Chapter 4

Making Sense of Play: Transforming Actions into Words

In this chapter, I present how my process of observing digital play informed and shaped my proposed hand typology and taxonomy. This chapter builds on Chapters 2 and 3, showing how the contexts and set-up decisions provided the background scene for developing the research and how this process led to the need for converging disciplines (introduced in Chapter 3) when researching children's digital play practices.

In order to better demonstrate how I reached my results, I briefly present the method I used, and how I analysed and coded my observations. The first section starts with a presentation of the methodological approach chosen, including subsections on the study's initial set-up and how the research structure was designed. The second section covers the data-coding process and the presentation of the final set of codes, plus an illustrated hand typology. The chapter ends with a final summary of the main theoretical codes that are further elaborated in the following chapter.

4.1.   Choosing Where to Start

The original intention with my research was to explore young children's play practices with tablets. I chose a qualitative approach and direct observations to more efficiently map these practices and chose a method that would better accommodate my choices regarding which approaches to employ. I chose grounded theory (Charmaz, 2014; Creswell, 2013; Glaser & Strauss, 1999; Thornberg, 2012) as it does not require an initial review of a set field, but instead suggests that the empirical data should inform the questions leading to theories that are relevant to the research.

> A grounded theory emphasis on comparative methods leads ethnographers 1) to compare data with data systematically from the *beginning* of the research, not after all the data is collected, 2) to compare data with emerging categories, and 3) to demonstrate relations between concepts and categories. (Charmaz, 2014, p. 41)

Consequently, the study was initiated by setting up a pilot study. In this first phase, the observations focused on children engaging in unstructured free play with tablets, and the results of this study informed the rest of the data collection. The purpose of the pilot study was then to help define the scope of the research and to avoid misconceptions of how young children currently use tablet devices.

The first round of coding and data analysis, plus an initial literature review, followed the pilot study. Subsequently, the actual data were collected in Denmark and in Japan. The data collection involved three institutions (one in Denmark and two in Japan) located in metropolitan areas of both countries. The pilot study goal had been to frame the field and define specific observation categories. It had been based on unstructured free play, meaning children could engage with the device and the apps according to their own choices. This method was then reproduced as the first phase of the study. In this first phase, which focused on unstructured play, children were invited individually to a room at the institution, where, together with a table and chairs, there was a camera set-up and the devices were placed on the table.

The main study also included a second phase that focused on structured play with a pre-defined activity. In this phase, children were together in one of the classrooms but divided into groups, where they could engage with the devices or draw with colour pencils and crayons in different areas of the room. In this second phase, some of the activities occurred in parallel, with some children playing on tablets, while others drew. This dual set-up meant that the observation was 'divided', as I had to go back and forth at specific times. As the rooms were not that large, this set-up was not overly problematic, but obviously meant that a few points might have been missed. When this second phase took place in Japan, two student assistants were present and helped both with the language as well as with the recording, as we could have two cameras available instead of one, which proved to be helpful during the analysis. A total of 84 children were observed, 41 in Denmark and 43 in Japan.

This chapter initially presents considerations taken regarding the study set-up, followed by a description of the study design.

4.2.   Deciding on the What and How

Before investigating the practices of young children playing on tablets in two countries, a couple of methodological challenges needed to be addressed prior to the observations. With the purpose of limiting too much discrepancy among devices and environments that could compromise the data analysis, it was important to limit the number of variables.

Devices: Devices customised for the observations, together with knowing which applications were installed, promoted some consistency. The devices used for the research would also present the children with an unfamiliar layout and possibly unknown applications. Trying unknown apps on someone else's device would possibly put the children in an 'out of their comfort zone', which may help assess some of children's digital literacy skills.

Location: Although many studies involving children reinforce the importance of the home environment (Chaudron, 2015; Ogan, Karakuş, & Engin Kurşun, 2012), and by being at home one could see how the devices are placed and used within an everyday routine context, unique physical and family settings (siblings, parental layouts, etc.) could interfere with the observations. Therefore, I opted for doing the observations at educational institutions, where the environment could be more neutral and controlled. Lastly, the choice of being with the children while they played on the devices was also relevant, as any unseen or unexpected mode of use could be further investigated. It also gave the opportunity to see and hear children's own ways of playing and describing their play while I took ethnographical notes.

Camera set-up: As this study is concerned with children's digital play, the decision to focus on children's hands and their use of the device was deliberate and aided the observations and the data collection in important ways. The camera focused on the context in and around the hands to learn how the hand performs and embodies engagements with digital devices (Pink, Horst, et al., 2015; Pink, Sinanan, Hjorth, & Horst, 2016). Digital ethnography scholars have invited researchers to rethink ways of capturing data related to the digital domain, considering the tactile aspect performed by the hand when interacting with digital technologies.

> Visualisations on the touch screen are not just seen but they are part of both what the hand incrementally learns and knows, part of how the hand knows and are inextricable from our sensory perception of the wider environments we are in. (Pink *et al.*, 2015, p. 5).

Institutions: A couple of children's preschools were contacted. The employees of one of them were very keen on participating as they already owned tablet devices and were considering how to involve them in their daily activities with the children in the preschool. The pilot study took place in Spring 2014, followed by the coding and analysis of the data. For the pilot study, 19 children were observed individually at their care institution. A room with a table and chairs was set up with a camera above the children that focused down on the tablet play instead of children's faces or full torsos. Two devices were available, and the children were invited to use both. The observations lasted around 20 minutes each, with a few children using even less of that time and some trying to extend it. All the video material captured during the sessions was watched several times and fully transcribed. The transcription work was shared with a Japanese translator. I did all the Danish transcription, while the Japanese translator did all the Japanese transcription to make sure no important details were lost.

The observations took place in the Spring semester of 2014 and 2015 in three preschool institutions: one Danish preschool (*børnehave*), which already uses interactive devices in their daily activities, and two Japanese preschools (*hoikuen*), which have no type of interactive device available for the pupils or

teachers. Upon the institutions' agreement to collaborate, a letter was sent to all parents of children age four and older who attended the institutions, requesting permission for the child to take part in the study and observations, besides also inquiring if the child was acquainted with tablets or similar devices. All the children belonged to middle-class families and lived in metropolitan centres of their respective countries, more specifically in the regions of Copenhagen, Tokyo and Fukuoka. In total, over 100 parents answered, with five sets of parents refusing to let their children participate, as they did not want their children to use tablets during preschool hours. The children, who were also asked if they would like to take part in the study both before and on the day of the visit, replied positively on both occasions. Only one child in Denmark, whose parents had also agreed with him taking part in the study, had never used such devices before.

The institution's pedagogues collaborated by providing a room where the observations could take place, and by facilitating contact with the children who took part in the research. Neither parents nor pedagogues were present during the sessions. The devices of choice were an iPad Mini and a Samsung Galaxy Note 10.1 (both released in 2014) with the latest running software installed. For the purpose of the research, a total of 60 apps were chosen and downloaded based on the age category, their descriptions and popularity ranking on the Android and Apple store (Google Play and App store). The types of apps varied from the *puzzle*, *game*, *entertainment*, *educational* and *family* categories, which were highly rated (four to five stars), however with download rates lower than 500,000 downloads at the time of the download (February 2014). Apps with download rates of lower than 500,000 were selected as a way to try to witness a child's first encounter with unknown apps and assess ways in which the children deal with these encounters. This decision aimed to assess how children choose the apps, together with observing how they discover what to do and how to play with them. If the children were very experienced with using similar devices, encountering unknown applications would show how or if they apply previous knowledge from known applications to foreign ones.

