Elizaveta Shkirando

Tangible interfaces for children’s mental healthcare
Supervisors: David Cuartielles, Simon Niedenthal

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Contacts:
liza@shkirando.com
www.shkirando.com
Abstract

The area of healthcare has a lot of challenges and restrictions when it comes to design. There is no access to one of the users. A research on this topic resulted in the creation of Robbi – an interactive toy that supports communication between a child and psychologist during their therapy sessions.

Children (patients) as stakeholders are a very vulnerable party of this project and as they were not involved in the process directly; there was no opportunity for intervention, observation or action research. When the therapeutic session is happening, the setting of the environment has to be as comfortable for the client as possible and the presence of a third person at the session would disturb the result in a severe way.

I would argue here that the therapists can act as proxies in the projects related to design for MHC clients. Psychology therapists are skilled and experienced observers and area experts. In many cases we actually have to think: who is the real end user of our design? What relationships are there between the stakeholders and the solution are? As the project involves therapists as participatory design actors it is fair to say that the therapists are primary users of the design concept that is to be created. It has to fit all the needs of the doctor, enable them to make the therapy sessions more efficient, engaging and profound. At the same time the concept has to be developed in the framework of interaction for children in terms of visuals, tangibility, emotional content and usability.
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1. Introduction

Motivation

Interaction design for children is a challenging, novel and future-oriented field of research. In today’s world where technology is developing incredibly fast year after year, including the technology of everyday use, children are introduced to interaction with digital interfaces and devices from the earliest age.

While they are using touch-screen devices and click-based computer interfaces their development is still in permanent need of tangible interaction as 3D objects enable spatial thinking, development of fine motor skills and cognition. The ability to touch, manipulate, feel shapes, materials and textures as well as the concept of space and positioning is crucial for children’s development (Antle, 2007). Most of those skills cannot be provided through 2-dimentional artifacts and interfaces.

The area of design for children is of my personal interest and professional background as a designer, illustrator and a teacher. Getting in contact with Barn- och ungdomspsykiatrisk klinik, Malmö (BUP, children’s and adolescence psychiatric clinic) revealed a new broad area of potential design contribution. The goal of the project is not only to produce a valuable academic knowledge but also to create a design concept that can be feasible and possible to implement in real settings of children mental healthcare, to get some hands-on result that would enable further research in creating valuable artifact for the area. At the moment there are not much tangible materials used in psychological practice with children at BUP Malmö. Most of the artifacts are paper-based, not interactive, involve drawing, writing and reading and provide only visual sensory input. The area of development tangible interactive experience for mental healthcare (MHC) is vast and open for the research.

Research question

There are two conceptual parts of the thesis that create different types of knowledge contribution. The frames of design for children mental healthcare are strictly limited in access to the user due to legal issues and secrecy of medical treatment. It is important to mention that the project assumes that the psychologist that are involved in the project are professionals and experts in the area and are working exceptionally in the interest of their patients and are to be trusted by the designer. The methodological approach and process of the design research for such settings can be formulated in the following research question:

*How can we develop interaction design solutions for children mental healthcare without direct access to the end user?*
Another goal of the project is to develop a design concept that would match a certain criteria developed together with the psychologists, meet their needs and the needs and cognitive features of the children. Since there are two main goals of this design development, the hypotheses are based on these goals:

_Hypothesis 1_

*Tangible interface is more effective in supporting communication between a child and the psychologist during the therapy session than illustrative 2D artifacts.*

_Hypothesis 2_

*Tangible interface is more effective in creating engagement with child’s own feelings and seeing him/herself from an outer perspective than illustrative 2D artifacts.*

Both research question and hypotheses are supposed to bring new knowledge to the design society but also to all kinds of research areas that deal with sensitive settings, remote access to the user and tangible artifacts.
2. Research area

MHC for children and adolescence. Collaboration with BUP.

The project involves close collaboration with the doctors from BUP (barn- och ungdomspsykiatrisk kilinik, Malmö) who are working with children and adolescence with mental disorders or traumas such as:
- behavioral deviance
- posttraumatic stress (anxiety, depression, phobias)
- suicidal state or self-harm
- eating disorders (anorexia, bulimia)
- identity disorder (gender, sexual orientation)
- neuropsychiatric disorders (ADHD, autism)

The children who become patients of the psychologists/psychiatrists have difficulties in communication mainly, have hard times talking about their situation and sharing their thoughts, feelings and emotions. Having this was the first basic knowledge that is driving this project. The area is so much more difficult to be approached than the psychological diagnosis and treatment of the adults who, in most of the cases, realize their problem and are willing to open up to the professional to get appropriate treatment. The practitioners who will be directly engaged with this project are a group of psychologists (2-3 people). Their job is mainly to diagnose children and provide psychological treatment based on talking and listening. Psychologists are working together with the psychiatrists who are responsible for medical treatment and curators/assistants that are providing communication between family members and are supervising the process of treatment from a more administrative point of view.

