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ONCE UPON A TABLET: A SCHOOL TOY IN THE MAKING

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Abstract. The current paper introduces the definitions of *playful literacy* and *multimodal hyper-intertextuality*, key concepts when researching children's use of digital tablets. The pilot investigation, which took place in spring 2014 in Denmark, is part of a larger cross-cultural comparative project exploring what emergent behaviors are present when preschool children use and play with tablets in their formal learning environments. In order to map the array of play and usage of such devices for this research, after the first round of observations, the tablet taxonomy was outlined and has been applied as a guide for the subsequent rounds of data collection. The proposed definitions are a valuable contribution to the field of multisensory interfaces, due to their pervasiveness on digital mobile platforms.

Keywords: Tablet · Play · Interaction Design · Intertextuality · Literacy · Education.

1 Introduction

Children are curious and natural explorers of their environment. They replay their routines and fantasize about their daily universes while playing with friends or with their toys. They become parents, children, pets and superheroes intertwined in stories and games aided by various toys or just plain imagination. The ubiquity of digital devices in the social sphere creates an environment where technology becomes a natural commodity in daily routines. In this context, children are no longer only observant of digital technologies, but they are players and users, with tablets becoming the digital toy of choice. In the case of Denmark, tablets and smartphones are present in over 75% of all Danish homes [1].

The use of tablets and smartphones devices is enhanced by the growth of the application (app) market. As tablets joined the home environment, they were shared among all family members, including children. This shared feature propitiates specific customizations in ways that allow smooth use by their assorted clientele [2]. Tablets either joined other digital devices in the home environment, or became the primary

digital tool. With the proliferation of these portable devices, daily activities, such as surfing the Internet, reading newspapers and magazines, listening to music, as well as playing games, have migrated from computers to tablets with little effort [3].

In order to map how 4-7 year old children in distinct cultures use and discover tablets' capabilities, this PhD research, which started in spring 2014, focuses on observing preschoolers' uses of these devices in three countries; Denmark, Japan and Brazil. Tablets, as the latest toy in the playground, raise a number of questions when studying children's digital knowledge: What is learned during tablet interactions? What kinds of skills are being developed with tablet play? How does the target group, which is still non-alphabetized, navigate digital literate interfaces? Does the concept of digital literacy cover preschoolers' tablet play? How can tablets promote social interaction? Which modes of interaction are present during tablet play?

More specifically, preschoolers' playful experimentation with tablet devices provides valuable information on future uses of technologies in educational institutions and how such technologies can be explored as learning aid tools. In order to complement learning and digital interactions fields of study, definitions of digital literacy are being revisited together with related theories, which help inform and define the current scenario of digital learning and digital play. Additionally, this research challenges notions of digital literacy by confronting how children's use of tablets is affording or complementing modes of learning, suggesting a definition of *playful literacy*. Supplementing *playful literacy*, the tablet taxonomy, which has emerged from the pilot study findings, has been defined and presents key topics towards upcoming researches that focus on children's interactions with tablets. Among the subtopics that emerged from the tablet taxonomy, the concept of *multimodal hyper-intertextuality* proves itself of relevance and it should serve as a valuable contribution to studies in the field of multisensory interfaces.

1.1 Digital Play

Digital play, on consoles and portable devices, has been an integral part of childhood for the past twenty years, through a combination of three key elements: technology, culture and marketing [4]. The playful trait of portable devices currently witnessed in society, with games amounting to 50% or more of tablet use [5], is also of high significance. Following a trend of touch screen mobile devices initiated in 2007 with the success of smartphones, digital tablets have grown in popularity and slowly become the device of choice for both work and play [6]. There are several available apps with various purposes such as games, education, reading, etc. As of February 2015 [7] there were more than 80,000 educational apps available for the iPad, and they target both educational institutions and families. Notwithstanding that these apps do not necessarily target pre-school children, it is still of relevance to acknowledge these numbers in order to better assess how digital learning became highly connected to tablet devices as the educational tools of choice within a five-year timeframe.

