- An interaction design project for children aged 8-12

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Abstract

The skill of cooking a meal from start to end is becoming a stressful every day activity in many homes in Denmark. Less and less parents focus on including their children in preparing dinner because they see it as a time-consuming activity that the child would rather be left out of. In this paper we examine the importance of teaching children how to cook from a young age as well as we investigate in why it can seem like such a big task for them to actually get started with cooking. The study focuses on how to develop an interactive tablet and smartphone application that provides children with an explorative platform for them to develop their cooking skills on. The detailed process of developing a simple tablet/smartphone application is explored in order to arrive at an understand of the challenges children face when cooking, how we encourage them to cook and how we facilitate them with the best possible options for this. By doing several explorative workshops and studying previous research about how children learn, understand and explore their creativity, we arrive at an understanding of the challenges, limits and benefits there would be with an application like this.

1. Introduction

There are several important reasons for why we should introduce children to the world of cooking at an early stage of their lives. Not only is it more likely that they will implement healthier food habits throughout their lives, but they are also more likely to try out new and different types of foods if they actively participate in preparing it. Other important skills that children can learn from cooking can be: Learning about kitchen safety (heat-, cutting –and sanitary-guidelines), learning basic math skills (counting, measuring) and to be encouraged to use their creativity.

So how come that not many children (in this case 8-12 year olds) in Denmark actually know how to cook? This project started out as a design project about children this age using collaborative media to share their own recipes. It was clear from the beginning, that a step back had to be made when it was realized that this age group does not have much experience with cooking and even what adults consider basic skills (e.g. measuring) is not yet logical to them. It very fast grew into a project about how we teach children about cooking in a way that is logical and simple to them. Having had three different explorative workshops, it was very obvious what the main problem areas –and thereby the research focus for this project – were.
1.1 Research focus and target group

The research focus for this project is what challenges children face, when cooking and how we can ease the process for them. Both in a way where they still feel interested in exploring cooking and in a way that encourages them to use their creativity during this process. The target group is Danish children aged 8-12. The research will also involve aspects on how children think and learn and how we can facilitate them with a tablet/smart phone application that supports these theories.

The reason for choosing a tablet/smart phone application is that children this age in Denmark most likely have access to a device like this. Many children have their own tablet/smartphone or their parents have. It is rapidly becoming a natural part of their everyday life and it is something that can easily be brought into the kitchen as a helping hand. It is small, easy for them to use and allows more opportunities for interacting than the regular cook book does.

Being good at cooking requires previous knowledge and it is something you cannot learn only by reading a book. It is a practical skill which requires that you “get your hands dirty” in order for you to learn it. This goes for anyone who is less experienced with cooking – if you have not tried it out, you will never know whether it works or not. The question then being, whether children have a different logic than adults, when it comes to cooking? Knowing how to prepare food also requires understanding and that you are not afraid of taking chances and being creative, but these skills are something that require previous knowledge/experiences which children this age obviously will lack.

This project is therefore a study in how children learn to cook and how we encourage creativity in a field where they are most likely beginners.

1.2 Research question(s)

➤ How can children be supported in learning how to cook with a tablet/smartphone application?

- How can we make an application, where the difficulties children have while cooking, are replaced by a simplified cooking language they can relate to?
- How do we provide a platform where children feel safe exploring cooking and being creative?
- How can we create an interactive, intuitive and simple cooking experience for children aged 8-12?
2. Methodology

When doing interaction design for kids in general it is important to keep in mind that we make sure that we design something which not only we, as designers, find interesting. But also something that the children we are designing for will actually be interested in.

Designing for children in general can be a job very different from designing for adults and the challenges with collecting data can seem big, when dealing with children who might very easily lose interest and who need more guidance. The fact is, that it is often much more difficult to get children to waste time on something that isn’t immediately interesting or entertaining – unless they have to.

2.1 Qualitative research method

For this project, a qualitative research method was used with a focus on the following specified methods:

**Ethnographic observations** were first part of collecting data from a specific social setting that was otherwise quite unknown: How children explore cooking.

It was important to hand over the “driving seat” to the children and let them take charge of the situation in order to promote their ways of doing things and not ours. Of course, some pre-defined settings were made in order to get them cooking, but this was necessary in order to observe a situation like this. It was not possible to walk in to a “natural” situation where children were cooking on their own. Therefore, a small group was gathered at a specific time and place. This might take away some of the authentication that would have been there if it had been a random afternoon at a friend’s house, but nevertheless, it provided a good foundation for observing the children’s ways of behaving in a kitchen and to figure out what their strengths and weaknesses were when cooking.

**Qualitative interviewing** was the most natural way of narrowing down the rather abstract observations to try and make sense of what had just happened. The interviews were semi-structured and very open-ended and more like conversations with a specific theme/subject that worked as the main focus. The children got the chance to verbalize some of the issues they found challenging when cooking, but the conversation also developed into a more general talk about whether they liked to cook in general, if their parents let them cook at home and what type of food they liked.

Based on the knowledge gained from the observations and interviews, the first workshop was arranged to explore some of the findings regarding the challenges children face when cooking, by doing small tests on measuring, tasting, explaining a recipe and identifying ingredients in certain meals. The findings from this workshop then lead to the conceptual and theoretical work. The theoretical work -how children learn, how
they unfold their creativity, their relationship with parents as a part of cooking at home and research about children’s use of tablets/smartphones – played a part in determining the first draft for a concept.

This was then tried out in a new workshop/observation session where the children had to do cooking again, but with a different approach than earlier on. The findings from all of these workshops, observations, interviews and theory, have been the groundings for analyzing and discussing the gathered data. The data has then lead to the final concept and prototype which afterwards lead to the user test/validation of the concept. (Bryman, A., Bell, E. 2007)

When working with qualitative research methods, one thing to keep in mind, is the fact that the group of people participating in workshops and qualitative interviews, are often (and especially in this case) much smaller than the amount of people you can reach with quantitative research methods such as surveys and polls. This will of course also affect the diversity in the observations and answers provided from the research method chosen in this case. But even so, this method is still to prefer given the fact that it is the children’s opinions and views that we are interested in. It is important to be able to put these answers and views into a context instead of having a lot of data where you might not understand the actual context of the answers provided.