4.3. Looking at Hands to Discover Play

For the first part of the study, the children, who attended the preschool and had been previously contacted, were called one by one to a room located outside their own group room in the building. The rooms were set up with a video camera overlooking the tablets from a top-down perspective, not focusing on the children's faces, but on their hands as they used the devices (See Figure 4.1 and others later in this chapter) following tactile digital ethnography principles (Pink, Sinanan, et al., 2016). There was no Internet access in the location. Both devices had mainly children's applications installed; however, as none of them were initially visible on the first active screen, the children were required to look for them. The children were asked a few questions regarding how they felt about the devices, if they owned one, frequency of use, what they did on it and modes of use (if alone, with siblings, parents or friends). They were then invited to
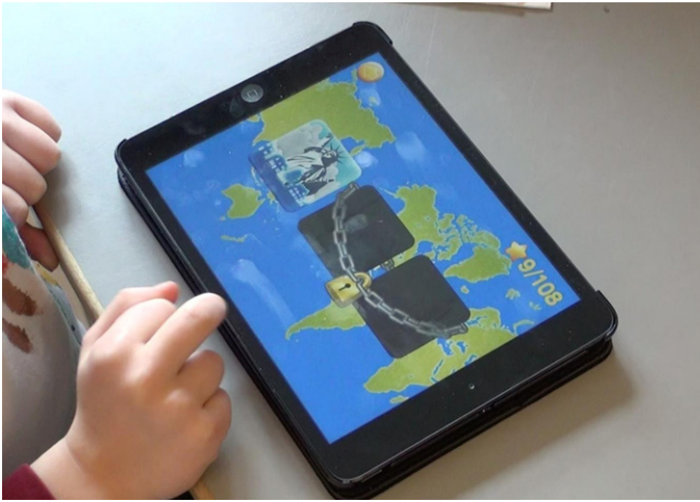
Figure 4.1.   Child Encountering a Locked Item.

engage with the devices, one at a time. The devices were turned off and without a password, so the children had to turn them on to use them and then they had to find and choose the applications they wanted to use. Each child had a total of 20 minutes to use both devices. After around 10 minutes and according to what they were doing, they were asked if they would like to change devices. After the pilot study had been completed, a series of informal talks with the institution's pedagogues and some of the parents took place. Although talking to pedagogues and parents had not been initially planned, it seemed a valuable addition to better contextualise the children's environment. These informal conversations and interviews also helped me to understand how tablets are perceived by the adults surrounding the subjects.

The pilot study proved valuable and presented a rich set of data, which was key for framing the scope of the research. The initial coding of the data took place after all the pilot transcriptions were complete and read through multiple times. With the initial coding process complete, the relationship among the initial codes was identified, which generated the focused codes, providing the final data for the theoretical coding (Charmaz, 2014). Main themes emerging from the theoretical codes served as guidelines for planning and structuring the second round of observations. They also informed a number of relevant topics that led to deepen my investigation process and helped me elaborate further on the subsequent analysis. Following the grounded theory approach, early writing is encouraged, as it demands more than reporting. Instead, it initiates the analytic process to be pursued via rewrites throughout the study (Charmaz, 2014). These topics are presented later in this chapter in the data coding and analysis section.

After coding the pilot study data, I divided the first round of theoretical codes into topic sections. These sections informed the first draft of the taxonomy of

tablet play (Fróes, 2015), which is further discussed in Chapter 5. The informed considerations were used as guides towards the second round of data collection and not as fixed points to be tested. The considerations, which are presented in the following, merely helped to funnel the observations towards more framed experiences (Table 4.1).

Based on the initial framework of these considerations, which could be perceived as rough hypotheses, I set out to explore how play was performed in groups. The activities, which are described later in this paragraph, were chosen to help further develop the aspects of problem-solving, vocabulary and digital involvement in groups, plus reveal how peer learning and collaboration were manifested in digital play practices.

While in the first phase of data collection, the children were left to choose whether they preferred to interact/play on the tablet, in the second phase they were asked to use a specific app and to draw on paper. The method for collecting data on the second phase was designed to explore some of the considerations and initial theoretical propositions raised after the pilot study.

Children were asked to use the device in groups, and two activities were planned to take place. The first activity was to see a short demonstration in order to learn how to use an app ('Book Creator for iPad – Create ebooks and Pdfs, Publish to iBooks on the App Store on iTunes', n.d.) and then create a 'book' using the same app. Book Creator is an app that allows for drawing, writing, picture taking, and video and sound recording. This app was chosen for two reasons. It would both allow the assessment of how children remember using the functions and symbols of an application for a pre-chosen activity, and it would allow for observing how children combine different modes of play and interaction (drawing, picture taking, recording) in one tablet activity. The second activity required them to draw on a piece of paper 'playing on a tablet'. Drawing on paper 'playing on a tablet' was intended to reveal how children represent and explain their own tablet narratives and experiences.

During four mornings, I was present during the activities carried out by the group's pedagogues. Each group has three pedagogues and one assistant pedagogue (normally a pedagogue student doing part of his/her educational training). Some activities involve the whole group of children, and for other activities, the children were divided into smaller groups. For example, on the days I was present, one group of children was playing board games, other children were playing with beads, making decorations, another group was playing with animal toys and yet another group was playing dressing up and role-playing. The tablet activity was added as one of the possible offers, and, just like the other activities, whoever wanted to join the tablet activity was welcome. On the first two mornings of the visit, two groups of children were presented and introduced to Book Creator separately. They were asked to draw or tell a story using the app. These functions were shown to the children as soon as the groups were formed. Due to space constraints and the limitation of having only two devices, the groups had four or six children at a time and, as a group, children had a total of 30 minutes to use the devices. While one or two had the device, the others could follow by watching and making suggestions. There were a couple of intentions with this

Table 4.1. Informed Considerations that Emerged from the Pilot Study.