Many problems, as the doctors consider, are coming from the family or at least are connected to the family situation, relationships between children and family members or are affected by the lifestyle or behavior of another member of the family that impacts the child’s mental state. Members of the family are usually closely involved in the diagnosing and treatment processes to see the bigger picture. Sometimes a hidden psychological trauma of a parent influences a child’s state in a negative way so that the child becomes a patient while the therapy includes both a child and a parent. There are various methods of such therapy, this for example includes drawing exercises when a child and a parent draw independently on a topic related to their situation and afterwards analyze them together with the psychologist. To generalize the influences and communication that characterizes any client with psychological/psychiatric disorder, except neuropsychiatric disorders (ADHD, autism) perhaps,
we can use a model illustrated in figure 1 by Coyle and Doherty in the paper “Towards Ontologies for Technology in Mental Health Interventions” (2008). For the disorders of autism spectrum or attention deficit disorder genetics play a significant role but as interaction design cannot really influence genetic state of the person, this project will not consider those elements. However, autism and ADHD is very open to psychological talk-and-listen treatment and this is what the current design process points towards.

![Diagram of client ontology in the MHC domain](image)

**Fig. 1 An outline of the elements of a client ontology in the MHC domain (Coyle, Doherty, 2008)**

As the parameters that influence mental state of a person are the same though they influence it in different ways, it is possible to create an interactive system that would be suitable for any of the mental disorder situation and would be a useful tool for a doctor from the stage of diagnosis to treatment. Moreover, each mental condition is varying from one patient to another, they can have different forms, levels of severity and speed of progression and therefore it is hard to categorize the conditions in a strict way and design for a certain one. Thus, the design solution that will be an outcome of this project has to be rather adaptable and allow the therapist to manipulate it in its use and purpose.
Technology for MHC

Most adults feel more or less comfortable when talking about their mental state (Matthews, Doherty, Coyle and Sharry, 2008). First of all it is connected to the fact that they realize the importance of the treatment and that their attendance of the therapy sessions is of free will. Grown-ups understand also the importance of face-to-face dialog with the psychologist as a professional that through collaboration is able to improve one’s quality of life. Also adults are not too sensitive to face-to-face sessions though it is always a nervous moment when a person starts an intimate conversation with a therapist for the first time. Apparently, for children whose initial need is safety and comfort (Markopoulos and Bekker, 2003) it might be much more stressful and confusing.

Another thing that comes out of children’s development is that children and adolescents find it difficult to express themselves in words and there is a need of some kind of medium that would make communication easier, more natural and engaging. Some studies show that people disregarding age felt more comfortable in talking about a sensitive topic while doing some irrelevant activity such as looking at the computer screen, walking or driving a car (Coyle et al., 2005).

Challenges in designing for children’s/adolescent’s mental healthcare.

1. No access to one of the users. Since children (patients) as stakeholders are a very vulnerable party of this project, they will not be involved in the process directly; there is no opportunity of intervention or action research. However doctors are the ones who are not only experts in the field but also users of the outcome of the conceptualization because they are on the opposite end of the usage – they interpret the data, communicate with the child through the tool to be designed. Therefore, we have a field study to research on the methods that can be applied in the settings without direct access to both users.

I would argue here that the therapists can act as proxies in the projects related to design for MHC clients. As the psychologist are experts in children’s mental statements it is possible to discuss and walkthrough the possible design solutions with them. A way to
engage the therapists in the design creation would be a cognitive walkthrough where one of the doctors takes the role of a child with a certain disorder and another doctor acts in his/her usual role. This would result in efficient feedback and reveal bottlenecks of the idea as the therapists can play through an extreme situation. Psychology therapists are skilled and experienced observers – it is a big part of their everyday job. They observe children for a long time and these observations are usually very complicated, require a lot of analysis, abstraction and seeing a bigger picture because the result of this observation is the diagnosis. That is why, I believe, it is possible to work with the psychologists as proxies in this project where the access to another user – children – is strictly limited. Therefore a team of an interaction designer and two psychology practice experts can overcome the constraint of missing part of the co-creation with the end user who is a child with mental disorder.

Secrecy: difficulties in observation and discussion of a particular case of a particular patient

2. Two end-users: a child and a therapist with very different needs

![Diagram](image)

Fig. 2 User situation
As the project involves therapists as participatory design actors it is fair to say that the therapists are primary users of the design concept that is to be created. It has to fit all the needs of the doctor, enabling them to make the therapy sessions more efficient, engaging and profound. At the same time the concept has to be developed in the framework of interaction for children in terms of visuals, tangibility, emotional content and usability.

3. Evaluation cannot be made directly by designer. There will be access to the end-user for a user test but the designer can evaluate the concept only from the perspective of interaction design and interface design. Only the therapist can evaluate the real influence of the idea on both users, the clinical effect on the patient and possible long-term consequences.

However it is important to divide clinical evaluation and evaluation of the design solution. To test the design solution it is possible to get an access to the children in treatment and to assess their interaction experience with the concept.

Another restriction to evaluation would take place even if the direct contact with the end-user is possible. When the therapeutic session is happening, the setting of the environment has to be as comfortable for the client as possible. A familiar room, the therapist who is not so much of a stranger anymore and calm atmosphere. The presence of a third person at the session would make the result disturbed in a severe way as the state of the child is very sensitive to the surroundings and to the new people that will have access to the emotions and thoughts of the patient.