It was important to the scope of the project focus on the meaning of the data and not on the quantity that a survey or poll would have provided. In some situations it is of course very useful to gather reliable and structured data, but for this particular project is has been necessary to understand the process that takes place when children are cooking. It was not sufficient to understand the answers they might give to specific questions concerning cooking.

For this design project, in particular, there might be –due to the few participants – a risk of generalizing the data gathered based on the children who participated in these workshops and interviews. To prevent that as much as possible, relevant theory on children’s learning and understanding from other researchers, has also been taken into account when developing the final concept.
2.2 Research through Design

Research through design (RtD) is, according to Zimmerman (Zimmerman, J. et.al., 2010) “A research approach that employs method and processes from design practice as a legitimate method of inquiry”. Löwgren (Löwgren, J. 2007) argues that RtD can lead to new knowledge that can travel to other design situations, claiming that one of the most important elements of design ability is to build a repertoire of examples that can be used to issue ideas in other projects. He argues that “On a general level, I would suggest that scientific criteria are about novelty, relevance, groundedness, and criticizability.” (Löwgren, J. 2007). Thereby saying that RtD is a relevant and important way of gaining scientific knowledge that can also be useful to other designers in the future - as long as it fulfills these criteria. The problem with RtD, according to Löwgren, that “interaction design research seems to be caught in the tension between the scientific norms of informatics/hci and the aim to make design a part of the knowledge-construction process under more general scientific criteria” (Löwgren, J., 2007).

Obrenović (Obrenovic, Z., 2011) describes RtD as a method that can provide knowledge that would not otherwise have been found. If done in the right way, RtD can actually compliment other design methods.

When talking about the RtD process, Gaver (Gaver, W., 2012) defines it as a very open process, where there is always room for changing things along the way. Not like more scientific design research, where you work in a more “problem-solving” process and where the experiment will be seen as wrongly executed if the results are not as expected. This project has had a very open process and has changed a lot during. It has not been focusing on solving a certain problem, but more on the process of reaching an understanding of the area and the users. It would seem, that there is a shared understanding that RtD is a more open process compared to normal design research processes. Löwgren discusses how a closed procedure might make sense in some cases, but for interaction design, this can often feel very unnatural since a digital product has a certain feel in use which cannot exclusively be described in text. The same goes for this project, where the finished prototype will be an application for tablets and smartphones which cannot be explained and tested without feeling it in use. The finished prototype will be very open-ended and the knowledge gained from this project can be important for similar future design projects.

Obrenovic describes design-based research as something that requires an alternative view on the relationship between theory and practice in comparison with other research methods. Neither theory nor practice is considered to be more primary than the other in design based research. “Design activity is often driven by existing theories, and at the same time it can provide a constructive environment for theory development. Design process can often reveal theoretical inconsistencies more effectively than analytical
processes.” (Obrenovic, Z., 2011). He also concludes that RtD can deliver knowledge products that usually could not have been produced by theoretical analysis or by other empirical approaches. This could – in the end – help us to actually understand the problem better and thereby generate better research questions. In this case, nor the research questions or the actual prototype would have existed without the explorative workshops and the children’s view on cooking. Much can be found in literature and there are many relevant theories that can be applicable in a project like this, but without the design activity the project would only be based on words and not actions.

3. Theoretical Grounding: Related literature/research

Not much research has been done within this exact research area so in order to try and get an understanding of it, we must take a step back and have a look at which fields of research we are touching upon. In the following we will take a general look at how children learn, how to deal with children’s hidden creativity, how cooking affects children and the relationship with their parents and how children use tablets and smartphones.

3.1 How children learn

When looking for research on how children learn, it is of course important to keep in mind, that all children are different and that some ways of learning might work better for one child than for the other. When this is said, there has been made quite a lot of research on how children learn and which practices work better for them when learning. In the following we will take a general look at previous research on the subject.

It is not new knowledge that we all learn best by trying things out. The more often you have tried something the easier it gets. This goes for adults as well as for children.

When looking into the learning process of children, it has been found that active involvement is one of the most important aspects of learning. In the booklet “How Children Learn” (Vosniadou, S., 2001), provided by UNESCO and The International Academy of Education, Stella Vosniadou, provides some general guidelines for educational practices of learning. She goes through different factors that have great importance for the way we provide the best possible settings for learning.

One of the first things mentioned is “Active involvement”. This refers to research which shows that, in order for children to learn, they must pay attention, observe, memorize, understand and set goals and that cannot be expected “…without the active involvement and engagement of the learner.” (P Vosniadou, S., 2001, page 8). It is obvious that by giving them hands-on activities, the active involvement occurs. Also facets like allowing them to make their own decisions in order for them to take control in their own
learning process are mentioned as important aspects of active involvement.

Furthermore she touches upon “Social participation” as a key factor for children’s learning process. The psychologist Lev Vygotsky is mentioned for claiming that “…The way children learn is by internalizing the activities, habits, vocabulary and ideas of the members of the community in which they grew up.” (Vosniadou, S., 2001) hereby also referring to the way parents interact with their children from an early stage.

Putting new learning into a context that we can refer to is also extremely relevant for learning at all stages of life, which is discussed in the section “Meaningful activities”. It suggests that by situating classroom activities in an authentic context, the knowledge they gain will seem more relevant for them. An example could be to learn basic math by measuring the ingredients of a specific meal (2 tomatoes, 4 cups of water, ½ an onion etc.). Children this age know what food is and that it has to be prepared in one way or another before eating it, which is something anyone can relate to.

One of the more challenging aspects of learning is the fact that we have to relate new information to prior knowledge in order to understand it. Research findings show that relating prior knowledge to new information is crucial for children to learn: “It is not possible for someone to understand, remember or learn something that is completely unfamiliar.” (Vosniadou, S., 2001, page 12). This is also central in order to employ effective and flexible strategies to help understand, memorize and solve problems, which is something children do from an early age in many contexts of their everyday life.

3.2 Age based learning

Children are developing new skills and new knowledge every day, but there are specific psychological theories that are more particular in determining at what stages of life children develop which skills. In this project the target group is children aged 8-12 years old, so the following section will be a short description of the specific understandings and skills that children have/develop at this stage of their lives.