Area	Deals With	Informed Considerations
Tablet vocabulary	Play terms and distinction between activities	When playing with tablets, preschoolers construct a unique tablet vocabulary and frame the type of play designed for digital objects due to the characteristic of mediated and delimited play
Mediation (parents, siblings)	Mediated play and interaction	
Physical × digital meanings (visible but not available)	Constraints and possibilities within digital interfaces. How are multimodalities identified in the digital realm?	
Tablet literacy	Learned interaction and tablet 'codes'	Tablets require learning (are not intuitive) and practice concomitantly/parallel with pencil and paper because the existing 'tablet knowledge' among preschoolers is too heterogeneous and can reinforce discrepancies
	Physical: performance, dexterity, literate and cross-platform knowledge	
Iconography	Icons × symbols × design: meanings and purposes (semiotics)	
Same toy, different rules	Many narratives and modes of play	Tablets afford versatile and un-designed play. However, they are a strong medium for branded play
Branded choices + branded play	App options and choices related to child and consumption	
Flexibility	Variety of tools within	
No other toy informs the same type of interaction	Physical interactions with tablets define how to play (swipe, press, turn, etc.)	Problem-solving engagement with tablets in preschoolers affords distinct modes of interaction because the problems are interpreted and assessed individually (based on individual experiences) and they do not frustrate the child in case of failure (not following the designed interaction)
Problem-solving magnet	Every interaction as a problem to solve or relate. (What does early problem-solving in digital contexts develop?)	
Play versus goal (blind interaction/ role of fun)	Little or no expectations of play outcomes keep the play going	
Familiarity	Mine versus yours	Digital involvement in preschoolers is culturally bound due to local knowledge and device perception from within the social circles navigated by the child
Privacy		
Storytelling (I × he/ she/they)	Role-playing and point of reference	

activity, first to explore how the multimodal possibility of the app, allowing for video, sound recording, drawing, etc., would be explored (if explored) by the children; second, if and how play would emerge during a pre-defined task.

On the other two mornings and still in groups (this time not necessarily the same group formation, but the same children as in the first two visits) children could use the tablet as they wished for 10−15 minutes and then had to draw on paper after playing with tablets. This time the idea was to gather how tablet play and digital play narratives emerged in an analogue format. Also, considering the initial findings from the pilot study, I was interested in observing which types of icons or symbols from tablets would emerge in paper drawings.

The individual observations took place (first phase) at one preschool, while the Book Creator activity and drawing on paper (second phase) were carried out at another preschool. Both Japanese preschools had similar profiles to those of the Danish ones (as defined in a previous chapter). These preschools focus on motor skills, social thriving, etc. rather than focusing on school-oriented learning, such as learning the alphabet. This aspect was carefully chosen, as I did not want to skew the data analysis by adding such a disruptive variable (children who have learned the alphabet and can read might still act the same with the devices, however, it would be difficult to compare their actions if the reading variable was added).

4.3.1.   *Some Considerations and Limitations of the Research Design*

While the one-to-one observations and informal conversations were quite calm, group interaction was more chaotic, and though it was a slightly more difficult to follow their conversations closely on the spot, everything was videotaped. Nevertheless, it was a great opportunity to see how children collaborate and play with each other when in possession of tablets, besides allowing for play events such as role-playing and game-like events to emerge (children would not make faces or make sounds for the device if alone, however as soon as another child was present, these actions entered their tablet play repertoire). The video data collected was very helpful, as it allowed me to capture these conversations for analysis after the events.

Overall, it became clear that the choices made earlier regarding devices, room set-ups and camera focus allowed for collection of a rich dataset. In addition, the focus on the hands while using the device proved to be an invaluable choice, as it helped shape questions and guide the analysis towards unforeseen, but appreciated directions. For example, during part of my data analysis, I took my focus away from the tablet object and instead directed it at the hands. Focusing on the hands led me to further consider how the hands act as a communication tool while interacting with digital devices. While children play, they also communicate their thinking behind their action through hand movements. Hands extrapolate from being just an interaction tool between user and device; hands are the silent communication tool between the user and his/her peers. The method choices, together with some of the results presented here, contribute to the field of digital ethnography by bringing the value of hands into focus when

studying digital media and children (Fróes & Tosca, 2016). However, this same choice of focus sometimes proved itself challenging as children moved the devices and their bodies, sometimes covering the camera view.

My choice of carrying out the observations at the educational institutions instead of at home could be perceived as faulty because children are not in their own 'natural' environment. Consequently, it can be argued that I did not observe children using their own devices or devices they know and that my observation set-up was too detached from children's actual practices. However, this choice provided the same starting ground for every child, and even though some of them had experienced tablets in other environments before, it was a first time with those tablets.

Besides the choice of location, in both countries, the children did not know me or the other research assistants, and they were called into a room with a video camera set-up, which already differs from their own room at the institution. Some of the children showed a degree of shyness and did not seem 'at home' at first. Notwithstanding these barriers, the children wanted to participate and were keen to try the devices and most of them had relaxed and were quite engaged by the end of the session.

Some children struggled with some basic interactions, such as swiping, sometimes requesting the researcher to intervene or help. Although helping the child was avoided as much as possible, it was accepted only when the child had been unsuccessful at least four times or when they went into 'delete' mode and did not know how to rectify the situation.

With the first two children, a few notes were taken on a notebook while they interacted with the device. However they did not seem comfortable with that and instead, for all the following children, notes were taken immediately after the respective child had left the room.

On the second and third days of observations, in both Japan and Denmark, the children were more at ease. As they had seen me before, I was probably less of a stranger. This aspect facilitated communication and reduced the level of shyness for some of them.

The transcription work took place a few weeks after the last observation had taken place. This timing was chosen intentionally so as to give some distance from the notes and whatever preconceptions may have been formed during the observation days. It is also relevant to explain why this empirical phase is called data collection observations instead of interviews. Although questions were asked and to some extent a mini-interview was conducted, the whole purpose of the encounters was to see the devices in use by the children, so to observe what and how they interacted with tablets in general (hence the camera angle set-up). The methodological approach followed suggests that it is relevant to become familiar with the participants' words and meanings (Charmaz, 2014), an important aspect for the success of this study. Consecutively, I observed a round of children playing in groups with the intention of assessing some group tablet interactions and how the 'playing on a device' roles are defined within pairs and groups.

I filmed a total of 18 hours and 16 minutes of video with children in Denmark and Japan combined. Besides the observation video, I also collected

video of two hours and 15 minutes of conversation with parents and pedagogues in Denmark, plus around two hours of informal and unrecorded conversations with parents and pedagogues from Japan, where notes were taken after the conversations. These conversations could be described as loosely structured interviews; however, as they were not in the initial research plan, and were not my focus, I still consider them conversations.

4.4. Coding Experiences

In grounded theory, the data collected is organised through a coding process, which is the core thread linking the data collection and developing a theory to explain the data (Charmaz, 2014, p. 113). The data collection analysis guides both the literature review and fuels early writings that are revised throughout the process. These revised writings form the final set of theories that contribute to the field by expanding current theories and asking questions for future studies in related fields.

One of the key characteristics in grounded theory (Charmaz, 2014), together with the order of the study phases, is its coding process. The structure for this analysis leads towards a rich but condensed overview of large amounts of qualitative data. The coding process is divided into three areas: initial, focused and theoretical coding (Charmaz, 2014), all described in the following:

Initial coding refers to coding data as actions, staying close to the action and choosing words that reflect it. As this initial coding is based on recorded observations, one incident is compared with another to identify similarities and discrepancies, e.g., uses force when touching the screen; tries to interact with locked items; and interacts with arrow symbols to both play and navigate within an app.

Focused coding refers to weaving the initial codes into a more explicit phenomenon to 'determine the adequacy and conceptual strength of your initial codes' (Charmaz, 2014, p. 140), e.g., acquiring touch knowledge through interacting with the device; some images require decoding (lock symbol = not available), and children create their own game narrative by using arrow symbols to continue playing instead of following the game order.