From a tangible perspective, due to their lightweight and size, tablets are more portable than laptops, so they are easier to store and transport. Tablets and apps, which are also cheaper than computer and software packages, have become an attrac-

tive option for institutions. Another perspective relates to access of knowledge. As the Internet has grown to be a reliable information resource, its use in schools has become more prevalent, with students using an assortment of online software and search engines as learning tools. Following this Internet role in society and schools, it is pertinent to say that tablets entered the consumers' market when a large infrastructure was already in place to make them a desirable and useful device. It is therefore hardly surprising that schools worldwide are adopting them as educational tools [8]. In Denmark, following local ICT initiatives, tablets (primarily iPads) have been chosen to complement educational materials in the Danish school system [9]. Therefore studying what preschool children know and how they interact with tablet devices is key to informing and challenging future development of similar digital tools in educational institutions. During the pilot study, nineteen children were observed, with seventeen of the observations taking place at the partnering institution, a Danish kindergarten that is in the process of acquiring tablets, and plans to use them as one of the kindergarten's activities in the near future.

1.2 Child-Friendly Interface

A unique characteristic of tablets' shared access lies in its interface. Despite tablet app icons' static behavior [2], the fact that there are no 'important files floating on the screen' facilitates its sharing capabilities. The primary interface contains only apps, which according to the pilot study's results, tend to be recognized by the intended users. Users are less concerned about undesired file deletion or other similar problems. Besides this, as they are touch-sensitive devices, the need for a "mouse" is eliminated, giving tablets the advantage of easy and faster setup and use in both formal and informal settings (on tables, as well as on couches).

As young children swipe their little fingers across screens and figures, they appropriate tablet devices to their own needs by playing and exploring icons and images beyond their intended design parameters. One example is taking screenshots of the main screen and using them in a 'paint like' application, or just playing with the placement of app icons as if in a type of game involving 'arranging' toys. Although preschoolers (and even younger children) mostly choose children's apps, they are able to engage with a large variety of apps, even ones that have been developed for literate users, such as YouTube and Google search. Initial pilot observations have shown that these children, who are not yet schooled, take on the challenge of copying alphabet symbols from their favorite toys into search form fields in order to engage with videos, images and games featuring that same character. They are not intimidated by apps that require the use of letters, words or numbers in their game play. They also tend to skip any written or oral information in a game and discover or create the rules and goals of the game themselves by virtue of trial and error. In an almost decoding process, the observed children were quick and keen to learn, even though they were not familiar with many of the apps in the specific tablets used for the research.

During the observations, children were not interested in apps that did not seem like children's apps. This is of relevance as it informs about children's semiotic awareness in relation to digital interfaces. How do children classify and identify digital icons?

What motivates a choice of one app rather than another? This semiotic trait is one of the skills being afforded by children's exposure to digital devices, it shapes children's expectations towards upcoming interactions and interfaces in the digital realm, thus it composes one of the categories identified in the tablet taxonomy.

2 *Toyblet Taxonomy*

The tablet taxonomy[10] definition was based on the first round of observations and it is briefly described below¹. The taxonomy topics are divided into five categories: *vocabulary*, *design*, *play*, *interaction* and *emotion*, each covering three or more related subcategories. For example, the topics of *vocabulary*, *design* and *play* deal with learning sides of tablet play, including symbolic meanings and cultural expectations; *interaction* and *emotion* provide information about skills being developed and social qualities observed when talking about or playing on tablets.

The taxonomy topics are grounded on the pilot study findings and address some initial research questions: a) What is learned during tablet interactions? b) What kinds of skills are being developed with tablet play? c) How does the target group, which is still non-alphabetized, navigate digital literate interfaces? d) Does the concept of digital literacy cover preschoolers' tablet play? e) How can tablets promote social interaction? Besides addressing these questions, the taxonomy expands them further into broader arenas.

The taxonomy topics are:

Vocabulary. Deals with themes of how adult mediation shapes and affects children's perceptions of their activities on tablet devices. The topic also deals with a lack of words that specifically define characteristics of the interface and types of activities, e.g. do we swipe to another 'screen', 'region' or 'app selection'? Apps are called games, even though they might be a read-aloud book app, or a full platform containing a wide range of activities, such as puzzles, sing-along or drawing.

Design. Relates to both graphical and interaction design features, such as tablet semiotics and how apps are designed. E.g. how children decode apps' symbolic meanings (what is available to use, what is 'locked', how they distinguish 'children's apps' from other apps, etc.); it also relates to what types of information app icons communicate during a first and subsequent encounters.