4. Poor quality solutions might make harm to the user at the stage of user testing. This kind of situation must be avoided. Through careful evaluation with the therapists the solution will be prepared for the user-test in such a way that the factor of negative impact on the child is minimized. The Hippocratic Oath philosophy is the number one rule to keep in mind when working with this area in any possible direction. Hippocratic oath written by an ancient Greek physician Hippocrates is taken by all the healthcare professional as a swear to practice medicine with honesty: “I will apply dietetic measures for the benefit of the sick according to my ability and judgment; I will keep them from harm and injustice” (Markel, 2004)
Development of children in the context of mental health care

For the overview, it is important to define the steps of child’s development in terms of cognition and interaction with the external world. The editorial paper “Interaction for children” (Markopoulos and Bekker, 2003) mention four age stages of social, cognitive, language and moral state.

Dependency/exploratory stage (0-2 years old)
At this age children start discovering the world through first movements and motor skills as well as listening and comprehending sounds. Through imitating intonations and figuring out simple sound patterns at a very early age, the language skills get up to 50 words at the age of 2. The visual characteristics of the design for children of this age group are very important. Roundish forms, basic simple shapes and clear bright colors are initial in interaction design for infants. At this stage children are tend to play on their own and the collaborative socializing is too early for them while the main needs (that have to be also provided by the design concepts) are love and safety.

The emerging-autonomy stage (3–7 years old)
This age group is interested in various fantasy storytelling but at the same time are not too abstract and without a complicated concept of time – the idea of present, past and future still appear to be hard to understand. Putting on the roles of fantasy world and acting in these roles are the most common way of communication through play. The language skills are getting to the level of using more complex grammar structures as sentences with “and” and “because” are used together with the first insights into writing and reading. In their playing experience children like to solve puzzles, following the narrative to achieve a certain goal without any competitive element.

The rule/role stage (ages 8–12)
At this age group children become more interested in real life than fantasy play along with getting more competitive resulting in the need for success and attention. They prefer to play in groups rather than alone and the influence of friends becomes more and more important compared to the influence of the family. The playing concept for this age group can be more complex as children are getting a better understanding of time flow, abstraction and logic. This is connected to development of reading and writing skills, this age group performs a shift “from learning to read, to reading to learn” (Markopoulos and Bekker, 2003). This period of a child’s life is very important in terms of developing social skills which can be crucial if the child’s mental state is not stable. Around 10 years old children learn to follow rules in life and play,
take turns, think strategically, deal with failure, disappointment and frustration. All these factors are quite sensitive if there is a deviation in the child’s psychological development (Kingsley, The Best Toys And Games for Kids).

Early and late adolescence (ages 13 and up)
For teenagers social engagement is critical: achievements, identity and sexuality are the new areas of focus. As they can fully understand irony, sarcasm and multiple points of view, the abstract concepts are acceptable and interesting for them. This age group prefers reality to fantasy world and that is why design targeted at these users has to fit reality and self-identity visually and conceptually.

The characteristics of each stage of development are extremely important in designing for children though this particular division that was described above is not precise and can vary depending on the person and can be divided into shorter stages with their characteristics. These are the essentials of any user-friendly interface that has to be considered through the whole process.

The current project has children of 4-10 years old as a user group. It is that broad because children with mental disorders are not fitting this development classification in a strict way. Most of the mental disorders and psychiatric states that are diagnosed at an early age affect the development of the child in various manners: social, educational, cognitive and language. According to the Diagnostic and Statistical Manual of Mental Disorders (2000) issued by American Psychiatric Association, most of the disorders diagnosed in the childhood and early adolescence are directly connected to difficulties in learning and communication. Many childhood disorders that are quite specific in their symptoms influence developmental delays in other areas of psychological state of an individual. For instance, coordination disorder from the group of motor skills disorders usually affects non-motor skills such as language expression or other phonological issues (Diagnostic and Statistical Manual of Mental Disorders, 2000). Conditions like autism that have social interaction impairment and limited interests and activities also make the development of the formal characteristics delayed or retarded. At the same time many individuals with autism spectrum disorders may show prodigal skills in very specific areas that would go far ahead of a normal development for this age group. The same applies to ADHD where IQ level can vary dramatically from one individual with this disorder to another. Some children have very limited learning abilities and perform very poorly at school while others can have an intellectual level much higher than average.

The current project resulted in a concept prototype called Robbi that is designed for the interaction between psychologists and children between 4 and 10 years old. Flexibility of the design is based on the idea that the function of it is applied through the therapeutic conversation. The interface is very subtle and puts the focus on the user rather than on the features of the interface. Regardless the age of a child, his/her psychological state and the
severity of the condition, Robbi may be used as a tool to encourage communication. The Robbi concept is described in further detail in the chapter Design process.

Related works and projects

Tangible artifacts in children psychology

Erica-method

This method developed by Erica Institute in Stockholm consists of a set of 360 miniature toys carefully designed for possible interpretation that are arranged on 12 separate shelves and a sand box. The child is asked to build a World for 40 minutes and afterwards he discusses the result with the therapist (Sjolund, 1981). No instructions or recommendations are given to the child. After three sessions it is possible to see repetitive behavior and themes throughout the narrative that a child creates. There is a list of criteria that has to be considered when interpreting the session such as choice of the toys, use of sand, type of play (explorative, storytelling, putting on roles etc.), level of organization of the world and changes made through the process. Nowadays the Erica-method is applied in most of the children mental healthcare across Scandinavia.