Theoretical coding 'simply means applying a variety of analytic schemes to the data to enhance their abstraction' (Glaser, 2005 in Charmaz, 2014). Theoretical codes also help to make the analysis coherent and comprehensible (Charmaz, 2014, p. 151), e.g., hand knowledge; semiotic, vocabulary; and play experience.

I used this coding structure for the initial analytical process of the pilot study data. Following the initial coding, I identified focused codes as tentative categories so as to further develop and explore these codes in the next round of iterations.

All the video material captured during the observation sessions was watched several times and fully transcribed – both what was said and the actual play (how children interacted with the devices). The initial coding took place after all

the transcriptions were completed and reviewed multiple times. With the initial coding process completed, the relationship among the initial codes was identified, then the focused codes were generated, which provided the final data for the theoretical coding.

As much as an analysis process is set to be a structured and organised activity, making sense of the data, together with clustering and creating the categories and codes, tends to be a rather abstract and unstructured process. Although some of the actions observed appeared to be easily linked to one another, an additional set of clusters could appear depending on the discipline analysing the data. Due to my cross-disciplinary background, I could identify a range of values in the dataset, since some data aspects could cater for interaction design, play, digital literacy and phenomenology fields. However, depending on how I clustered them, they would gain a distinct focus. This clustering process was a huge challenge, and the way I dealt with it was to follow a disciplined structure, while allowing the data to overlap into more than one set of codes.

The data analysis process started with transcribing every single video by describing the actions that were occurring together with things children said during the session. Sometimes questions and my own comments emerged during this transcription process and were written down in the transcription next to the paragraph that provoked the thinking, e.g., 'He has clearly played with tablets before as he asks for the password, however when encountering a blank area, instead of swiping sideways to find other apps, he just taps the applications visible in the lower bar.'

As points emerged, I captured screenshots from the videos and added them to the transcription to illustrate the description. After each transcription, I listed all the apps that had been used. At the end of each transcription, I would write the main actions, together with the utterances of the children, into a file. The collection of these passages formed the first set of codes.

After many hours of attentive video transcription, it is not uncommon to miss seeing repetitive actions that could feed into valuable questions. Consequently, I tried to carry out just three hours of transcription at a time to avoid this problem as much as possible. By having a couple of hours' break in between, I was able to return to the data refreshed and aware of the material I was transcribing.

Throughout the process, I realised I also needed to code or define the hands' movements, as they informed some of the communication and intentions during the play. Besides, as the hands do most of the interacting actions while children play with tablets, I also needed to define these actions in order to have some consistency in the analysis. This focus on the hands led to a typology of hand interactions, presented in the following section.

4.5. The Context of the Hands

During the transcription period, another aspect of the data emerged: the role of hands in communicating as the centrepiece or the magic wand that brings the

screen alive. As when describing what children were doing on the interface, I needed a clear description of the actions they were performing. These ways of interacting with the device informed an initial typology of hands' actions. This typology can be of use to both those observing children's screen interaction and readers in the following chapters when sections of the data transcription are presented. A small glossary follows the hand typology as it provides as an additional aid during subsequent chapters.

The observed variety of actions aligned with differences in hand movements and intentions led me to classify the touch inputs observed into a preliminary hand typology, which I summarise in the following[1]:

- Hovering (Image 4.1):
  - Action: moving the hands or just one finger above the interface.
  - Suggested intention: still in doubt and exploring the possibilities, making a choice, deciding what to do.
- Tapping (Image 4.2):
  - Action: fast touch with one finger (or by chance with an arm or another hand).
  - Suggested intention: to play, the child had made a choice regarding an app, or a symbol and decided to interact with it.
- Swiping (Image 4.3):
  - Action: while touching, moving one finger across a small area of the screen.
  - Suggested intention: to enter the device, to browse on the device, to flick through pages in a book, to go forward inside an app.
- Dragging (holding; Image 4.4):
  - Action: tap and, without letting go of the contact interface, move the finger/hand across the screen.
  - Suggested intention: to move a character or icon around the interface, to move apps across the screens/areas of the device.
- Continuous tapping (Image 4.5):
  - Action: a series of short consecutively taps.
  - Suggested intention: to try to get an icon to respond (even in cases when it is not necessarily interactive), insistence.
- Force tapping (Image 4.6):
  - Action: tapping with pressure (can be related to using force when drawing on paper).
  - Suggested intention: to try to force an icon to respond, persistence.
- Long tapping (Image 4.7):
  - Action: tapping for a bit longer than a short tap (observed when either trying to choose something for the second time or trying a non-interactive symbol).

---

[1]An earlier version of this typology was introduced in the article by Fróes and Tosca (2016).

Image 4.1.   Hand Typology, Hovering – Moving the Hands or Just One Finger above the Interface.

Image 4.2.   Hand Typology, Tapping – Fast Touch with One Finger (or By Chance with an Arm or Another Hand).
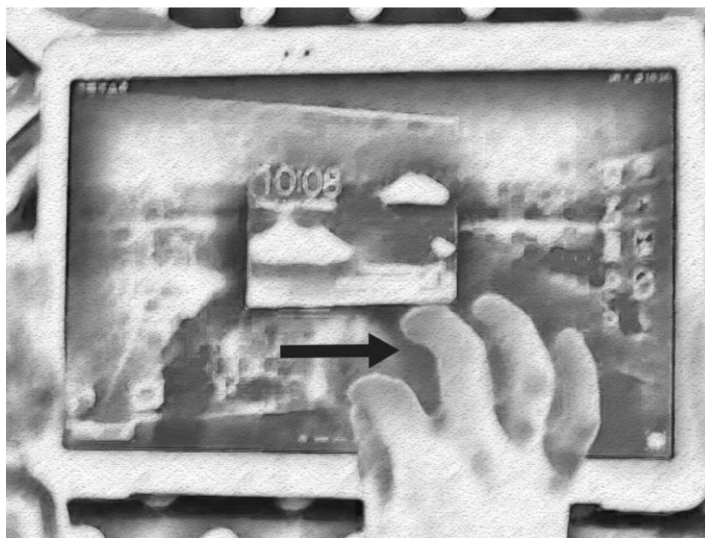
Image 4.3.   Hand Typology, Swiping – While Touching, Moving One Finger across a Small Area of the Screen.

Image 4.4.   Hand Typology, Dragging – Tap and, Without Letting Go of the Contact Interface, Move the Finger/Hand across the Screen.

- – Suggested intention: Also persistence, as if the device had not obeyed.
- Tilting (Image 4.8):
  - – Action: moving the device sideways, vertically or horizontally.
  - – Suggested intention: to control icons or characters within an app, e.g., to pour liquids, to drive, to make things fall, etc.
- Divergent dragging (Image 4.9):
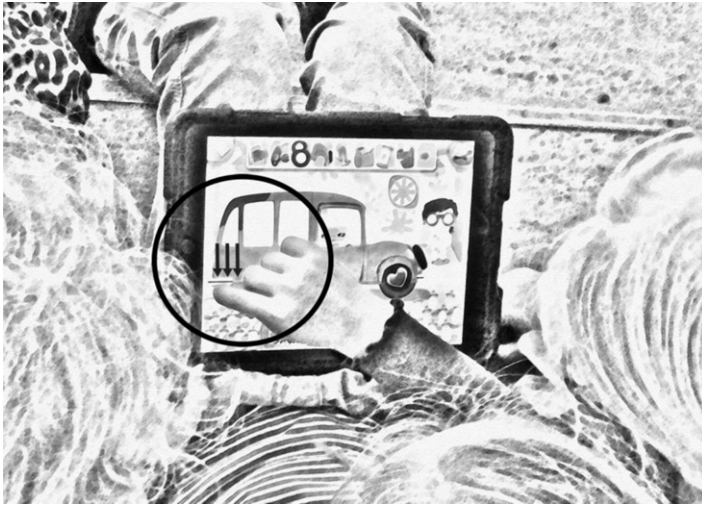 - – Action: moving two fingers in opposite directions.