In the early phase of this age group’s life, the child will begin to think logically and to put things into a context. They are able to categorize things into “boxes”, e.g. that apples, pears and bananas are all different types of fruit and that spoons, pots and pans are a part of kitchen equipment, as well as they are starting to learn the context of different concepts and units such as weight, width, height and volume. In the book “Psykologihåndbogen” (Bryrup, M. et.al., 1996, page 76) the understanding of this is illustrated with the example that children this age understand how the amount of water will stay the same if you pour
it from a small glass into a bigger one - the way they think becomes less and less dependent of their immediate impressions.
They also develop an understanding of time and space and can distinguish between various distances. Their ability to concentrate also develops in this phase of their life which is important in order for them to learn. They now understand that the knowledge they gain from one experience can be used for different situations further on. In general their thinking becomes more independent in here-and-now situation and they are able to think back on a certain situation to understand a current one. They are also able to envision a situation before it happens and to logically imagine what they could do with things/objects/ingredients that they have in front of them. This ability is a key factor in creative thinking. The conditions for this logical and prospective thinking is, that it needs to be based in something that is concrete and present for their perception leading back to the theory that in order to learn new things, we need to have prior knowledge to be able to put things into context.
In the last phase of this age, the child becomes more and more abstract thinking.

The developmental psychologist, Erik Erikson, describes this phase of the child’s life as a stage where the foundation is laid for their self-esteem. He describes that children who are intellectually stimulated and learn to do their best, will develop a feeling of competence. It is crucial for children to experience success and satisfaction in the learning process in order for them not to develop low self-esteem that could potentially haunt them for the rest of their life. It is extremely important that the adults in a child’s life accept them and take them seriously in their opinions and the choices they make. (Erikson, E.: [http://www.terapeut.net/artikler/menskadf/erikson/erikson.htm](http://www.terapeut.net/artikler/menskadf/erikson/erikson.htm))

### 3.3 How to unravel children’s creativity

Imagination is an important condition for creative thinking and hereby creative expression since we need imagination in order for us to transfer creative thinking into practices. Imagination is a physical process based on the diverse inputs and observations that the child gets through life and the more experiences they gain, the more they are able to imagine and thereby creating. (Rasmussen, K.; Broström, S., 1981, page 96) Creativity is shown when the child in a process of reaching certain goals shows great imagination, combines knowledge and understanding, associates methods and skills in new, inventive ways to create meaning of something or creates a specific product. A child, who manages to solve a creative task like this, will experience joy, a better self-esteem of having a finished product and develops a desire to explore new things. Creativity is necessary because the process will strengthen the child’s personal development. An example of a creative task, could be when a child has cooked a meal for their family (either by themselves or with parents) Here they have played an active part in creating it and they will receive positive feedback.
and recognition for its creative skills. This will support the child’s desire to try out cooking again (Rasmussen, K.; Broström, S., 1981, page 92-97).

When this is established, we can move on to take a look at how we can unravel this creativity in children. Alessandro Antonietti, discusses this in the paper “Unlocking Creativity” (Antonietti, A., 1997) where he states that “Under the right conditions, all children can become more creative thinkers and problem solvers” it is only a question of having the right strategies to become so. Some of the techniques for unlocking this creativity are to accept and respect the child’s own beliefs and tendencies toward creative thinking and support these evolving competences. To help them select, execute and monitor the strategy needed. To encourage them to take risks and support them when they pursue new approaches instead of relying on familiar ones. He also claims that one of the key factors in a creative process is to teach the child that it is OK to be anxious or uncertain in situations since these obstacles are necessary for them to develop creative approaches. He advices to give children “a helping hand”, but Instead of giving exact instructions about a certain process, we should describe the strategy behind it and exemplify how to apply it in different situations. This will make then more likely to transfer a strategy from one setting to another.

3.4 Including children in family cooking

Many things have has changed in our society during the past 60-70 years and the way children learn has been influenced by this change. The gender roles were very different then and in the 1950’s most women were stay-at-home moms who took care of the children before and after school while the men were working. In Scandinavia today we have day care-centers, kindergartens, after school places and so on, where children spend a lot of their free time because both parents are working and thereby have less time. This means that the amount of time which mothers spend together with their children is much more limited than it used to be. For most parents, cooking can easily become a stressful part of their everyday life and something they spend less and less time on. Actually including the children in the cooking process – that might already be something they are rushing through – can seem time consuming and therefore it is easier just to do it themselves. From an article in the Danish newspaper, Politiken, it is stated that only one out of ten children has a fixed cooking-day at home and every fifth parent admits that they would rather do the cooking without having the children intervene. The data comes from a survey done among 1.110 people on children’s role in home cooking. (Politiken: [http://politiken.dk/mad/madnyt/ECE1448596/danske-boern-laejer-ikke-at-lave-mad/](http://politiken.dk/mad/madnyt/ECE1448596/danske-boern-laejer-ikke-at-lave-mad/)).
Looking back 60 years, most girls were taught how to cook by their mothers as an important part of their home education while boys were expected to learn other practical things that were regarded necessary for a boy to know at the time. As mentioned, very much has changed since then and on the plus side, cooking is now something that is seen as equally important for both men and women to learn. But unfortunately reality is that less and less children are introduced to cooking by their parents and thereby they might not even be able to boil an egg when they grow up. They never learn to cook anything and are used to their parents serving them a meal every evening. Thus they might even adopt their parent’s view on cooking as a stressful thing that just needs to be done in order for the family to get something to eat. Not only good food habits will come from promoting home cooking together with children at an early stage in their life, but also the relationship between children and parents can be enhanced by spending time together on cooking activities. In their book “En nødvendig pædagogik”, Keld Rasmussen and Stig Broström mention, that interaction between parents and children is not as significant as it used to be. Not because parents want it to be like that, but because of a stressing day to day life where work and practical things at home take up a lot of time. This will result in children who are more isolated from basic interaction with the adults surrounding them. (Rasmussen, K.; Broström, S., 1981) This could point towards involving children in some of the practical work that takes up all this time – e.g. cooking.

A research done on what family cooking means to the children even shows that being able to cook in their teens will help them becoming more independent individuals later on. The researchers actually suggest this as a better motivation for why parent’s should include children and young people in cooking at home instead of the traditional reasons of health and nutrition (Simmons, D.; Chapman, G.E., 2012).