Mass market stuffed toys

There is a number of products that have more commercial purposes for general public rather than medical in-patient use. Paraplush created a line of stuffed toys (figure 3, a) and a flash game about the animals that are suffering various mental disorders. The set that a customer gets includes a toy, a reference letter from the “hospital” – a psychiatric clinic for abused cuddly toys and recommendation about treatment. The toys are distributed through online shops and retailers to the end consumer directly and the idea behind them is that "children and grown-ups like their vulnerability and find something in them that gives them a great sense of comfort in helping to heal them" (parenting.com). There is no official research done on the usage of the toys from the sales but looking through the comments, articles and reflections on this product that can be found on the web, most of the users are young people without any psychological problems that are interested in the toys because of their unusual and provocative selling points. An interesting detail is that the toys are representing characters of a flash game where a user becomes a doctor in the mental hospital and follows the guidelines to treat the toy.

Kimochis (Dodd, 2011), what means “feelings” in Japanese, are stuffed toy characters with special behavior and a number of small pillows that represent feelings through emoticons and corresponding written word on the back that can be put in the pocket on the characters stomach (figure 3 b). Each toy has three basic feelings that interpret its personality but the
feelings can be combined and exchanged with other toys. The toy set is supposed to be used in the setting of a school or kindergarten group and it aims to help children with autism spectrum disorders or aspergers syndrome mainly to develop positive peer communication. Through role play mediated by the teacher and identifying with the characters children are learning basic social skills such as taking turns, asking, apologizing, agreeing or disagreeing.

![Image of toys](image1.png)

**Fig. 3.** Kroko, a toy with paranoid psychosis. Kimochis Cat that teaches helpfulness and forgiveness with his main feelings: happy, curious and cranky.

Both examples do not have any interactive element in them. To enable communication and playful engagement the process has to be mediated by the teacher, parent or therapist. However, the idea of tangible, child-friendly representation of one’s feelings and personality issues and feelings that can be physically “put” inside someone are important benchmarks for the current projects.

**Tracking physical parameters using digital technology for psychology**

SimSensei (Firth, 2013) is a new program that is able not only to have a real-time conversation with the user but also to recognize his/her facial expression. By doing that the program can quite accurately identify if the user is suffering a depression (rather than just bad mood). The technology behind the program is based on Microsoft Kinect and face recognition software that tracks detailed movements on person’s face very precisely, including hesitation, eye contact,
voice level, bodily activity, etc. The interface of the program shown on figure 4 is quite straightforward: screen-based interaction is led by an animated avatar of a “psychologist” character that asks the questions in a very gentle way and is able to have a natural flow of a conversation with the user. This technology brings a usual questionnaire to a new level of accuracy and interaction but is still under development.

Fig. 4, SimSensei, the virtual psychologist

Quite similar research has been done currently in the University of Minnesota’s Institute of Child Development (Firth, 2012). Kinect-based technology can track the early stages of a tendency to autism spectrum disorder. The Kinect cameras are placed in the nursery room and can follow up to 5 people by identifying them by color and shape of their clothing. The algorithm tracks children who are particularly active or too quiet through their movements and special behavior, and attempts to identify a sign of early autism. This is not a system to diagnose autism directly but to help track possible deviations for further research.

Related methodological approaches

Cultural probes as a method to approach design for sensitive settings has been widely used in research with elderly and handicapped user, including mentally handicapped (Crabtree et al., 2003). Cultural probes are a set of intuitive, unstructured tasks that evokes emotions, thoughts and fragmentary clues about people’s lives (Gaver, 2004), they help a designer to access the user without conducting any common “observations” because in these settings observations can be interruptive, abusive and inappropriate. At the same time cultural probes enable broader view of the situation, including people’s emotions in a playful and natural way and give
new inspiration to the designer. Andy Crabtree et al. in their paper Designing with Care: Adapting Cultural Probes to Inform Design in Sensitive Settings (2004) describe using this method for the settings quite similar to the current project. They used photographs, diaries, postcards and drawings to get an idea about the users at the retirement hostel, their wishes, needs, emotions and daily routines. Daily routines is something that became a center of attention for the researchers and therefore cultural probes became some sort of “informational probes” (Crabtree et al., 2004) that were to be analyzed and used as a source of information and knowledge rather than just design inspiration as Gaver (1999) suggests. According to this study this kind of probes is still a very initial way of gathering data and it should not be considered as a sufficient grounding. Moreover it was used with ground ups and still the props where often misused or abused so that the camera, postcard or a map distracted the user from an action that was supposed to be done using those props as instruments but not drawing attention to them. When working with the children, this problem can arise even bigger as children especially psychologically unstable are easily distracted and anything can become just a toy rather than a source of insights. One can argue that misusing a tool is nothing wrong but also a way of using something but when a tool is an instrument of making cultural/informational probes it has to be understood that there still has to be a maintained focus of the research and a certain goal has to be achieved.

It is important to mention here again that the user group of the ongoing project is rather blurred between the psychologists and the children. At the same time from the interviews with the psychologists it is learned that they are using some sort of method that is similar to cultural probes just with a purpose completely different from design. The children are getting home tasks, diaries, drawing exercises that give the doctor some new insights for the psychological research with the goal to diagnose or to see the changes in a patient’s condition. All this information that is already gathered by the therapists can be used for design purposes through different ways of analysis and different goal.