Image 4.5.   Hand Typology, Continuous Tapping – A Series of Short Consecutively Taps.

Image 4.6.   Hand Typology, Force Tapping – Tapping with Pressure to Try to Force an Icon to Respond.

- – Suggested intention: to see things 'closer', zoom in.
- • Convergent dragging (Image 4.10):
  - – Action: moving two fingers towards each other.
  - – Suggested intention: to bring it back to its original size, zoom out. To try holding an object.

Image 4.7.   Hand Typology, Long Tapping – Tapping for a Bit Longer than a Short Tap (Observed When Either Trying to Choose Something for the Second Time or Trying a Non-interactive Symbol).
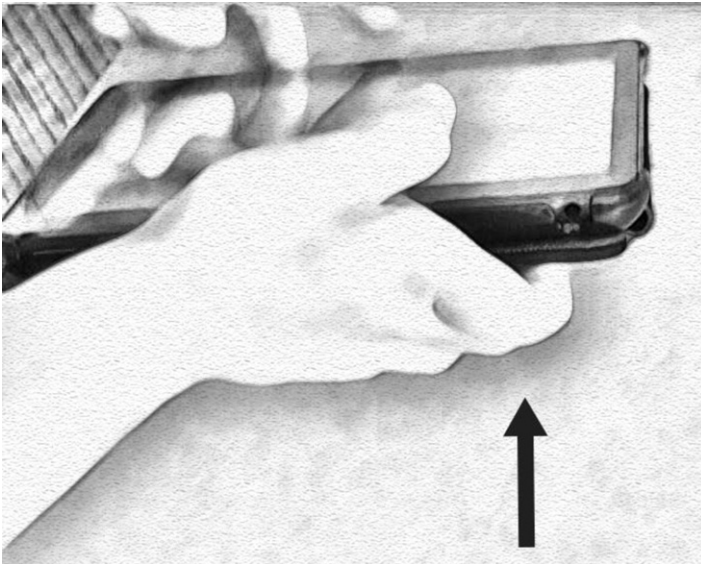

Image 4.8.   Hand Typology, Tilting – Moving the Device Sideways, Vertically or Horizontally.

- Simultaneous holding (Image 4.11):
  - Action: tapping and holding simultaneously with two fingers (on related picture index and thumb are used to try to rotate an object on the interface).
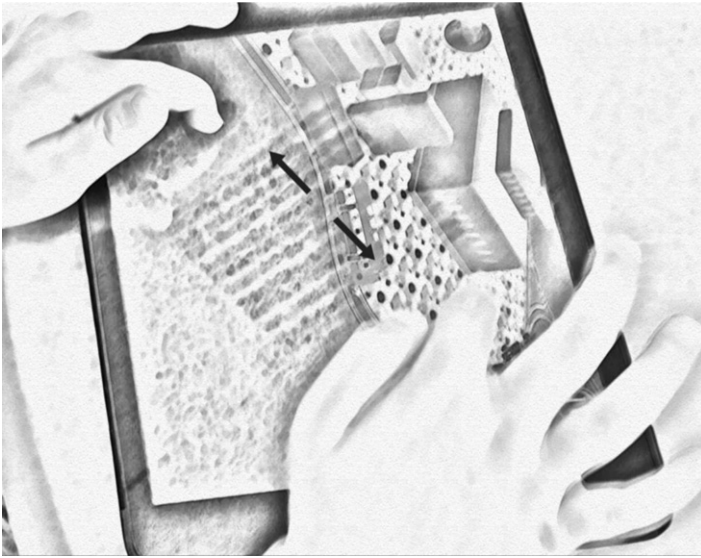
Image 4.9.   Hand Typology, Divergent Dragging – Moving Two Fingers in Opposite Directions to Zoom In.
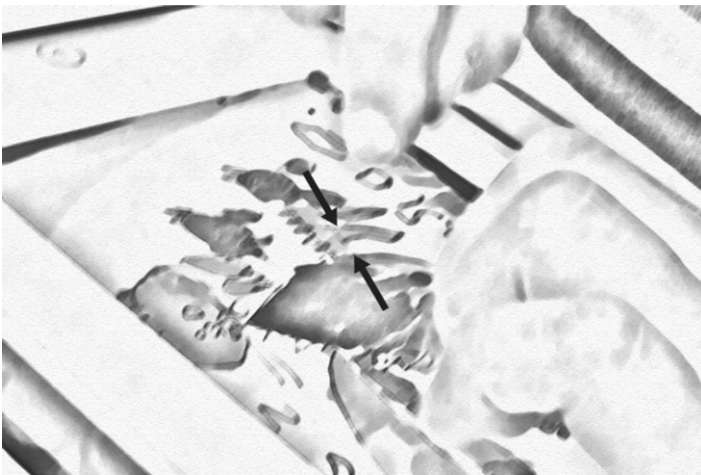

Image 4.10.   Hand Typology, Convergent Dragging – Moving Two Fingers towards Each Other to Zoom Out or Move an Object.

- – Suggested intention: to move the orientation of the space in the case of 3D environments.
- Reach (Image 4.12):
  - – Action: pointing closely as in tapping or 'touching' an icon.

Image 4.11.   Hand Typology, Simultaneous Holding – Index and Thumb Are
Used to Try to Rotate an Object on the Interface.

− Suggested intention: showing something, sometimes using words that indi-
cate physical distance despite device proximity.

Some of these terms, such as tapping and swiping, already belong to an
everyday vocabulary when referring to touchscreen interfaces. However, even
though some of them are associated with digital devices, they are not necessarily
defined beyond their precise physical actions.[2] The typology proposed here
defines some of the actions a bit further, and matches them to intentions of use.
For example, while playing a game where one needs to drag a boat across the
screen to save a drowning sailor, the dragging action was accompanied by the
child saying 'you have to take him there'. The actions identified in the analysis
and classified in the typology helped frame the hand language vocabulary, which
seems to have been learned through interacting with tablet devices.

