to twenty children and three teachers, had access to one or two digital tablets. A video ethnographic approach (see e.g. Heath & Hindmarsh, 2002) was used in order to collect data that is as multimodal as possible. To get a good understanding of the environment, I as a researcher participated, observed and communicated with the participants of the study (Heath & Hindmarsh, 2002) for an introductory period, as well as met the teachers and parents in both formal and informal meetings.

Just as Heath and Hindmarsh (2002) point out, I needed a period of fieldwork for deciding where to place the camera; a handheld camera was needed to be able to follow the children, who often moved around and changed angles. The choice was made to abstain from recording the rest of the room and to focus on activities in which groups of children interacted with the tablet, henceforth tablet activities, in order to create manageable data that could help answer my research question. I decided to be consistent with these choices of selection, and decided to avoid zooming, being aware that the video recording can be seen as a first analysis (see e.g. Emerson 1995).

The video recorded tablet activities (when children used digital tablets) went on for approximately thirty minutes up to an hour and a half, and data was collected about three times a month for seven months, which resulted in approximately twenty-five hours of video data. The number of children participating in the different tablet activities varied from two to six children, and the children often took turns, so that all of them were given the opportunity to use the tablets. The data collected involves almost all of the children in the three preschool settings, approximately fifty-five children, and in this article two examples of activities are used to help answer the research question *What are the relations between the participant’s interaction and the digital tablet’s affordances, and how do these relations affect children’s agency?* The limitation of this study is that it is carried out with only three groups, in one municipality, which will of course affect the results. But careful consideration has been given to choosing three different preschools, in three different areas of the municipality, considering socio-cultural and economical factors, as well as collecting data from different age groups in order to collect more heterogeneous data. This study has been conducted strictly following the guidelines of research ethics (Vetenskapsrådet, 2004; Vetenskapsrådet, 2005); all participants have been anonymized; and authorized letters of information have been signed by all the parents and the data is kept in a safe.

Collecting multimodal data – a challenge

Facing the task of making visible complex, multimodal communicative events and children’s displays of agency, a handheld video recorder was used and,
When possible, a wireless recording of the digital tablet frame. To be able to observe many modes of representation (Kress, 1997) often used in combination and simultaneously (Kress, 2003), and not just focusing on the verbal language, it was crucial for this study to find a data collection method that could reflect all of these different ways of communicating, including capturing the digital tablet screen. The screen recording was made using the software Reflection, together with the built-in software AirPlay, to mirror everything that happened on the digital tablet screen onto a laptop computer. On the laptop, a recording of the digital tablet screen was made. The connection between the digital tablet and the laptop was wireless and enabled by either creating a local network, or by using a local wireless network. The outcome of the data collection method is video data in which it is possible to observe both the children’s actions and what is happening on the iPad screen.

A problem remaining to be solved is that the wireless connection needs preparation, which makes it difficult to record the screen in more spontaneous activities. Because of this problem, some of the data collection was made without a screen recording, as shown in example 2. However, this fact shows how important it is to have a multimodal system of data collection. When making the transcription it feels like something is «missing» because the screen cannot be seen clearly by the reader. The data collection method used in this study makes it possible to reflect a more complex and rich representation of the resources used by the children, as compared to using only a video recording.

To systematize the data used in this study, a general, broader categorization has been made, to discern overall reoccurring patterns in the data. The categories emerged when the data was examined on three levels. First an overall viewing of all of the video recordings was made and the content was systematized in an excel sheet, where information was written down about the number of participants, the applications used and an overall account of the activities and the participants communication. On the second level, a need for further categorization emerged, and the concepts of modes and resources was used to in line with the theoretical approach Design for Learning. The choice is based on the need to focus both on the affordances provided by the tablets and the interactions of the participants. In much of the data, the children proved to communicate in many different corporeal and visual ways, for example, both with each other and with the digital interface. These different modes and resources, for instance touching the tablet screen or each other, used in communication, both between the participants and in the applications, were categorized and added to the excel sheet. Information on whether the tablet activity was teacher or child-initiated and how the children designed the activity was also included. It was on this level that a link between the children’s agency and the different affordances of the applications became visible. On the third level, six different excerpts were transcribed and further explored, with the research question in focus. Here an even more detailed examination was made of the different modes and resources used by the children to communicate, as well as of the modes of communication used in the design of the digital tablets and the appli-
In this study, children have used a wide array of applications on digital tablets. Two of these are represented in the examples used in this article – a stop-motion filmmaking application and a train application, selected in order to analyze children’s agency in relation to different applications’ affordances. A comic strip style has been used, in an attempt to create a multimodal transcription, inspired by, for instance, Ivarsson (2010), reflecting gestures and other embodied communication, in line with, for example, Mondada (2007:818–819). The transcripts are presented frame by frame and followed by an analyzing text, to make it more comprehensible for readers to link the analyses to each detail in the transcription. The intention is to make it possible for the reader to follow the transcription frame by frame, in an effort to make the analytical process more transparent. As Bezemer and Mavers (2012) states, the transcription used in this study has been subject to the «agency of the transcribers in that they make significant representational choices(…)» (Bezemer & Mavers, 2012:194).