3.5 Children and tablets/smartphones

In a report from Danmarks Statistik (Statistics, Denmark) from 2012, made to determine the Danish population’s use of IT, it is stated that nearly 99 pct. of households with children have access to a computer and to internet. The number of families where smart phones are present in the households, were in 2012 55 pct. (27 pct. in 2011) and for tablets the number was 19 pct. In 2012 and only 9 pct. In 2011 – more than a doubling within a year. A similar report from 2013 has not yet been conducted, but the numbers here indicate that smartphones and tablets probably will be present in most Danish households within the next couple of years (Danmarks Statistik: http://www.dst.dk/pukora/epub/upload/17443/itanv.pdf ). For the past few years tablets have grown bigger within the field of learning materials and they are becoming more and more common in education settings. They are interactive, easy to use for most children, small and easy to carry around and can – to a certain extend- replace some adult guidance which means they can be
timesaving in many situations.

### 3.6 Theoretical grounding conclusion

To sum up the past few sections of theoretical background knowledge, it is fair to say, the children learn in many different ways depending on their age, gender, individuality and so on. But to generalize a little bit we can see from the research presented above, that there are clear signs that point in the direction that some generalizations can be made when looking at these children as a whole group. Active participation as well as involving them in decisions and to encourage them to practical doing is a good and almost bulletproofed way of learning. This also leads to the fact that, the more previous knowledge they have of something, the easier it gets for them to understand and learn about it. Putting things in context is also important for children in order for them to relate to it which is something they really start doing at the beginning of this age (8-12) as well as they begin to categorize things and become less dependent on immediate impressions. To be a good chef, imagination and creativity is needed and research shows that these skills are something we, as adults/designers, can help encourage at children this age. First of all, it is crucial that the child’s own belief is accepted and that we – instead of making their decisions for them – merely offer them a helping hand when they have to make decisions. It is equally crucial that we encourage them to take risks and support new approaches. Something that can easily start at home, in the kitchen, making family dinner which will both provide stressful parents with a very much needed helping hand and at the same time be beneficial to the children due to the social time spend together with parents/siblings.

### 4. Analytical grounding: Related design examples

Even though there is not much research done about children and cooking, there are still a lot of initiatives on how to get kids cooking. In the following, we will take a look at related design examples. There are a few interesting examples that should be mentioned here. The first one is a cooking application for children called “Big fork, little fork”. This application is a collection of easy recipes made for children and their parents to cook together. It provides video guides, nutritional information and safety tips, shopping lists, games and even a special section for picky eaters (Itunes: https://itunes.apple.com/us/app/big-fork-little-fork/id379783460?mt=8&ign-mpt=uo%3D4 ) (Image 1).

This application seems to have it all for teaching young children how to cook and it provides very good options for teaching them all the little tips and trick you need to know in order to complete a recipe. The recipes are simpler and well-explained versions of normal (adult)recipes and there are hundreds and hundreds to choose from. In general there are lots of options in this app and for some children, it might be
a bit overwhelming. Their video demonstration (http://www.kraftrecipes.com/media/blfl.aspx) shows this quite well and by the end you feel a little bit lost from all these possibilities. Even so, this application probably provides a good foundation for parents who want to cook with their children, but it does lack any possibility for the child to actually contribute to the final results. It should be mentioned that this app is not available in Denmark or in Danish and it has not been possible to test a working version with Danish children.

A Danish cooking application with a special focus on teaching children how to cook is the “GoCook” app from FDB (image 2) which is made with the intention of encouraging children to learn how to cook. The concept is almost the same as the concept from “Big Fork Little Fork” (without the games) and the main focus is on providing pedagogical pre-defined recipes as well as to offer short video clips that can help teach the children various cooking skills. Again there seems to be a lack of options for the children to make any decisions themselves or to influence any of the recipes (itunes: https://itunes.apple.com/dk/app/gocook/id561394631?mt=8).

Other projects that involve children and cooking, but not necessarily via tablet or smartphone applications, are projects such as cooking classes for the entire family, a project in Copenhagen where kindergartens include the kids in the daily cooking and multiple websites that offers child-friendly recipes in Danish. In general, there are many options if the goal is to find easy step-by-step recipes aimed at children. But so far, there is nothing (from what have been found during this project) where children are actually actively participating in creating the content.
5. Empirical grounding: Workshop process and findings

Workshop 1

Four boys, all nine years old. One adult present to lead and document the workshop.

The workshop was about exploring the children’s interest in cooking. What are their general capabilities and preferences and how much do they actually know about it?

The boys were divided into two groups of 2 in each in order to avoid too much chaos and to give everyone a fair chance at trying out the different tasks involved. One group did main course, the other group did the desert.

The first thing they needed to do was to sit down and decide what they wanted to cook. The goal was to stay as much out of the decision-making possible. It turned out that they did not completely grasp the fact that it had to be something they knew how to cook. It was very difficult for them to understand that it should not just be what they liked the most: Spaghetti with meat balls, lasagna, pizza, cake, pot roast etc. were the first suggestions that came up.

Early on it was quite clear that it was very difficult for them to come up with something on their own, so a few cook books were provided for them to look in. It was clear to see that the main course-group was definitely more into the challenge than the dessert-group was.

In the end, the two groups decided upon: Spaghetti with homemade pesto and an “ice cream cake”.

The groceries were bought without the children’s help.

The workshop was done in in two rounds; first one group made the main course and served it for the others for lunch. There were a lot of talking about cooking and food before the other group started making the dessert which was also followed by a discussion.

The pasta-group was more enthusiastic about the whole workshop. They took a long time going over what they wanted to cook and how to cook it. They wrote down a recipe and drew a sketch of the finished meal. One of them even claimed that he was very into cooking and wanted to be a chef when he gets older. He also had a weekly cooking day at home (when his parents didn’t forget about it) and had a good general knowledge about the ingredients. The other one was also very interested and also sometimes cooked at home.
The desert group was not as interested as the first group. When asked if they liked to cook, they both said no. But they also said that they never cooked at home with their parents. One of them told that he bakes bread and cakes with his mom once in a while and he likes that.

The boys in this group really had to be kept focused in order to finish their cake. They kept wandering off to see TV or to look at their smartphones. All in all, they did not have much interest in the workshop.
Along the way, the boys were asked a few questions and the conclusion from this workshop is, that the more they are interested in cooking, the easier it is to hold their attention.