Play. Concerns the modalities of play taking place when using tablets. Both the modes of play afforded by a wide range of applications (solve a puzzle, listen to a story, draw or pop symbols, dress-up dolls, etc.), as well as ways in which children create and defy these modes through playing (not necessarily following the suggested solution, just playing for fun without following the app design). This category also deals with how digital play is intertwined with a broader culture outside tablets, which

¹ The tablet taxonomy is fully described at Fróes, I.C.G.: *Toyblet : A Taxonomy to Children 's Playful Interactions with Tablets*. (Forthcoming).

involves television programs, movies, toys, clothing, language references, etc. For example, users can choose an app based on a TV program, a brand or a movie, and choose clothing with app character icons. Together, this vast universe of play modes combined with the interlinked knowledge from distinct sources, define the subtopic of *multimodal hyper-intertextuality* that will be described in more depth in a later section of this paper.

Interaction . Covers what motivates and engages children’s use of tablets. It also deals with how preschoolers tackle and explore unknown narratives and interfaces. For instance, every time children are confronted with unknown apps, they have ways of identifying and ‘problem solving’ during gameplay, either by trying things out or by comparing the app with previously experienced apps. Another aspect is playing on an app without expectations i.e. ignoring the game goal, besides not having to ‘put toys away’ after they have had enough of an activity – just choose another app instead.

Emotion . It includes subcategories covering notions of identity, privacy and attachment. They directly relate to social and emotional properties linked to tablet play: e.g. referring to app avatars and characters as ‘I’; being able to join in conversations related to apps in their social environment, with peers, relatives and others; associations of playing on a tablet in specific circumstances, such as on holidays, together with friends or family, etc., which may shape emotional bonds and memories.

The tablet taxonomy contributed to acknowledging emerging patterns encountered during *tablet play*. The taxonomy also served as a guideline to review and challenge a number of theories connected to ways children use and play with digital media, as well as children’s tablet literacy.

3 Playful Literacy

While the early concept of literacy is defined as the ability to read and write, and a number of scholars have already covered the area of how digital technologies can aid the processes of acquiring literacy skills [10, 11, 12, 13], digital literacy has a broader perspective and covers a much larger learning spectrum beyond reading and writing skills. With the spread of computers and IT-related communication, digital literacy was initially defined as the ability to use computers [14, 15, 16]. Internet and Internet communication technologies (ICTs) helped outline new forms of literacy and due to technological advances, digital literacy is in continual change and development [18]. Additionally, the advent of mobile devices has brought a change in how literacy is attained and perceived [18, 19].

For the purpose of this study, I chose to use Martin’s definition of digital literacy due to its comprehensiveness. He defines digital literacy as:

“The awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and syn-

thesise digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process.” [15]

Although Martin’s definition covers an extensive ground in terms of digital literacy, other scholars have suggested parallel and sometimes complementary definitions, such as media literacy [17], and emergent literacies [20]. Media literacy broadens the scope of digital literacy and is described by Buckingham as the capacity not only to use media devices, but to also be able to assess and understand the breadth of media’s cultural aspects and impacts [17].

The concept of emergent literacies predates the other concepts above, and according to Spencer [20], it is characterized by:

“The continuous incidental interaction of children and adults in a world of increasing semantic complexity, intercultural contact, common experience of media, and the possibilities of almost immediate communication systems ... have to be acknowledged as events in emergent literacies” [20]

Due to the ubiquity of portable devices, such as tablets, and even to the ongoing development of new interfaces of interaction (wearable, non-touch interfaces, etc.), it is relevant to reassess the roles of digital-related literacy currently witnessed in society. This assessment has to be complemented with investigating the modes of learning they are affording. By observing the types of literacy occurring outside specific apps that are present in digital device interaction as a whole, it is possible to identify the assets of some of these modes.

Based on the findings resulting from the pilot study observations, it became apparent that the ways preschoolers use tablets portrayed degrees of literacy; however they did not fit within existing digital literacy definitions. A simple example refers to the term “*appropriately*” and the *reflective* theme suggested by Martin [15] in his digital literacy definition. Neither of them applied in the context of the researched target group. E.g. children challenged the way apps were designed by tapping back buttons and playing in infinite loops rather than following the app design. Another example was trying to control an interaction by shaking the device instead of using a finger.