---

[2]Crescenzi, Jewitt, and Price (2014) have presented a set of touch-based codes in their
research with nursery school children, aged 1.5−3 years, while doing finger painting
activities on iPads and paper. Merchant (2015) similarly presents a set of touch inter-
actions in research with young children, aged 14−22 months, when using story apps
on an iPad together with an adult. Despite identifying a couple of similar touch
behaviours, our research foci differ in both the age group as well as the type of ana-
lysis. For example, although the authors identify some of the same hand movements,
such as *tapping*, they do not associate that behaviour with any type of specific inten-
tion. Nevertheless, the studies are related as all three explore young children interact-
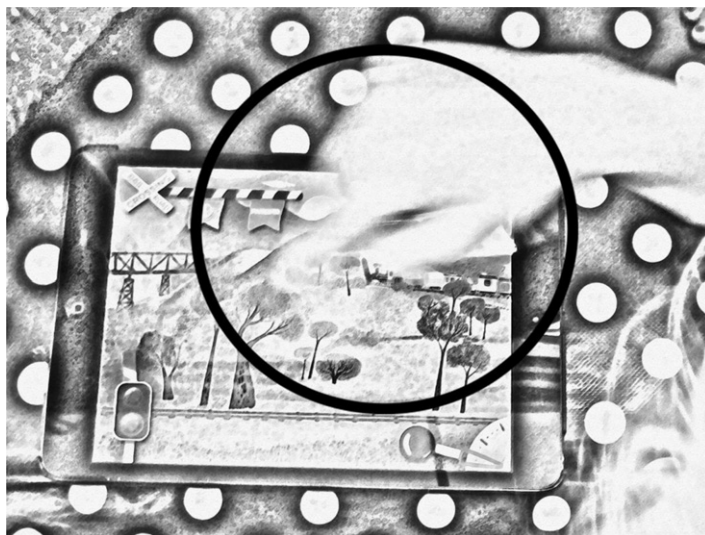ing with digital technologies (Crescenzi et al., 2014; Merchant, 2015b).

Image 4.12. Hand Typology, Reach – Pointing Closely as in Tapping or 'Touching' an Icon.

4.5.1. *A Slice of Data*

The following examples of the transcription and coding illustrate how I followed this coding process. These examples, one from Denmark and the other from Japan, are followed by a compacted version of the whole coding table.

First phase, Subject J:

> He looks continuously at the screen while trying to see where to tap. He then tries the star on the right top corner followed by the lock symbol in the centre of the screen. When tapping on the lock, it loads the next stages of the game that are not yet available (what signs and symbols are part of tablet semiotic vocabulary?).

> He keeps tapping on the locked images for some time. As he does not appear to grasp what should happen, I have to instruct him to tap on 'x' to close that window and also have to instruct him to choose the area that is 'open' and say that he can choose that (icons/symbols informing a narrative?).

Initial codes: trying to interact with non-interactive icons (locked images, stars); hand position in relation to activity, changes fingers, uses pressure on tap and repeats tapping on an icon when the device does not respond (Figure 4.1 and Figure 4.2).
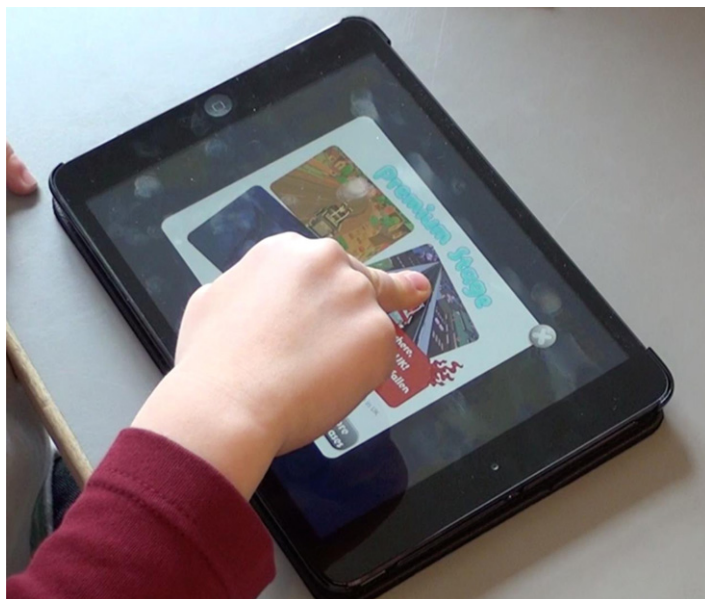
Figure 4.2.   Force-tapping on Locked Images.

First phase, Subject H:

> He watches the video holding his hand above the device, waiting for interaction and even taps on the screen while the animation is still going (Figure 4.3). (Hand position indicating intention/expectation?)

> As the truck starts to drive, he holds the device with both hands to control the truck through its physical position, brings the device down when the 'action' stops. Tries to interact (swipe) with the loading bar (signs and narratives) (Figure 4.4).

Initial codes: hand position in relation to the device (ready to act), taps on non-interactive icons, taps repeatedly on icons in order to get a response. He tries swiping on the loading bar (similar to the opening bar on the device's main screen).

4.5.2.   *Coding and Decoding Codes*

Following this initial process, I compiled a table including all the initial codes. I then linked the correlated combined quotes from the codes into groups where I summarised the actual transcriptions into main topics that formed the focused codes. Following the examples above, points such as trying to interact with locked items or trying to interact with loading images led to focused codes such as relation to iconography and images, and tablet symbolic knowledge. When combined with other focused codes, these aspects

Figure 4.3.   Tapping on Character (Trying to Interact) while Animation Is Running.

informed two theoretical codes: semiotic knowledge and play expectations (see Table 4.2).

The table of codes drafted after the pilot data analysis was revised and adjusted a number of times throughout my project to keep the data alive in the process. This process led to revisiting the codes and notes, building the final frame I have developed prior to writing this book. I present the final summary of coding and the set of theoretical codes in Table 4.2, as they are valuable input for the subsequent analysis chapter.

As demonstrated in Table 4.2, some theoretical codes appear more than once. Therefore, one theoretical code can span different aspects of tablet play. Despite the 'multi' aspect of some of these codes, in an attempt to further classify them, I have combined and summarised them in the following descriptions.

4.5.3.   Codes Overview

● Language: this code deals with ways of describing the play or the device, explaining if it is a game or an app, calling different areas on the device

Figure 4.4.   Trying to Interact with the Loading Bar.

different names, describing spaces such as here and there although both are on the tip of the finger; e.g., I have 'spillede', calling the areas or spaces as a page, window, app, game; also how children describe their play 'I have to take him there'.

- Semiotic knowledge: this code relates to learning the meaning of symbols such as locks, stars and arrows, as well as trying to interact with images that have a meaning, but were non-interactive; e.g., children tried using locked items (items that were not available to be used, either as they need to be bought or earned through playing), these items had a lock symbol on their side or they were faded out to indicate their non-available state.
- Play and design expectations: this code deals with how children engage with characters and images even when they are not interactive; e.g., children tapped on loading images, star icons and characters expecting them to respond, sometimes even tapping on them consecutively, showing that they expected these characters and symbols to be responsive.
- Cultural aspects: this code covers calling tablets iPads, calling all activities available on tablets games or just identifying them as something unique to digital interfaces, such as apps; e.g., in Denmark, it is common to use the

Table 4.2. Summary of Coding Process.