Other interesting things the boys mentioned, were all the things they find difficult when cooking: Two of them said that measuring was the most difficult part of cooking and the other two mentioned that knowing when you should do what and for how long you should cook things, was the most challenging thing for them. Knowing what ingredients are good together is also difficult since they worry a lot that they do something wrong. Also, they really worry about putting exact measures in. They counted all the basil leaves and almonds that had to go into the pesto to make sure it was exactly what the recipe said.

In general it seems that their knowledge of cooking is not too big at this age and it very much depends on their interest in it.

**Evaluation of workshop 1**

From the explorative first workshop where the children were cooking by themselves, some big issues started to show: Measuring, timing, knowledge about cooking and making decisions by themselves seemed to be the areas that were most difficult for them. With this knowledge it seemed important to investigate a bit more in these particular problem areas.

The next workshop was therefore designed with this in mind and the main purpose was to explore these areas a bit more.

**5.2 Workshop 2**

One boy, nine years old. One girl, eleven years old. One adult present to lead and document workshop.

For the second workshop, the focus was still on exploring children’s knowledge about cooking and to look more into the way they think about it.

Four different exercises were carried out in the same way with both of the kids.
1. Taste test

For this exercise, the kids had to taste different food without seeing it beforehand. This was done by blind folding them and handing them the food without them touching it with their hand. They were allowed to take as much time they wanted to give their answer. This was done to try and investigate in how many different tastes they know and how much they actually taste with their eyes. It was clear that this test could have benefited from using ingredients that were a bit more unfamiliar to them. Since the taste test was done in one of the children’s house (with the other one being a frequent guest), all the different types of food seemed to be recognizable for them and that might have made it easier for them to give the correct answers.

They both did quite well and the troubles they had where very similar. Out of ten, the boy had 1 wrong and the girl 2. They both struggled with differentiating between the different types of nuts and the banana also caused confusion because it was shaped like a square.

2. Audio-recording

This exercise was meant to show how they explain themselves to friends and to take a look at their logic when it comes to cooking. They were both asked to imagine that they had to explain a friend how to make a dish of their own choice. It was recorded into a phone. This turned out to be quite difficult for them both and especially the boy struggled with explaining how to cook “Spaghetti Bolognaise”. It seemed like it made a lot of sense in his mind and he had a clear structure for the explanation of his recipe, though it would not have been a very eatable final product if someone would have followed it a 100%. The girl was a bit clearer about structuring her recipe (pizza), but did not know how to make the dough and suggested to buy a finished one. With a pizza it is, in general, easier to recognize the different ingredients, cause they are all visible at the final result, where it can be difficult to distinguish all the ingredients in spaghetti bolognaise. This could also explain the logic and structure being used to explain that recipe.
3. Drag and drop ingredients into a recipe

This exercise was about exploring how much they know about the different ingredients in simple, recognizable recipes. They were presented to two different “titles”: Spaghetti bolognaise and Tomato soup.

Image 10 and 11: Drag and drop ingredients, 2nd workshop

There were different ingredients to choose from on the right side of the paper and I asked them to drag and drop the ingredients that they thought were in both recipes – one at a time (result, img. y)

It was quite clear to see that they had more knowledge about the first dish and therefore knew more about the ingredients. It is something they both had as one of their favorite meals and they said that they get that more often than tomato soup. In the tomato soup they only dragged in what they can see with their eyes when they are served this once in a while; tomatoes, onions and pasta. No salt, no spices.

4. Measurements

This exercise was carried out in order to see if the predictions about measurements being one of the most difficult parts of cooking, were true.

They were given a list with the shortenings for the following measurements:

- Liters (l)
- Deciliters (dl)
- Milliliters (ml)
- Gram (g)
- Kilos (kg)

Then they were asked questions that were aimed at figuring out how much they knew about measuring in general. It was very easy for them to point out what each shortening stood for and they got all of them right. Knowing how much each measurement was or what was more/less than the other, was far more challenging for them. In fact, both kids got almost all of them completely wrong and one of the only things they were both certain on, was that one liter is more than one deciliter. But none of them knew how much
more. The boy suggested that a 100 dl was equal to one liter and the girl suggested that 2 deciliters was the same as one liter. The same confusion was present when asked about gram vs. kilos even though the boy was right about 1000 kg being equal to 1 ton. (Image 12)

In the end of this task, they were asked to find a kitchen scale and weigh off 100 grams of flour. This challenge also turned out to cause a lot of confusion. They both knew how to turn the scale on, but when it came to the actual weighing, both of them needed help to find a bowl.

The mistake they both made was to turn off the scale, place the bowl and then pour the flour into it. When the scale hit 100g they stopped, even though it was mentioned, when they started, that the bowl already weighed 80g. That meant that they actually only had 20g of flour. This really indicated the lack of knowledge about how much something weighs or how much space it takes up, but it also revealed exactly how little skepticism they have towards kitchen machines. On the other hand, they were very careful when weighing the 100g and if the scale said 101g, they would remove just enough flour to make it say 100g exactly.

**Evaluation on workshop 2:**

From this workshop, it became clearer what the exact problems actually were. Measuring seems to be a more challenging thing than predicted. The children seem to have their own logic when it comes to these measurements, but they would never be able to follow a regular recipe based on this logic.

Knowing what ingredients go in a specific recipe also seemed to be a big issue for them. It is logic for them, that what they can see in a dish is what is in it. Unless they have some previous knowledge about that specific type of food, in which case they are able to identify more ingredients than what they can see from looking at it.

The third workshop was designed with these factors in mind as well as to test out the basic ideas behind the concept of simplified cooking where the only measurement tool was an ordinary table spoon.
5.3 Workshop 3

Simplified cooking, one boy 9, one girl, 10. One adult present to lead and document the workshop.

The children were handed a cookie recipe that had been adapted to the new way of measuring the ingredients: using only a tablespoon. Furthermore, the recipe also told them to come up with a filling for the cookies – no help provided.