The styles of digital play that tablets afford, together with the knowledge of app characters and with the range of activities and possibilities within one device, have entered children’s play discourse – either in drawings, or when talking about some of the games. However at this stage there is little reflection upon the whole process and even about perceptions of abstract topics such as “Internet”. Even though there is a degree of reflection while playing on a device, these children, who were all younger than seven years old, saw the devices as a toy containing many games. They did not differentiate between distinct activities on the tablet, such as drawing, watching a cartoon, or playing a game. All of these activities were described as game like activities. However, when the children were asked to use a specific application (Book Creator app), this activity was not recognized as play time, even though the children were

doing something they tend to recognize as play in other settings (drawing, telling stories and jokes to their peers, etc.).

Based on the playful characteristics that regulated the observed interactions, I have proposed the concept of *playful literacy*. **Playful literacy** is defined as *the ability to use, interact, relate, communicate, create, have fun with and challenge digital tools through playful behavior*.

This definition of *playful literacy* is intended to challenge and expand digital literacy perceptions, aiding future studies that address children and emerging digital technologies. Moreover, the concept of *playful literacy* acknowledges the role of ‘having fun’ as a key quality of successful digital interactions among preschoolers. *Playful literacy* can also be helpful in supporting forthcoming assessments of technologies among older target groups, due to the wide spectrum of playful multimodal interactions afforded by tablets and similar devices.

4 Playful Intertextuality

Despite the screen constrains, tablets afford a *playful literacy* by being versatile toys with diverse modes of play and topics of interest, and fitting in with children’s curiosity and pace. As different apps are available in one device, and more apps can be downloaded through the devices’ ‘digital stores’, tablets can be described as unique multipurpose toys that afford a subtle link between physical and digital experiences, e.g. actual payments for digital downloads. These exchanges between the digital and physical realms relate to notions of intertextuality [24, 25, 26]. In 1987, John Fiske defined the concept of intertextuality as:

“Any one text is necessarily read in relationship to others and that a range of textual knowledges is brought to bear upon it. These relationships do not take the form of specific allusions from one text to another and there is no need for readers to be familiar with specific or the same texts to read intertextually. Intertextuality exists rather in the space between texts.” [26]

This definition of intertextuality has been expanded to delineate the ways in which a variety of media interrelate, shaping the later concept of transmedia intertextuality [24, 25], [27], when characters or stories converge throughout various media, creating an intertextual narrative. The narrative from one medium suggests the consumption of the next medium, such as read the story, play the game, watch the movie, etc. In tablets, this type of narrative can occur from within one app, where a child can listen to the story while playing a game with one of the characters, followed by a small video, which can then lead to an online store or website where the child can be exposed to existing merchandise (physical or digital) related to the character or brand. The notion of intertextuality is very much connected to hypertext, hypermedia and hyperintertextuality theories. Hypertext [28] was regarded as a live reference to distinct pieces of textual information, hypermedia [28] was defined as complexes of branching and responding graphics, movies and sound as well as text, and hyper-

intertextuality [29, 30] has been portrayed as the multimedia version of hypertext. However, the intertextuality and intertwined features of tablet applications afford a new paradigm that I am currently proposing to define as multimodal hyper-intertextuality.

Multimodal hyper-intertextuality refers to the wide array of media and modes of use in which users rely on and experience the interaction and interdependence of applications on mobile platforms, tablets and smartphones.

One example is encountering or being exposed to a specific topic at a static location, such as at home, or while on the go, and picking up the portable device in order to search for related information on a browser. As you click on one of the images, you are redirected to another application that will allow you to access the information, for example tapping on a video icon that will open YouTube and possibly redirect you to the “store” app, where you can then download the app in order to see and explore the searched content in more detail. If the information related to a cartoon character, you might be led to a book, movie or game app and so forth. If the content searched was related to music, you could watch a video, listen to a song, and if you like it, add it to a playlist.

Preschoolers are growing up with this vast realm of possibilities and continuous technology developments. When asked why they liked playing on tablet devices, all the children observed mentioned “fun” as the main reason. Tablet devices’ *playful literacy* and *multimodal hyper-intertextuality* are shaping children’s learning skills and perceptions of their everyday life. This trend not only shapes children’s experiences with digital devices, it also prompts other interactions to follow suit, and to contain a multitude of perceptions in every interaction, which will feed into another experience.