Initial Codes	Focused Codes	Theoretical Codes
Using different words for devices and types of play (*lege*, *spille* − *asobu*, *suru*; apps (*Appuri*, アプリ, *gemu* ゲーム games; computer, iPad − Samsung and iPad)	There is no common and defined language to refer to areas and symbols of the interface	Ways and words for describing/ language
Confusion about specific functions of the same symbol in distinct contexts and applications (i.e. arrow to move to the left, arrow to go backwards, × to close a 'layer' or to go back)	Diverse range of modes using various signs	Semiotic knowledge
Follow the 'designed play' when they have played with older siblings or parents	Learn and teach interactions and narratives (P2P)	
Adults and older siblings affect how the apps are played and what things are called		
Tapping and trying locked items	Symbol knowledge	
Tapping on 'loading' images	Relationship to iconography and images	(Play) expectations
Tapping on images that look like buttons	Expect responses and have some symbol knowledge	
(tablet = iPad)	Brand pervasiveness	Cultural aspects
Differentiate devices (iPad × computer)	Mediated learning and mediated play (cultural aspects)	
Games (DK) and apps (JP)		

Table 4.2. (*Continued*)

Initial Codes	Focused Codes	Theoretical Codes
Symbol incoherency	Interface acquaintance	Familiarity
Icons and symbols knowledge required for a smooth play experience		
One sign can mean many things, depending on the app	Symbolic language and meanings	
Instead of moving forward to finish the 'game', they simply returned to the previous screen and continued playing	Play narratives	Play experience
Not following the app narrative allows for infinite play		
When asked to use an app, do not recognise it as play	Agency	
Some children struggle with basic interactions	*Heterogeneous knowledge	Hand knowledge
Struggling with basic interactions (swipe, finding applications)	Different levels of knowledge and dexterity regarding the medium	
Requires practice	Touch	
The interactions are learned	Not intuitive	Literacies
Going from one application to the other just by pressing the physical button, apps remain open in the background	Media literacy	Privacy
Apps keep running in the background		
The applications are silos in themselves, no interconnection	Constraints	Design
	Limitations of the design	
	Distinction from regular toys	

Table 4.2. (*Continued*)

Initial Codes	Focused Codes	Theoretical Codes
Different environments on the same platform	Multiple possibilities	Engagement
Knowledge of app library, many games and play possibilities	Many digital toys, large library	
Look for children's apps, when they swipe through, they do not stay long on areas with other apps such as Google, word, etc. They swipe back to the area where the children's apps are located	Learn iconography	Tablet semiotics
Recognition of apps for their target group (children's apps)		
Few children chose the apps on the front, safari, clock, calendar)	Exploring environment	Exploration
	Getting acquainted	
Children who had never played struggled at first but caught up within the session	Fast physical learning curve	Hand knowledge
Apps don't necessarily 'interact with each other', can't do a drawing in one and paste it into another. Not many import, export options. Only if you save it as an image and the app is designed to access the photos	Limited range of cross-interaction	Design limitations
Different from computers, apps are not designed to necessarily cross-interact	Silos	

Table 4.2. (*Continued*)

Initial Codes	Focused Codes	Theoretical Codes
No problem going from one device to the other	Acceptance of screen as interactive interface	Semiotics + culture
		Notions of space
Go from one app to another	Acknowledge the variety within one device	
Flexibility within a device		
'I'm there' ways of describing and participating in the interface	Perceptions of location, foreground and background	
Sound feedback expected	Children are used to apps with various output and input modes (movement, sound, video, etc)	Multimodality
* Make their own design rather than following the suggested app design	Disrupt narratives	Agency
* Deduce and create their own rules for the games ('I think this is about matching the red dots')	Create their own rules/ appropriation	
* Initially look for known apps, but don't mind trying apps they do not know.	They are curious to see which apps are on the device, one device with many options	Familiarity
	Comfort	
* Having fun while playing (creating combinations on *Bad Piggies* to see what happens to the car and to the pig, feeding king pig to hear sounds and see expressions)	Curious to discover, explore and invent how to play	Curiosity
Children were curious to explore and try new things		Exploration

Table 4.2. (*Continued*)

Initial Codes	Focused Codes	Theoretical Codes
Moving apps around (doodling)	Becoming acquainted with the digital environment	Hand knowledge
Having fun while playing/ using the device is the main goal/reason for playing	Fun	Toy (object to play with)
LEGO apps were favoured compared to other apps	Recognised/known symbols	Familiarity
Recognition of brands and known apps	Brand pervasiveness	Branding aspect
Although there are physical parallels with some of the iPad activities (puzzle, drawing, watching videos), the dexterity required to use a tablet is only learned on similar digital touch interfaces (smartphones or other tablets)	Similar games, but unique tactile interaction and feedback	Hand knowledge
Unique ways of physical/ digital interaction		
Use both hands when using the device without necessarily always having a defined preference	Both hands can be equally valuable	
Hands are the primary communication tool when interacting	Communication, learning and playing through hands (intention, expectations)	
Use of force when device does not respond	Physical characteristics being applied in digital environments	

Table 4.2. (*Continued*)

Initial Codes	Focused Codes	Theoretical Codes
Change fingers if the device does not respond to the first finger	Logic	Problem-solving
Do not follow or wait for instructions, instead forward to actual active part, pause and 'assess' the interface and start trying some of the symbols/icons	Exploring and deducing the digital environment	
Every new interface is a new problem to be solved (instead of just tapping everywhere, there is an 'assessment' of the interface)		
Children-appropriate device features to create own games		Agency
Children do not seem to care if they 'win' or 'lose'	The goal is having fun	Fun
Playing = having fun, if an interface does not respond after a few trials, they might abandon this app and try another. However, often they go back to the 'failed' app to try again.	Very little expectation regarding game outcome, fun is more important	
(Skilled children) know about different narratives and different types of games	Knowledge of game narratives and symbolic meanings in digital environment	Familiarity
Know who is the 'bad guy' in firemen game (big fire ball)	(Tablet play literates) understand narratives and goals	Game literacy/ media literacy

Table 4.2. (*Continued*)

Initial Codes	Focused Codes	Theoretical Codes
Seem to enjoy using the tablet (some children did not want to stop playing)	Having fun while playing	Engagement
Fun as the main motivator		
'it's fun'		
Winning is not a goal		
A small number of children did not use all the 20 minutes and wanted to go and play outside instead (2 of them had their own device at home)	Preferences	Agency
I do this then nothing happens	Discovering and understanding the game and the play demands logical thinking (*I do this then this happens*	Problem-solving
I do this then this happens, therefore I move forward	Decoding game narratives	
I do this then nothing happens, therefore I try something else)		
When referring to the icon on an app they say 'I'	Self-referencing	Identity
Some children own a device, some use parents' or siblings' devices	Shared device	Familiarity, ownership
Watching TV programmes and playing the app (Ramasjan), Rasmus Klump cartoon and app, and talking to friends about some apps (Angry Birds).	Socialisation	
When playing together, create their own games and rules for the device	Personalisation and customisation of devices	

Table 4.2. (*Continued*)

Initial Codes	Focused Codes	Theoretical Codes
* When asking when they use it, they mentioned ('at home', 'all the time', while parent cooks, holidays, etc.)	Cultural exchange part of social bonding	Identity/digital narratives
'It's me' (while pointing at a character in the app)	Personal history/ experience/emotional bonding	
'I have to take them there', 'I have to go there'	Personal history, personal narrative, (future nostalgia?)	
Use the hands to prevent or invite the others to play together	Relationship to device (control)	Ownership
* Apps are rarely closed, only left open in the background and another one is chosen	Limited knowledge on background aspects of device use	Media literacy
Provide a lot of information back to apps – never close apps	Accessibility of data (by 3rd parties), privacy	
No knowledge about 'web' as a concept, or about self-exposure or *data* (due to age group)		
* Parents download apps and make purchases. However, children are not necessarily supervised while playing	Own experience, tablet companionship	Agency
	Little supervision on day-to-day playing	
	Mediation	
	Control	

term 'spil' (playing a game) for iPads, while in Japan they use mostly the term 'app' for the applications on the device. Children followed this cultural aspect accordingly, using the widespread term used in their culture to describe the programs/games/applications available on tablets. Another example within this topic refers to how the type of play converges through the tablet medium.