They started finding all the ingredients, a tablespoon, a bowl and a hand mixer. It seemed pretty clear for them what to do and as soon as they realized that they were only supposed to use that one spoon for measuring, they really got it. The interesting thing was, that to begin with, they did not even look at the recipe, but turned straight to the adult and expected the instructions to come from there. They had to be told to read the recipe before they even thought about it. When asked what the first thing they needed to find was, one of them suggested a kitchen scale – again without looking at the recipe. It was very clear that they are not used to reading a recipe because they do not expect themselves to understand it.

It was pretty easy to convince them to read the recipe though and when they first did – and realized that everything was measured in tablespoons – they understood it immediately and they very fast became confident with using the spoon for measuring without thinking about the amount they put on the spoon. It was easy for them to pour everything in the bowl and using the hand mixer (with adult supervision).

When asked to come up with something to put in the cookies, they immediately thought of chocolate, but since that was not available, they had to go through the kitchen to look for something else. They discussed this matter a lot with each other and went over almonds and raisins, but in the end they decided to chop a KitKat bar into smaller pieces and mix into the dough. (images 13, 14, 15 and 16)
Image 13, 14, 15 and 16: Captions from 3rd workshop: Simplified cooking.

6. Research results/Findings

Throughout the three different workshops, some interesting findings have occurred and the main five findings are as follows:

- The children taste what they see and not what they taste.
- They need more guidance during cooking than predicted.
- They want to have room for creativity, without feeling unsafe or being afraid of “failing”.
- The traditional cooking measurements are extremely difficult for them and create a lot of confusion.
- One recognizable measurement-tool is makes the process a lot easier.

Elaboration of the main problems they face when cooking and the ways to approach these issues below.
6.1 Lack of knowledge about ingredients – Taste what they see:
The first obvious finding, based on the workshops, is that the children clearly taste what they see – and not what they actually taste. If they can identify ingredients with their eyes, they mention it as a key ingredient in the recipe. On the other hand, they have a hard time identifying ingredients that they cannot see or do not already know is in a certain dish. This could prove that one of the main obstacles when cooking is the lack of background knowledge. The more times you taste a certain thing, the easier it gets to identify that specific ingredient – even if it is not visible in the final meal. For adults, this identification comes naturally and often without thinking much about it, basically because that particular taste has been identified over and over again throughout life. Based on various factors (age, knowledge, practical experience) this can vary a lot for children in this age group, but in general it was clear from the workshops, that they overall ‘taste what they see’.

To help facilitate this problem in a tool that is meant to help them explore cooking, it is important not to forget this when developing the final concept. It is not a given that they know that “invisible” spices can be very important ingredients when cooking specific meals. Therefore, it could be beneficial to provide them with a basic recipe that contains the most important ingredients to get them going. The start has to be “safe” and with the needed help provided. The creativity should come in at a later point.

6.2 Need guidance from adult/someone with more cooking knowledge
Another important finding is the fact that this age group needs more guidance than first predicted. Throughout all workshops, it has been very clear that the presence of an adult is strongly needed in many situations – especially for safety reasons. In general, they tend to turn to an adult for any question that might occur, even before they look for answers in the recipe or from each other. This proves to be a very general way for them to think and react when they are confused about something. Even when provided with all information needed to complete a recipe, they naturally look for advice from an adult. Also for safety reasons, the presence of an adult is needed in many stages of the cooking process; to put things in/ take things out of the oven, to use sharp knives, to use an electric mixer or blender etc. This depends much on their age and their skills, but in most cases the children will not be able to do all the cooking by themselves. This is important to highlight as an accepted part of the process in order for the experience of the final concept to be as natural as possible for the children. A way of doing this could be to make sure that there is a strong emphasis on adult guidance throughout the final concept, making cooking a shared activity between the children and their parents, grandparents, siblings etc.
6.3 They are afraid to fail, but like to explore – how to facilitate that?

It was very obvious that the children are extremely focused on measurements, timing and temperatures when reading a recipe. They are very careful when making sure they have enough of this and enough of that. They do not feel confident enough to use the recipe more as a helping hand, but go through it step by step with a huge focus on not doing anything wrong. They seem to think that the smallest “mistakes” will ruin a complete meal, because they trust everything in the recipe, but they do not trust their own cooking skills at all. To try and meet these obstacles in a positive way, it is important to facilitate them with a “safety net” that will make sure they can try things out in their own way without being too afraid of failing. During the last workshop, it was clear that if a basic, simple recipe is provided to them – where the possibilities of doing anything wrong is limited – they feel confident in exploring new things and making a few, simple decisions on their own. In the final concept, this is could be met by providing them with basic recipes and basic measurements and convince them that this is something they can actually do. At the same time, it is equally important to make sure there is room for creativity for them to start exploring cooking. From the workshops it was clear, that leaving them with small, easy decisions will make them engage more because they have a say in how the final result will be and thereby feel more involved and respected. This could be done by providing them with easy options for add-ons to the basic recipe provided. Additionally there could be an option of adding their own ingredients to a certain recipe – to make sure that they will not feel too limited by the existing suggestions.

6.4 Simple measurements work

One of the most significant findings during the workshops is, that children this age do not yet know how to measure liters, deciliters, milliliters, gram, kilos etc. These measurements have turned out to create great confusion with the children who participated in the workshops and they are potentially one of the reasons why many children find cooking very difficult and a bit intimidating. One of the goals was to find one simple measurement that could be found in any household and does not differ too much. At the same time it should be a size that was small enough to use for salt, pepper, spices etc. without creating too much confusion about the amount. A tablespoon is something that everyone has in their household and it will be just about the same size no matter where you find it. This was tried out as a measurement tool in the third workshop and proved to be very efficient for them. It is simple, they can recognize it and it is easy to use. It can almost sound a little too easy and accessible that it makes you wonder why this is not already a standard way of measuring in children’s cookbooks.

An interesting thing that also happens when using a tablespoon for all measurements (except for 1 egg, 1
onion, 1 tomato etc.) is that it will differ a little bit how much they put on the spoon. Some might have a big pile on top of it and others not. This will of course mean that the outcome will be a little different depending on which child is cooking, but it might also help them loose a bit of respect for the exact common measurements, when they realize that it will not make such a big difference in the end.