For the purpose of being able to take into account how the participants’ interaction interplays with the different affordances of the digital tablets, and how this affects children’s agency, interactional approaches (Corsaro, 2000; Martin & Evaldsson, 2012; Heath & Hindmarsh, 2002; Mondada, 2007; Walldén Hillström, 2014) were combined with a multimodal, design-theoretical approach (Selander & Kress, 2010; Kress, 1997; Kjällander & Moinian, 2014). The notion that material and embodied resources play important roles in children’s communication and their display of agency links together the literature presented, the methods used, the theoretical approach and the findings of this study. The choice to present research made on digital tablets in particular is based on the assumption that tablets have different affordances than digital resources in general (see e.g. Walldén Hillström, 2014; Kjällander & Moinian, 2014), and that these material and embodied differences are important factors as to which ways the children can use different means of communication, such as touch or visual means, and in this way act agentively. The interactional approach used is also based on the notion that material and embodied resources of communication are important factors, and must be reflected in the data collected. That is why a video ethnographic (see e.g. Heath & Hindmarsh, 2002) method has been used, combined with a multimodal design approach focusing on screen recordings of the digital tablets. The theoretical approach of Design for Learning, used in this study, also strongly underscores the importance of recognizing material and embodied resources in relation to children’s communication (Selander & Kress, 2010). Martin and Evaldsson (2012) have an in-depth discussion about the relations between children’s agency, children’s par-

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2. E.g. the Clip research group at Uppsala university and the DD research group at Stockholm university.
participation, children’s interaction, and affordances, building on Corsaro’s concept of interpretative reproduction (Corsaro, 2000, 2011) and Goodwin’s (2000, 2007) notion of participation. They find that embodied and material resources, integrated with spoken and written language, are at the heart of the children’s interaction as well as in the way the children are afforded to act as agents, when they appropriate and co-construct schoolyard rules in a Reggio Emilia school (Martin & Evaldsson, 2012). The whole setting of the environment, where the children were expected to be agentive and be active participants in the different activities, afforded the children not only to use embodied resources to state and exemplify their ideas, but also to «exert collective agency» (Martin & Evaldsson, 2012:71). This can be compared to the importance of settings recognized in the Design for Learning approach (Selander & Kress, 2010).

RESULTS

As will be demonstrated in this study, the emerging affordances of the digital tablet and the different applications, as well as the teacher’s setting, prove to be important factors in enabling or undermining children’s agency.

In the following section, the emerging affordances of the digital tablets will be examined in detail in two examples, and the children’s agency is investigated, focusing on relations constituted between the participants’ (teachers-children-peers) interaction and the digital tablets’ affordances.

The affordances of digital tablets

When compared with stationary or laptop computers, digital tablets can be found to provide other forms of affordances. Firstly, the touch screen makes it possible for young children to engage with the digital interface without having to use a mouse and/or master the alphabetical mode. Instead they can use the touch of their finger(s) to manipulate the content. In line with Ljung-Djärf’s (2004:127) findings that laptops are not very supportive of children’s cooperation, for example due to the fact that only one child can hold a mouse at a time, the digital tablet allows for multiple children using it simultaneously (compare with Walldén Hillström, 2014). Secondly, the home button makes it possible for children to exit an application quickly and easily. Thirdly, the shape and size of the digital tablet make the screen accessible to a number of children at the same time, since they can gather around it if it is placed for example on a table or on the floor. In comparison to a laptop computer, more children can see the screen at the same time, and no one can end up «at the back of the screen», as shown in example 2. The shape and size, together with the affordances of the applications, can also enable multi-player use, where several children can touch the screen at once and work together (depending upon whether the application in use allows for multi-touch, that is, that the application can register the touch of two different fingers at the same time). Portability
is also a part of its affordances, enabling the children to carry it around and, as can be seen in the data collected for this study, to carry it outside to the preschool courtyard or into the forest, for example to take photographs.