- Familiarity: this code refers to being acquainted with the digital interface, looking for known apps or brands, recognising narratives, symbols and characters; e.g., children look for known apps and if they do not encounter a known one, then they try a new one; children mention they know the brand or the character while choosing certain apps.

- Play experience: this code refers to ways of playing that do not necessarily follow the designed narrative, so using back arrows just to go back into the game and repeat the play; it also refers to aspects of agency as children apply their own tastes and logic to their playing (even if they go against the design of the activity/game); e.g., creating combinations based on their tastes, as in the LEGO Food app, and going back in the app instead of going forward and following the designed narrative.

- Hand knowledge: this code refers to ways of being physically acquainted with the interface of digital devices, knowing or not knowing how to use their hands to interact with the device, levels of pressure, types of movement and using both hands; e.g., trying different fingers if one finger 'fails' to open the app, showing their intentions through how they position and move their hands around the device.

- Literacies: this code refers to the ways of learning, both physical and digital aspects of tablets combined with not only alphabet and numbers but also to the wider range of modes of interaction, signs and symbols, narratives, characters and types of activities; e.g., both physical and digital interactions are learned through trial and error, from the physical use of a touch-sensitive screen to being able to fully explore the applications and possibilities within.

- Privacy: this code deals with the aspect that children hardly ever properly close the apps. Consequently, the apps keep open in the background, gathering and sending information of the device use; e.g., children go from one app to another by pressing the physical home button.

- Design and design limitations: this code refers to the different design aspects that were popularised and characterise mobile digital interfaces, such as mobile phones and tablets: ways how applications are acquired; modes of exchange between applications (or lack of); narratives and symbols commonly used in digital applications and devices; notions of space on the device and background/foreground aspects; e.g., what is created in one app cannot necessarily be used in another app. Apps continue to run in the background, as children do not necessarily close them.

- Engagement: this code deals with the possibilities of a device and the way children happily engage in exploring them; children find playing on digital

interfaces fun; e.g., when asked why or what they liked about tablets, children replied 'it's fun'.

- Tablet semiotics: this code refers to children's symbolic knowledge when using the device. This code complements the semiotics code although it relates mostly to the device interface as a whole and not necessarily to symbols used in apps; e.g., children were quick to identify children's apps, hardly choosing others and, if this occurred, rapidly extricated themselves from the app as they recognised the interface did not seem like something 'to play with', as in the case of a browser or a calendar app.
- Exploration: this code deals with how children were keen on exploring the device areas, assessing what was available. They also explore activities within the apps, e.g., tapping on side tabs, swiping through all the areas to see what was available and planned tapping on a range of icons to see what happened.
- Notions of space (digital): this code refers to both the notion of existing areas/regions in the device as well as a way of describing and participating in the narratives, e.g., saying 'I've been there' for having tried an app before.
- Multimodality: this code refers to all the modes (sound, voice, touch, movement and visual) afforded by tablet devices with which children engage while playing; e.g., besides the obvious touch and visual information required to interact, children also engage with sounds and body movements when exploring and playing on the device.
- Agency: this code refers to ways of appropriating the design and specific aspects related to tablet play, where children superimpose their own tastes and narratives, dismissing the tablet's and the apps' own design and goals; e.g., creating their own rules for certain activities and playing by those, such as in the case of the ice cream in the LEGO Food app.
- Curiosity: this code refers to children being interested in investigating possibilities and options within diverse interfaces; e.g., creating combinations on *Bad Piggies* to see what happens to the car and the pig.
- Toy: this code refers to how the device becomes a prop or a mediator of the play, either through the activities it carries or some of its physical and digital affordances, such as the reflection and the camera; e.g., playing with their own reflection and creating games with the camera functionality.
- Branding: this code refers to how devices are called by their brand and how brands are rapidly identified in the digital environments of apps (semiotics), e.g., children saying they were playing LEGO, calling both tablets iPads.
- Problem-solving: this code refers to the multimodal ways of interacting with the device by using logic and deduction; e.g., changing fingers if the device fails to respond to the first finger; assessing the interface before interacting with it; and verbalising notions of the game narrative.
- Fun: this code deals with how children find playing on tablets fun and this aspect is a clear motivator of the interaction; e.g., when asked what they liked about tablets, or why they liked playing on tablets, the reply was 'it's fun!'

- Game literacy: this code refers to children being knowledgeable and reflective about app/game narratives; e.g., knowing goals and how the games are played, so being able to identify the character that needs to be destroyed or to know that the amount of stars shown at the end of the game indicates how one played (just won, did very well, etc.).
- Identity/digital narratives: this code refers to children identifying with the characters and how the identification promotes a distinct engagement with the interface (emotional bonding). This identification also reflected how children describe digital spaces as being part of it; e.g., calling the character 'I' or pointing at characters saying 'it's me' or 'I have to take him there'.
- Ownership: this code relates to the identity code previously described. It refers to being able to customise a device, create spaces both digitally through dragging icons and also physically by ways of positioning their arms and hands, inviting others to join the play or preventing them from joining; e.g., hugging the device; positioning the device close to themselves or on a flat surface; and dragging icons around to organise them in a certain way.
- Media literacy: this code refers to the further control over the media in general that is yet to be acquired. As much as children can create, challenge and consume media content, they are a young group and do not necessarily acknowledge how all of that happens. Consequently, their use is not necessarily critical of the backstage, though it can be critical of types of content; e.g., children take pictures and acknowledge if they are good pictures or if it is a good or not so good game/app.

4.6.   Chapter Overview

Coding the data provided me with a clearer overview of all the observations, while allowing me to see the data in patterns. As I finished the first big round of the theoretical coding after both phases, it became clear that the code group was too vast to work with individually. Besides, many of the codes intersected. Furthermore, it also became evident that when the codes intersected, they gained distinct 'weights', helping shape more of a contribution to the field. Therefore, by following these intersections, they were further grouped into clusters that shaped the five categories leading to the taxonomy.

With the taxonomy at hand, I identified a number of key points that other scholars had written about extensively. Throughout this process, a number of questions were raised, from ways in which children interact and engage with the device to ways in which children communicate and learn with and about digital devices through play.

In the following chapter, the theoretical codes are further presented, analysed and discussed from within the taxonomy and intertwined with the relevant theories. The further analysis and discussion guide my theoretical contribution that follows.