7. Discussion

The following is a discussion of the findings, previous knowledge and theory addressed further up. Our society has changed a lot during the past years and people have less and less time at home with their families. Practical things, such as cooking, are becoming stressful burdens for many parents who just want to have it done as fast as possible. At the same time, less and less children and teenagers (and thereby the next generations) can cook a dinner for themselves and since no one at home is trying to teach them these skills, how will they learn. This is of course a generalization of the Danish society and how families deal with this issue, but as addressed further up, not many children are given the opportunity to cook at home – both because their parents find it easier to it themselves and because the children might find it more interesting to watch TV or play X-box while someone is serving them dinner. For the children who never learn to cook, they leave home without knowing how to boil an egg. It does not only effect their eating habits and thereby their health, but as mentioned earlier, the lacking skill of cooking, can promote less independency when the child grows up. Could it be that cooking as a practical activity at home could also promote parents and children to spend more time together and thereby enhancing the social bond and at the same time “educating” children to take responsibility. In the end it could turn out to be more timesaving to actually teach your child how to cook as they might be the ones serving their parents dinner at some point. Of course it can –without doubt – be difficult to find the time it requires to bring the children into the kitchen and get their hands dirty – Especially if they are beginners. It might even be more difficult if they do not seem to show any interest about cooking what so ever. From the workshops mentioned earlier, it is clear that the more fun they think it is, the more enthusiastic they will be –as with everything else. It can be very difficult to motivate them into doing something that they are not into. Especially if they find it difficult at the same time, they tend to give up faster.

According to the findings, the things they find most challenging when cooking is: measuring, knowing what ingredients go where, and exploring without failing. So in order to provide a helping hand that can both take away some of the pressure that parents might feel and at the same time ease out the process in a way that makes it more accessible for the children to approach, we must take these findings into consideration. A simple measurement method was tried out by using a table spoon as the only way of measuring which
seemed to work out very well and provided them with more confidence in the process. Being afraid of failing, but still wanting to explore can be tricky. We want them to learn how to cook and not only to memorize different recipes and methods for cooking. In order to do so, we must create a platform that provides a helping hand, but still leaves some of the decisions to the child in charge. This will make them feel more accepted and will ultimately make them feel more responsibility and ownership about their cooking which will – according to the theory – create a better setting for learning. The same goes for creativity. There should be room for exploration and maybe even failing in order to unravel their creativity and imagination. This can only be done if the settings are not completely pre-defined and there is some opportunity for them to play and explore the world of cooking. At the same time, there should be some kind of “safety net” that will make sure that all of their efforts are not wasted if they make one bad decision about a certain ingredient or cooking method. It is a fine balance of giving them a helping hand without overruling the entire process and at the same time taking a step back without leaving them in complete confusion and chaos.

Based on the findings, it is also clear that adult supervision is needed for them to feel safe making decisions. This is probably very individual and age-dependent, but also for kitchen safety adult guidance and help will be needed.

The traditional cook books for children lack something that seems to be important for their development and creativity. The interaction and participation between the actual recipe and the user (a child) is not present in a cook book in the way that a tablet/smartphone application can facilitate.

8. Final design concept/ prototype

Based on the findings and discussion above and based on the ways of approaching these findings that have proved to work best for the children in a given cooking situation, the final concept is introduced in the following part:

The final design will be a cooking application for children with a specific focus on simplifying the process of cooking and with a focus on letting them explore cooking on their own terms within their comfort zone.
8.2 Step by step explanation

The final concept is an application that provides a database of basic recipes for the children to choose from. This is done based on the finding of them not feeling safe enough and lacking knowledge about creating recipes. It will be important to have a good selection that still will not become too confusing for them and the selection should be varied. This decision is made based on the findings from the workshops that proved that children can lose interest very quickly if they are not fully into the process and the decisions. Having a varied selection of recipes will make it more likely that they all will find something of interest.

When having decided what they want to cook, they are shown the basic ingredients and simple instructions based on the simple measurement-method where only a tablespoon is needed for measuring. Below this information they will find examples of ingredients that would go well with this specific recipe. It could be different spices, vegetables, fruits, meat etc. When they press one of these ingredients (image/icon), the name will be said by a speaker (to make sure they know what it is). This decision is taken based on the workshop findings and the educational principal that states that children learn best by active involvement. Giving them a say in the process – and thereby the final result – will enhance their self-esteem relating cooking and give them a certain pride about the food they are making. Being proud and gaining respect for the choices they make will enhance their interest in cooking again.

They now have the possibility of dragging and dropping the extra ingredient into the basic recipe that they have already chosen. When this new ingredient is dropped into the basic list of ingredients, a little box with instructions will appear beneath the basic instructions. This can be done with multiple ingredients at a time - making the possibilities varied and more personal, It will also be possible to add their own ingredients and to use these in the basic recipe to encourage them to use their own creativity and so that not every ingredient is pre-defined.

In general, the application should provide basic “bullet-proof” recipes that provide the helping hand children this age need, but at the same time challenge their creativity and allowing them to have a say in the food THEY are cooking. This will not only strengthen their trust in their cooking abilities, but according to the educational principles, this is of great value to the learning process of children this age.

As a last step – after cooking the meal - it will be possible to save the newly created recipe either for own use or to share it with friends and family via facebook, instagram, twitter etc. This step has not been tested in the validation and is therefore only a suggestion based upon an assumption.
9. Validation/User test

The user test was done based on a Low-fi prototype made from paper cut-outs. To design a fully functioning prototype or application would have been too time consuming to fit within the scope of a short research project. The user test was done with a person without knowledge about the project to accompany the child during the cooking process. This was done to keep the user test as objective as possible.

Creating well-working, user friendly and interactive tablet applications can be difficult and Low-fi prototypes will often not resemble the finished product very well. It is, on the other hand, good for early ideas and concepts like this one where the main focus is on how a potential application should work in the best possible way without focusing too much on the user interface. A Low-fi prototype is easy to develop and can give a good understanding of the task ahead. Designing for children can be very different than designing for adults since they see things differently and it can be hard to tell what might be too easy for them and what might be too difficult.

The user test was done as a real life scenario with a 9-years-old boy cooking dinner with adult guidance while simulating how a potential finished app would work by changing the screen manually with small paper cut-outs.