The emerging affordances of the applications

In the following section, two different excerpts have been selected in order to analyze children’s agency in relation to two different applications’ emerging affordances. In the data collected for this study, the children use a number of different applications, ranging from a camera, through train-driving applications, to barber shop hairdressing games. Most of the applications were chosen and downloaded by the teachers and most of the time the teachers took an active part in the digital tablet activities, but there are also occasions where the teacher is nearby or in an adjacent room. The activity in the following sequences is part of an ongoing project about monsters, feelings, and different emotional expressions.

Example 1: The stop-motion application

Two children, here called Casper (four years old) and Anton (four years old) are in the preschool studio, together with a teacher. The children have previously made clay figurines of monsters and they have also used the digital tablet to make stop-motion films, as a part of the project. The teacher and the children together explore the functions of the application.
Introducing an application by exploring together

The teacher moves her hand towards the tablet screen...

Shall we try something? What happens when I press this button?

...presses the play button, and a stop motion film consisting of the pictures taken, starts playing. (...)

Here?

...Nothing happens, since Casper only points towards the shutter button, without touching it.

Casper points towards the shutter button.

Or here?

Try!

Casper points towards the play button, and after the teacher's invitation to try...

...he presses the play button, and the stop motion film is paused.

Picture 2.
In this introductory part of the activity, the teacher and the children try out and explore the stop-motion application’s affordances together. The teacher creates a setting (see Selander & Kress, 2010), where the children are expected to act as agents (compare with Martin & Evaldsson, 2012) and designers (compare with Selander & Kress, 2010), using the application’s *affordances* (Kress & Selander, 2010). That the teacher makes way for the children to act agentive is further made possible by the digital tablet’s and the application’s affordances building on pictorial (photos and circular buttons), auditive (shutter button sound) and corporeal (touch screen) modes. This in its turn makes it easy for the children to engage in taking pictures and to turn them into stop-motion movies, by pressing either the shutter button, or the play button.

To be able to understand the following excerpt, the stop-motion application’s affordances are now examined.

**The Stop-motion application**

![Stop-motion application]

The stop-motion application’s affordances make it possible to take pictures and turn them into a stop-motion movie. When the shutter button is pressed, a picture is taken, and at the same time there is a sound like an analog camera shutter. The picture taken automatically ends up in a row below, and when the play button is pressed, all of the pictures taken are played as a stop-motion movie. If it is pressed again, it pauses the movie. The application is based on modes of communication like colors, shapes, sound, and movement, rather than on written text.
Using the application’s emerging affordances to act agentively

(...)
The children continue taking pictures of the clay figurines when Casper turns around, holding the digital tablet towards the window, instead of the figurines...

Casper points the digital tablet towards the courtyard...

...presses the shutter button and takes a picture.

Casper uses the portable affordance of the digital tablet, to point it out the window, and the pictorial and auditive affordances when pressing the shutter button, taking a picture of the courtyard where a couple of children are playing. The portable affordances of the tablet here make it possible for Casper to act as an agent and choose (see e.g. Kress, 1997) the motif of the picture, by pointing it out the window. At the same time the teacher is asking him to round up the activity, so that they can watch the stop-motion movie, but he resists...

Casper continues to point the tablet at different objects in the room...

...taking pictures pressing the shutter button.

I was thinking that you could finish, so that we could watch the movie... We can make more movies later!

Not today, can I stop...

Not today? When are you going to finish, then?

Noo...
Casper continues to resist the teacher’s request both by using corporeal and visual modes, continuing to take pictures of different objects in the room, and in verbal modes, telling her that he «can’t stop.» By doing this, he acts as an active designer of the activity (Selander & Kress, 2010). At the same time, the teacher allows him to continue taking photographs and a negotiation takes place, where the teacher is cajoling, while Casper is maintaining his objective.

When Casper has finished taking pictures, he presses the play button, without help from the teacher, and this single press of a finger starts the stop-motion movie consisting of all the pictures taken by him. That he does this, in a relatively independent way, is an example of him acting in an agentive way (compare with Selander & Kress, 2010). He evaluates his competence by stating in verbal modes «– That’s how it’s done! That’s how much I can do!» and in corporeal and visual modes, by actually pressing the play button. This is an example of how the modes are always intertwined and used together, and never isolated (Selander & Kress, 2010). Casper chooses between the means at hand (Kress, 1997) to best communicate content to the other participants. Here, he uses corporeal modes by starting the stop-motion film, but chooses to also use a perhaps more apt (Kress 2003:3) mode for communication with the teacher, by stating in verbal modes how much he can do.

Afterwards the teacher asks the children if they want to make a movie out of their clay figurines, which results in a narrative style stop-motion movie.