The theme of *multimodal hyper-intertextuality* complements that of *playful literacy* and both contribute to the field of multisensory interfaces informing current modes of experiencing and interacting with tablet devices, i.e. adding characteristics of fun and intertwined app interaction together with diverse inputs (touch, voice) and outputs (visual, sound, tactile), as some of the ways that digital events can be experienced. Furthermore, even though the definition emerged from a study on preschoolers, it can be expanded to related research involving tablets or other similar connected portable devices.

4.1 Multimodal Hyper-Intertextual Culture

Following the lines of a *multimodal hyper-intertextuality* phones and tablets are seen in movies, cartoons and advertising, they are used by people around us as well as by characters in TV series. As mobile devices feature in this fantasy universe, they also belong to households across countries and cultures. An observant child therefore learns by watching not only people, but also TV shows, movies and flipping through comic books. Some of these TV shows are broadcast across the western and eastern areas of the world through various channels, both television and online, shaping a common knowledge and expectation towards various devices. The pervasiveness of mobile platforms in society has afforded the interesting phenomenon of ‘mobile play-

ing’ among a wide age group, from young children to older generations [5]. Some of the game apps have developed from a piece of software into a whole product industry. For example, *Angry Birds* [21], and *Minecraft* [22], both produced in Scandinavian countries (Finland and Sweden, respectively), have become known worldwide and have developed into assorted merchandise and products, such as cartoons, toys, and clothing, creating brand universes of their own. They evolved from digital toys to physical ones. This brand pervasiveness shapes a cross-cultural language, reinforcing a common culture as stated by Buckingham [23], “... *global brands provide an international language or ‘common culture’, particularly among young people.*”

In the case of the above-mentioned *Angry Birds*, there are ‘good’ characters (birds) and ‘bad’ characters (pigs). However, in this case, the birds’ intention is to destroy the pigs and the structure protecting them. The birds are launched from a sling platform and the player has to find the right angle in order to maximize the destruction caused by each throw. Children who have played this game can identify the symbolic representation of the characters, hero and victim, or hero and villain (pigs steal birds’ eggs). Both the characters (birds and pigs) and how one plays this game (dragging a digital elastic band on a sling to reach a certain angle) become recognizable and replicable in other games or toys sharing any of the similarities (sling, pigs, birds, etc.). The game design follows laws of physics and although young children do not necessarily know about angles and projectiles, they play with them on the app, eventually learning about some of these properties in an informal setting. Such specific knowledge and behavior shape a digital *common culture* and the child as an active consumer of this culture [23], developing specific physical dexterities and knowledge, as in the illustration of digital sling throwing. Some interesting questions emerge from this: How does this culture eventually shape physical interactions? How are distinct cultures appropriating digital aspects? Are there specific cultural facets that inform the choice of apps? How does a *multimodal hyper-intertextual* experience frame expectations of digital interactions?

5 Concluding Remarks

The current paper contributes to the field of multisensory interfaces by introducing two key points that emerged from the pilot study regarding children’s playful interactions with tablets. Acknowledging the role of fun within modes of interaction informs and broadens the field of multisensory interfaces. The concepts of *playful literacy* and *multimodal hyper-intertextuality*, which emerged from the analysis of the observations, challenge existing definitions of digital and media literacy while covering the close interaction and interrelations between modes of use of portable devices, their associated apps and their actual praxis. The purpose of presenting these definitions is to spark further discussion regarding not only children’s digital (and playful) literacy, but also to provide an incentive to reflect on roles and uses of tablets in education while pushing boundaries towards acknowledging further related themes for investigation. Both definitions incite future research on how the growth of playfulness on

portable devices is affecting expectations of digital interactions, and how it is shaping upcoming digital designs.

While tablets are being adopted as school tools, their full scope of use and impact has yet to be mapped. Observing and understanding the multiple ways pre-school children are experiencing and shaping their own concept of mobility and tablet interaction is a valuable asset for professionals from diverse areas, especially those involved in design and education. Furthermore, as digital interfaces have entered the sphere of everyday work and play, investigating how they become intertwined in cultural perceptions and expectations can guide prospective developments of interactive platforms.

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