The research area of the current project is still quite broad and requires narrowing down through the fieldwork. The sensitivity of the settings requires careful and thoughtful idea generation with the respect to all the limitations mentioned above. A very important point is that the result of the concept development has to involve technology only to that degree where it does not substitute the psychologists but creates a helpful tool.
3. Design method

The design method is based on the framework used by Coyle and Doherty in the design of Personal Investigator (Coyle et al., 2005). In the paper the authors describe the method for user-centered design when the access to the user is strictly limited. The researchers were working in close collaboration with the doctors as experts and proxies. The design resulted in a computer game for adolescents that have difficulties in communication with the doctors during the psychological sessions and showed successful results.

For the Avatar project this method is refined and modified according to the time limits, academic, practical and personal goals.

1. Initial interview with the therapists. Goals: frame the area, understand the main needs of the doctors as users and of their relations with a child. Needs of the child as a user based on the doctors’ expertise. Discussion of the current situation with artifacts that help therapist in their work with the children, existing solutions and directions, use of technology in the psychological practices.

2. Analysis of the interviews and previous works, creating basic design ideas that would initiate further discussion and narrowing down the ideation process.

3. Further interviews with the therapists. Co-creation of the design solution, ideation, discussion. Making decision on the direction of the design process based on the basic ideas presented to the therapists in a visual way (storyboard prototype). Storyboard is a visualization tool based on motion picture and comic tradition that enables all the stakeholders to easily understand the concept. Drawn sketches or photographs that are put together in a narrative sequence can represent any experience from the user perspective and are easy to “read” for anyone who wants to get an idea of the concept. Storyboard as a design visualization tool helps a “reader” to experience the interaction from the point of view of every user involved just like when reading a comic-based story and to see a bigger picture (van der Lelie, 2006). Seeing the displayed event from the outside enables the reader to reflect on the experience shown, to analyze it from abstracted point of view and therefore to find unanswered questions, bottlenecks and flaws in the process. That is the way the storyboard drives design creation and improves interactive experiences.

   Establishing the criteria of a successful solution for the design case. These criteria will be used throughout the design process as well as for the evaluation and user-test stage.

4. Creating a mock-up of a design solution. Paper mock up is an essential tool of interaction design. If allows early testing with the stakeholders, seeing and fixing
problems at the first stages of the design process. A mock up is usually made of paper or cardboard and does not necessarily have all the functions of the final concept but it enables a user get closer to the final idea and imagine all the functionalities and the process of interacting which gives valuable feedback of basic functions and usability and reveal some important details that a designer has to consider (interaction-design.org).

5. Role-play walkthrough using the mock-up. Identifying strengths and weaknesses of the concept.

The role-play is based on the knowledge of the therapists who can represent the behavior of a child precisely with one or another diagnosis or symptom. One of the therapists is playing a role of herself and another one is playing the role of a child. To get into the role play, there will be described “personas” that represent different children with potentially different needs and diagnosis but of the same age group. To describe those personas we will be using the elements of a psychological state mentioned in chapter 2. There will be 3-5 situations for the role play that will engage different “clients” and a therapist using the mock-up. Low-fi prototype like a paper mock up in combination with a role play can provide a designer with useful information at the early stage of concept development. A role play enables the team not only evaluate functionality and usability but also create some new important functions on the spot, to develop the concept unintentionally (Svaenes, D., Saland, G., 2004).

6. Specification of the final prototype, detailed design concept. Final evaluation with the therapists: interface, physical parameters, graphics (if any) etc.

7. Creating of the final testable prototype. The prototype has to have main functionality and recreate a real product in terms of basic interface elements to get relevant results.

8. Testing and evaluation of the prototype with the end-users in a real-life situation.

Implementing the prototype in the talk based therapy session. Number of sessions should be more than 5 and the child user might represent different situation in terms of gender, age and diagnosis. Due to the restrictions and limitation in access to the user-testing setting described above, we are going to use a questionnaire base on the criteria of a successful design solution that were defined by the doctors. The questionnaire is structured based on the example of rate-based assessment implemented by Coyle and Doherty in assessment the 3D computer game Personal Investigator (Coyle, Doherty, 2009). After each session with the child the doctors is filling in the questionnaire where they rate statements regarding the testing situation. After all sessions are complete, we have a discussion about the user-testing to see more details that have to be improved and to see the relations between the questionnaire and the discussion.
The plan of the design research and design process according to the following method is shown in the figure 5.1.). However there have been certain doubts about the way of approaching the issue of lack of access to the user. There has been a choice between following the suggested method as more “hacker”-approach where the prototype is tested at the early stage and is being improved further or to have more in-deep field work research, step by step coming closer to the concept.

**Initial interview:** area, needs, practice, communication

**Ideation:** 3 directions

→ **Participatory design** with the psychologists

→ **Concept development & mock-up (single idea)**

→ **Participatory design** with the psychologists: role-play ”Psychologist & child”

→ **Hi-fi prototyping**

→ **User-test with real users** in real situations

**Evaluation:** questionnaire & discussion

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**Fig. 5. 1. Applied design method**

The problem of access to the user would not allow multiple testing of low-fidelity prototypes with the end user (children at mental healthcare) but it would be possible to try out interactions with ordinary children (figure 5.2.). On one hand this way might lead to the deeper understanding of the research area but at the same time it take the researcher even further away from the end user. Testing with ordinary children would result in missing many details from how children with psychological problems interact. As it was said in the chapter 2, the development of these children is drastically different from ordinary mental and
physical development of a child. It is also very important that the concept fits the needs of a child with a particular diagnosis and helps this child interacting and communicating. Taking all this into consideration the first suggested method has been followed throughout the research and concept development up to the testing phase.