Image 17: Low-fi prototype, user test.
The app would guide him through the process of cooking spaghetti bolognaise by taking him through each step with audio, images and text to explain each step. Every time he pressed a button/icon there would be a reaction; either the slide would change or audio would appear with instructions or information about the icon he was pressing. One adult was there to help out with whatever tasks seemed to be too difficult or unsafe for him to do. The advantage of doing the user test with a low-fi prototype was that everything is movable and easy to change as you go along and audio can easily be simulated just by speaking when a certain icon is presses or moved. The limitations are that everything works very slowly and unexpected (re)actions can be difficult to act fast upon while testing. (Low-fi prototype Reference)

Please watch the video documentation of the user test here:
http://www.worldwideweb.dk/video.html (Requires QuickTime Player)

This user test proved to be very informing even about little things such as numbers, symbols and placements of icons. Some of the main problems with the prototype seemed to be the fact that it is difficult to make sure that the child actually reads all the text provided and they tend to make their own, very fast, decisions after they have read what they think it says. One way of facilitating this issue is to enable audio explanations as soon as the text appears on screen, so if a textbox appears saying “cut onion in half”, an audio recorded voice will tell you to cut the onion in half as soon as it appears on the screen. That could also make sure that children who have difficulties reading are not dependent on someone to read it for them or to struggle with it themselves. Or it could prevent an onion from becoming garlic (in Danish: løg vs. hvidløg) which was the case in this user test. On the other hand, we are dealing with intuition here, which is something unavoidable and in many situations, valuable. Acting upon intuition is natural for all of us and it takes experience to know when you need more than just intuition before you act - experience that will also come with age.

One extremely clear issue was the missing details in the prototype. All details should be there and many more than first assumed - including how much water is needed in the pot where you cook the spaghetti and the fact that the lid goes on in order to make it boil faster. Things that we as adults seem to forget are not common knowledge for someone who is a cooking novice.

On the plus side, it proved very motivating for him to take part in deciding extra ingredients and easy for him to understand the point of it. He chose fresh basil as a complementary ingredient to the already pre-defined basic recipe, which seemed quite easy for him to understand (except from where to place the little
basil icon on the screen) and it was incorporated into the basic recipe in a way that was clear for him to follow. The simple measurement theory also proved to be rather easy for him to use which was expected due to the previous workshop. It is difficult to say how much of a difference it makes in a recipe like “Spaghetti Bolognaise”, since only a few of the ingredients (salt, pepper, spices) are reliant on a measurement tool like a table spoon – which is what you would probably use otherwise since you do not measure salt and oregano in milliliters or deciliters. The rest of the ingredients were easy to count in either ½, 1 or 2 (onions, cans of tomatoes etc.), so no measurement tools were needed here either. But for baking, this method will have its advantages and take away some of the challenges that children have proved to have with distinguishing between grams, kilos, deciliters or liters. The need of an adult providing a helping hand is still there despite the presence of the application which only proves that we should not aim at making the parent’s, sibling’s or any other help redundant but merely using it as an extension of the application.

In the end, you could say that the user test went quite as expected based on previous findings, but in order for this to be developed as a working application, much more testing and many more prototypes would have to be done in order to reach a finished design. The finished design would have to facilitate all challenges children face while cooking, as well as it should have the right interface that could provide them with the most informing yet simple instructions. Many more decisions about small features such as audio or video that could potentially make a big difference in the way they understand the in content of the application would also have to be tested. In other words, the findings from the workshops and theory discussed earlier have interesting values when motivating children to get engaged with cooking.

9.1 Final prototype

The final video prototype is made with stop-motion technique. It has been re-designed with the main findings from the user test in mind. Please watch the final video prototype here:

http://www.youtube.com/watch?v=-6_5CGKyYtE

10. Knowledge contribution to interaction design community

This research adds knowledge to the design community by providing a study about how you design tablet and smartphones application for children. More specifically it provides knowledge about how to design cooking theme application for children aged 8-12; what challenges they face and what the important aspects are when designing an application like this. Furthermore it adds knowledge to the relationship
between children and parents in a specific situation like home cooking and it provides a practical study on how children learn to cook and what methods work for them in these situations.

The research done for this project would of course also be applicable for several other types of projects focusing on children and cooking. Workshop planners and writers of cook books could use these findings in a positive way as well. Also Danish schools could potentially use some of the research that this project provides in their obligatory cooking classes in elementary school.

11. Conclusion

How can children be supported in learning how to cook with a tablet/smartphone application?

The findings from this project shows, that the best way of supporting children in learning how to cook is to accept what they find challenging and try to develop a simple application that focuses on re-thinking cooking measurements as well as it should have a focus on including the children in the decision making.

So, how can we make an application, where the difficulties children have with cooking, are replaced by a simplified cooking-language they can relate to? It will take more testing and more research to come up with the final answer, but from looking at this project, the findings point in a direction of creating an application where the basic recipes are in place, but instead of traditional measurement tools, a simple table spoon is used for all measurements. Workshops and user test proved this method to be very easy for the children to understand. Further on, the application should provide room for the child to explore and be a part of creating the final recipe if wanted. This could be done by providing them with a basic recipe and leaving “extra” decisions up to them. This will make sure that they will always have a finished, nice tasting meal – with or without the additional ingredients. It will also make sure that the platform offers a helping hand that will make them feel safe exploring cooking and being creative without being afraid of failing or not wanting to make the decisions that are the fundamental core of the recipe. Adult guidance from parents (or others) will be needed no matter what – for help and safety issues. That is perfectly fine since the activity of cooking will not only be a good learning experience for the children, but will also work as a way of spending more time together within families as well as it could potentially help with the practical burden that many parents struggle to lift every day.

How to create an interactive, intuitive and simple cooking experience is something that needs to be tested more in order to be certain about what will work best and how. Hand drawn images of food as well as an including and welcoming interface language, has gotten good feedback, but has not been tested as a single factor and would need to be further developed along with many other decisions related to the user interface. Video clips, audio, real pictures of food, colours and so on are all things that should be taken into
consideration if developing a finished cooking application like this. These findings advance previous knowledge about how children learn, but they contradict with previous design examples on tablet/smartphone application. On the design examples mentioned earlier, the focus is more on providing simple recipes as well as having a fun and simple interface, but not so much on challenging the way we view traditional cooking (and cook books) by changing the “language” and including the kids in the decision making. This is where this design project contributes with new and relevant knowledge regarding children and cooking.
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