**Agency, in relation to the participants’ interaction and the stop-motion application’s affordances**

As demonstrated in the above example, Casper decides what to do with the application, and what content he wants to fill it with. The teacher has, in the introduction, made a setting where the children’s agency is accounted for and supported, by exploring the functions of the application together with the chil-
The child acts as an equal, and does not need the teacher’s help to take pictures and then turn them into a stop-motion movie. Instead, he manages to use the affordances of the application and make a movie, with his own chosen content, with just the press of a finger. This first stop-motion movie does not result in a traditional narrative story, but is rather an assemblage of both content chosen by the child in a non-linear storyline and an experiment, the learning of the functions of the application. When the children and the teacher then go on to make a new stop-motion movie using the clay figurines, the outcome is more one of linear storytelling.

Example 2: The Train Conductor game

In the following excerpt, three children use the digital tablet to play different games. They have used the tablet before, and the teacher is in the next room, visible through the glass door. The teacher has asked the children questions about how they want to take turns, and then leaves them to explore the digital tablet on their own. This is a part of this teacher’s stated approach to the use of digital tablets: to see what happens when the children are allowed to explore the digital tablet together, with the help of friends, but not always helped by a teacher. The child with the digital tablet in front of her is here called Millie (five years old) and the one next to her Naomi (five years old). The child farthest to the left is here called Grace.
Working out how to use an application

You mustn’t, there’s going to be water, at some point, I think. There mustn’t be water... Or it isn’t supposed to touch...

Oh, you have to pull it in time! Oops... It’s going to be a little bit difficult....

Millie draws her finger against the screen, pulling the train along the track. Grace points to the screen.

Picture 7.

Starting the activity, the children try to work out how the application works and what it is they are supposed to do with it. Grace uses verbal and corporeal modes, pointing towards the screen and trying to help out, telling Millie that «there is going to be water, at some point, I think,» perhaps building on previous experiences with this or some other application. Millie uses the affordance of the digital tablet’s touch screen to pull the train along the track, but this is not enough to solve the game. To understand this sequence further, a description of the application is needed.

The Train application

The train application in example 2 is designed with three train tracks, numbered 1, 2 and 3. The trains, which move along the tracks, are also numbered 1, 2 and 3, but each one moves along the «wrong» track. The player is supposed to move each train to the «right» track – the track with the same number; the train marked «3» should be moved to the track marked «3» and so on. The affordance of this application is built using several modes, but the written numeral mode becomes crucial to solving the game. It is also built upon the
understanding that the numeral mode is superior to the other modes, such as movement, color and sound.

Millie continues to try to solve the game by trying different strategies: pulling the train along the same track and trying to change tracks. Both Millie and Grace comment verbally on the appearance and disappearance of a new track, which turned up when Millie changed tracks. Even though the children are now closer to solving the game, they get stuck, since the application only communicates with numeral modes which track is the «right» one.

Now the game is «lost,» but Millie chooses to try again, pressing the «play again» button. Contradicting this persistence are the verbal reflections, concluding that she is not going to win and that this time it is more difficult. Here the continuing corporeal communications of Millie touching the screen, trying to get the train to the «right» track, but failing, is an example of lack of agency: She cannot influence the application and she cannot act independently (compare with Selander & Kress, 2010) within the digital interface.
Finally, Millie chooses to give up and exit the game and she does this both by using corporeal modes, provided by the digital tablet’s affordance of the home button, and with verbal communication. The use of corporeal modes is here interpreted as an act of agency, since this can be seen as a multimodal way of choosing (Kress, 1997) to end the activity and choose another application instead. In this way, she is choosing between the resources at hand (Selander & Kress, 2010), the different applications, as part of the design of the rest of the activity.

Agency, in relation to the participants’ interaction and the Train application’s emerging affordances

In the above example, the children are focused on how to use the application. Millie pulls the trains along the tracks, but cannot work out the «aim» of the application – that each train should be moved to the track with the same number as each train. The numeral mode is an important part of this application’s affordance, and is crucial if the game is to be solved. The children become dependent upon a teacher’s support and interpretation, but in this example they do not call for the teacher’s help, even though she is in the next room. Instead the children collaborate and try to work it out together, by talking, pointing at the screen, and trying different hypotheses, based on former knowledge, like when Grace explains that there might be water, and that you are supposed to pull the trains (compare with Walldén Hillström, 2014). But in spite of their collaboration and experimentation, the children cannot work out the aim of the game, and exit the application. This is an example of how a mode, in this case the numeral mode, as used in an application, becomes inapt (Kress, 2003:3) for the children. The less apt the modes are, the more the children’s interaction tends to orient towards working out how to use the application, and after collaborating and trying for a while, they give up and exit the application to choose another one with different affordances. In another setting, the children might have asked the teacher for help, but that would still prove that certain modes used in the application’s affordance make the children more dependent upon a teacher’s help and interpretation.
CONCLUDING DISCUSSION