*Fig. 5.2. Possible directions of the research method*
4. Design process

Finding the research focus: initial interviews with the therapists

The initial activity to narrow down the research area of designing for interaction in the mental healthcare for children and adolescence was to start with the initial interviews with the practitioners and experts in the area who will also become indirect users of the final design concept as they inevitably will be analyzing and interpreting the way and outcomes of the interaction between the patient and the artifact.

The first interview with the psychologists took place at BUP, in a comfortable area for the therapists where they feel closely related to their work. The interview was very open-ended and aimed to gather data about the field and narrow down the research area. The participants were two children psychologists working with children of various age and various problems. The questions discussed:

- Describe the tools, artifacts and materials you are using at the moment. How and in which situation they are used? What are strengths and weaknesses of those tools?
- Discuss existing projects related to the area. Their advantages and disadvantages.
- What are the challenges in your everyday practices?

During the conversation different aspects of their work were discussed. The talk touched such topics such as common practices, challenging situations and conditions of the children, communicational issues and positive experiences of using different methods and techniques of treatment. Throughout the interview the psychologists also mentioned typical and atypical cases, challenges that they were facing and solutions that they came up with or artifacts and methods that helped the treatment.

Besides dense data and useful knowledge there were some questions that came up and that are up to the designer to decide on:

- Who is the user group we are designing for? What is the age group? Are they children with any psychological problem or only specific cases?
- What are we designing? Should it be a tangible or graphic interface? What are the dimensions (the level of embodiment) of the artifact and what platform or device it is using?

These questions have to be answered through further research of the existing works and projects as well as through closer involvement with the therapists’ team. The second question
is mostly to be solved in participatory design workshops with the psychologists and discussion sessions, as their expertise mainly brings the content for the concept development. Based on the first interview, I came up with the three ideas that would lead design in slightly different directions. These ideas are described below through discussion of the participatory design.

**Participatory design session with the psychologists**

After the initial interview it was possible to see a few distinct directions of the concept development based on the needs of the doctor and the child and creating interactions between them. The three ideas were created and sketched up showing a storyboard of interaction between the child, the artifact and the doctor in some cases. Participatory design session included discussion and critical reflections on the suggested ideas and brainstorming on how the ideas can be elaborated and improved. The meeting took around 1,5 hour and showed productive and constructive result because of personal engagement of the therapists. To take a step further the three basic ideas were discussed and using post-it notes all remarks were documented for the further synthesis.

![Psychologists brainstorming on the initial ideas](image)

**Fig. 6. Psychologists brainstorming on the initial ideas**
3D avatar

Description of the idea:
Tangible interface that enables conversation between the users, reflection on the emotional content of the conversation and prolonged interaction through one-person usage (the child). The important part of this direction is sustainability (to a certain level) that allows interacting with the artifact on different levels depending on the stage of the therapy session.

Fig. 7. 3D print your emotional character
Basic idea shown on figure 6 is tracking the child’s movements (directions, speed, acceleration, trajectory) and voice (volume, amplitude, frequency, pauses) while conversation with the psychologist took place. Through analyzing those parameters the computer program creates a 3D model of a toy character that is visually similar to the parameters of movements and voice. For example, if the amplitude of voice had a big difference in peaks, is had no pauses but was uneven and the movements were sharp, random and quick then the toy would have sharp edges, aggressive face expression, sharp nails and teeth. After the 3D model is created digitally, it is printed on 3D printer in a few minutes and the physical model is discussed with the child. This toy character is a representation of himself/herself, his emotions and, what is very important, how others might see him. This 3D avatar enables the discussion that brings together physical look of the emotions of a person, their behavior and how they feel inside. It explains to the child their issue and brings them to the next step, which would be finding a way to improve the situation. The doctor can talk with a child about what they would like to change about this character that represents their self and by painting on the toy the child embodies those characteristics that would make the toy different, the one he wants to be and the one he wants to be seen by their friends and family members.

**Reflection on the idea:**
The first and the most important comment was considering the voice parameters and their connection to the symptoms. The characteristics of the voice amplitude, volume, pauses and speed would not give a full picture of the person’s emotional condition as they can fit completely different cases. Instead the psychologists suggested having a test that would identify the child’s state and result as some visual representation of it. The movement tracking on the other hand appeared quite reliable feature and an interesting point as the movements show a lot about the person’s character and emotions if tracked precisely enough.

The question that comes up is why let the computer make these decisions if the psychologist can see the situation clearer and notice important details in the behavior that cannot be tracked digitally? This question makes the idea evolve and get to the next stage of the concept development.

Another comment on this direction was feasibility. Even if at the step of ideation and brainstorming it is not supposed to evaluate the idea from this point of view, it is important to take it in the consideration while developing a concept for this area as the method includes a user test that has to be as “real” as possible. Avoiding usage of expensive advanced equipment is also rather relevant not only from a financing and production point of view but also from accessibility for the doctors that do not want to spend too much time to learn how to apply the new technology.

At the same time the idea was very strong in terms of showing the child how others see
him/her, initiating the discussion but maintains a playful and creative atmosphere. It is also very flexible and can be used in a number of cases and fits a wide age group. Further improvements could be made to make it even more adaptable and interesting to discuss by adjustments and changes made to the tangible object by the child through the conversation.

All cats have Aspergers

Description of the idea:
This is a tangible metaphorical representation of a child’s condition that helps the child realize and accept his mental state, understand that it is not a disease and not to get negative and socially stigmatic image of his/her issue.

The stuffed cat toy (see figure 7) that has sensors and can perform various movements is behaving like a real cat would do. For instance, it is sensitive to touch, acts unexpectedly and avoids communication in most cases. That would be the characteristics of both: any cat and a person with aspergers syndrome. To help the cat behave more socially, have more fun and energy a child has to give the cat a “medication” that might be represented as a bottle of milk. After applying the medicine, the cat-robot responds to the touch and becomes more socially active (or as much as a toy can be).

Fig. 8. A toy-cat with Aspergers syndrome
Reflection on the idea:
The biggest advantage is that the object is tangible and not only explains the child’s problem but also represents himself. However there are a few weaknesses. One of them is limited flexibility: a particular toy can only be used in a particular situation (ADHD / Autism / others), therefore there is only a need for a toy that would be suitable for certain circumstances. This would not be relevant to the example that was presented as there is no medicine for aspergers syndrome. The medicine is usually used to treat conditions such as ADHD which has more than physical characteristics. There are symptoms of ADHD, such as forgetting things, being too talkative and think about too many things at the same time, that cannot be represented in a tangible toy unless it is using some advanced digital technology. Autism can also be medically treated but the same problem comes up where the main symptoms like difficulty in socializing or getting eye-contact are hard to be represented in an understandable tangible form.

Another critique was considering the concept not fitting the age group of the users. The difficulty in explaining a child the necessity of taking medicine is mostly relevant for the teenagers. Little children are given medicine by their parents and are quite dependant on their actions while the teenagers require more autonomy and are willing to see a clear picture of their condition and why medical treatment is necessary. However a user group of any stuffed toy would be pre-school children, older kids are not interested in this kind of play.

Make up your fear
This concept represents the idea of construction blocks that when put together represent a monster or a robot-like creature that envisions a person’s fear or emotional condition (see figure 8). The child puts the blocks together according to how he/she feels inside, what he thinks his facial expressions looks like. The limbs of the creature that would also represent the thoughts on the child’s vision of himself, his abilities, powers and skills. If the case considers the fear state or phobia it can be relevant that the child visualizes his/her fear, how this fear looks like, how strong, fast and powerful it is. This visualization gives a good ground for discussion with the doctor in a playful way. The child can change the pictures through discussions showing what he/she looks like now, before, in the future, what he/she would like to look and feel or what the others think about him/her.

The toy set can be taken home for the child to go through his thoughts and feelings again, and realize it better when they start working on them. For the next session the child and the therapist discuss the changes that happened to the toy, why it happened, and if those changes positive or negative.
Reflection on the idea:
The idea of taking the avatar home and “live” with it and improve it was very appealing to the psychologists. However to make it feasible the materials should be cheap and accessible because this materials might be used with several children at a time and they might be damaged while using if this tool would not allow children to see themselves from the other’s point of view however here the emphasis is put on using one’s creativity when he/she has problems articulating his feelings, emotions and thoughts. The parts of the “body” of this creature would also symbolically represent different parts of a child’s self-identity and everyday experience. For the feasibility side of the idea, one of the suggestions was to make the block-like cubes with different picture on each side of the block so that each block represents a group of emotions and each side of the block represents more specific characteristic of the emotion.

Analysis and mock up

Reflecting on the participatory design session and discussion of the criteria of the final concept, there has been a list of the key statements made that would characterize the idea for the product:
• Tangibility. As it was said before, tangible interface makes the interaction deeper, more detailed and engaging especially for the pre-school and school age children. TUI also provides more emotional experience but does not interfere with natural conversation with eye contact and sensible dialogue.

• Encouraging communication. This is the most important task that has to be accomplished using the designed tool. The grounding for this feature are the tools commonly used in children’s psychology such as emotion cards and the Erica method described before. Those tools create a base for narration via visual input.

• The tool has to help children to answer the question – how do others see me? The product should allow to use it as an Avatar of a child’s physical characteristics that are affected by his/her emotional state and therefore enables child see his own “reflection”.

• Adaptable. It is important that the concept allows using it in different situations and cases. Talking about school, family or friends with children suffering very different conditions has to be equally possible to engage with the interaction. Thus the design is to be non-specified in terms of the visual, tangible or any other characteristics, however the idea has to be strong from the functional perspective.

• Open source. That would mean that the functionality of the design has to be easy to modify and add-on so that the stakeholder could either do it themselves or they could find someone with the knowledge to help them. The situations and contexts of use are very different and we want to make the toy relevant for all of them. Openness can be achieved through simple DIY philosophy when a therapist together with a child creates something out of everyday materials. Another way is to have basic tangible object that can be modified by the therapist according to the case of the child Based on those principles, the mock-up of Robbi was created. Robbi (figure 9) is a toy that encourages conversation between a child and a psychologist and enables a child see himself from the other’s perspective.
Fig. 10. Paper mock-up of Robbi kit.