How the tablet’s and the application’s aptness affect children’s agency

When the digital tablet’s affordance is more apt (Kress, 2003:3), children are less dependent upon a teacher (for instance) to help them. In example 1, for example, the child can use the stop-motion application to make a movie, on his own, without the help of the teacher, because the application’s affordances are built on visual modes, among others. But the setting is also created by the teacher making space for the children to act out their agency on their own, as shown in example 1. They collaborate with their friends and are engaged in what they want to use the application for, rather than how it works. When the affordance is less apt, the children often start to collaborate with one another and try to make sense of the application, as shown in example 2. If that does not work, they ask their teacher or exit the application by pressing the home button. Sometimes the teacher cannot work out how the application is used either, and when this happens the children often change to another mode of representation, exiting the application and choosing another, or by choosing another activity «outside» the digital interface.

The majority of the data collected for this study consists of occasions where the children’s agency is enabled. But, as demonstrated in this study, children’s agency can be both enabled and undermined, depending upon the aptness of the affordances of the applications. The data collected in this study shows that, to the children, more apt modes are, for example, touch, pictures, shapes and music, whereas inapt modes are, for example, written language and numerals.

The aptness, for the children, of the modes used (Kress, 2003:3) in the digital tablet’s affordance relates to the degree to which the participants can interact independently with each other and make their own choices. But these affordances are always subject to the setting (Selander & Kress, 2010), set for example by a teacher, as shown in both examples. The aptness of the digital tablet’s affordance relates to the children’s interaction in a way that makes them less dependent upon for example their teacher the more apt the modes that are used. More apt affordances also enable children’s agency by making it possible for them to put their own interests and engagements into the activity, as shown in example 1. Less apt affordances can undermine children’s agency, as shown in example 2.

The affordances of the stop-motion application make it possible for children to display their agency in interaction with other children by creating a film with the content of their choice, by pressing a button. The advantage over a digital camera for example, which is commonly used in preschools, is that the stop-motion application on a digital tablet makes children less dependent upon their teacher, thus more able to display agency. With a digital camera, the transformation from pictures to a stop-motion movie would require a lot of help from the teacher, as well as time.
However, the disadvantages of some of the applications used by the children in this study, concerning children’s agency, are shown when limitations emerge, as shown in example 2. That the applications might in fact be «too difficult» could be interpreted in a Vygotskian tradition and seen as a sign that these applications were not in the zone of proximal development (see e.g. Rainio, 2010:10–11). From the perspective of a Design for Learning and a multimodal, design-theoretical approach, these applications can be seen as using modes of representations not apt for the children, using alphabetical or numeral modes, or English instead of Swedish. This can also be compared with Kress’ (2003:5) discussion about how children’s sign-making is focused on apt use of the means at hand, in contrast to adults’ conventional use of culturally-made means, such as writing.

The overall advantages of digital tablets, then, are that multimodal ways of communication are dominant, in the data produced in this study, for example corporal modes (the touch screen) and shapes, colors and symbols. These factors enable young children to display their agency, as a part of the design of the whole activity, where their interactions with other children and the teachers and the setting are also important components (Selander & Kress, 2010).

The findings highlight that the certain affordances of the touch screen, the portability of the tablet, and the use of pictorial modes within the applications, contributed to children’s agency within the digital tablet activities.

**CONCLUSION**

The findings underscore the importance of combining a multimodal, design-theoretical approach (Selander & Kress, 2010; Kress, 1997; Kjällander & Moinian, 2014) with interactional approaches (Corsaro, 2000; Martin & Evaldsson, 2012; Heath & Hindmarsh, 2002; Mondada, 2007; Walldén Hillström, 2014), taking into account how the participants’ interaction interplays with the different affordances, when digital tablets are being used in preschool settings. The interaction-based analysis combined with a multimodal design-theoretical approach contributes to the understanding of the aptness of the affordances of the applications used in preschool settings. The data collection method of video-based research is also developed here, showing the possibilities of integrating new technological solutions with the social sciences. Furthermore, the study shows how an understanding of children’s agency may be expanded, through the use of multimodal approaches, including the Design for Learning approach, by recognizing how children as designers make use of the affordances of the digital tablets as they act in new, embodied, material, and agentive ways.
REFERENCES