The Robbi kit represents child’s feeling and a projection of the feelings to the child’s behavior and facial expression and furthermore the relationships with the others and the world around. The child is told to imagine that the toy represents him like an avatar. The child chooses an object that represents the feelings relevant to the conversation (his feeling now, before, his fear) and places the object inside Robbi. Pink tag on the object (future RFID tag) must match the tag reader on Robbi. When the object is placed, the facial expression changes that is shown in the mock-up through changing cards with illustrations of different emotions. The child can agree or disagree with the correlation between the feeling (object) and facial expression and can change the facial expression by pressing the button. There is a possibility to upload new pictures for the face through USB interface. Another way to make the idea more open-source like would be to enable the therapists create new objects by placing an RFID tag to some toys/blocks or any other object that can be relevant to a particular child.

This mockup has then been used for evaluation of the idea through cognitive walkthrough.
Cognitive walkthrough and reflections

The mockup was brought to the meeting with the psychologists that has been participating through the whole design process and a psychologist that was new to the discussion. Two psychologists that were familiar with the project participated in a short role-play that represented a situation of using the toy. The person playing the therapist was given a brief manual that explained how the Robbi kit is functioning. She introduced it to the “child” and they had a conversation. The questions that came up immediately were “What happens if there is no object placed inside?” and “Is it possible to choose the face without an object inside?” Furthermore, there were some concerns about how it would be possible to assign an RFID tag and a referral face expression to a new object: what kind of interface would it be?

Other important points were:

- more facial expressions and nuances should be represented, perhaps 3-4 nuances of each expression
- basic objects that represent feelings have to be abstract rather than creature-like looking. If there are two faces (on the object and on the Robbi itself) it would create confusion. All the parts of the system have to be quite clear in their visual definitions
- shape, color and texture of the objects can trigger many thoughts and emotions and this is a great advantage in comparison with paper emotion-cards.

Further development of the prototype was carried out based on the workshops and discussions with the psychologists that were described above but also grounded on necessary theoretical input that is discussed in chapter 5. Fieldwork and theory give a research all the important data that after a certain analysis results in creation of a concept.
5. Synthesis and prototyping

Theoretical grounding

Tangible interfaces for children

Through the whole project the emphasis on tangibility has been essential. A few studies have shown that TUI provides more deep and detailed interaction for children than GUI (Hong, 2012). In “Storytelling through Drawings: Evaluating Tangible Interfaces for Children” Sylla et al. (2009) the researches divide children into two groups to experience the same educational narrative through interaction with a graphical interface and a tangible interface. The workshop included a tangible and a computer-based interface with identical content teaching children about oral hygiene. TUI was experienced through “brushing off” germs that were projected on a model of a tooth about 70 cm high whereas GUI had the same images of the tooth and germs that had to be removed from the tooth using the computer mouse. To evaluate the results of the interaction children were asked to draw what they have just done. According to the drawings children who interacted with TUI felt themselves more as a part of the process, where their drawings represented a bigger and more detailed picture. This means that the involvement in the process of interaction by using a real toothbrush to clean the physical tooth was more engaging than cleaning the tooth on the computer screen.

The idea of tangible user interfaces was widely discovered by Hiroshi Ishii. In the paper “Emerging frameworks for tangible user interfaces” (200) he describe TUI as interactions that “couple physical representations (spatially manipulable physical objects) with digital representations (e.g. graphic or audio), yielding user interfaces that are computationally mediated but generally not identifiable as “computers” per se” (Ishii, 2000). One of the main characteristics of the TUI is that tangible representations are technologically and perceptually connected to relevant digital information. That means that every physical object that has a function in the interface has some digital data that directly depends on it, is represented through it or that physical and digital parts make sense when they co-exist. Tangibles usually enable control over the system while coupled to them digital elements represent dynamic information. There is a number of the digital media and other associations that can come out as a result of tangible interactions. Such associations can be:

- Static and dynamic visual media like 2d and 3d graphics, video and animation.
- Computational commands, operations and applications
- Data structures
- Remote operations, people and devices
The current project is dealing with interacting with visual media through a tangible interface. The images are controlled by the position of the physical object and can be manipulated by simple tangible input.

Further in the paper Ishii and Ulmer (2000) are talking about different instances of tangible interfaces and structure with some examples as spatial, constructive, relational or associative system. According to this classification Robbi is between relational and associative as it combines both features. For Ishii and Ulmer associative systems associate a certain physical object with a digital representation but a number of those associations (tangible-digital) do not organize any system of a higher level of relationships and are acting independently. The images that are shown on the LCD screen (digital part) are impossible without physically opening and closing the object (tangible manipulation) and placing another object inside so that direct relation is created. However, Robbi does not enable any literal creation of a larger scale interaction in this tangible-digital correlation. At the same time looking at the bigger picture, placing an object and showing an image initiates creating a narrative based swapping of the images that leads to a particular conclusion and brings a certain sensible result to the user. Therefore Robbi is also a relational system as the images may be changed and the relationship between tangible and digital is not so direct anymore but represents some conclusion.

**Children and semiotics**

The understanding of sign in the broad manner, seeing visual representations in different ways and associative thinking is an important part on the current project. In the paper discussed previously Ishii and Ulmer (2000) mention a definition of phicon as physical “icon”, a symbol that has a strong visual and tactile reference to a certain action, operation or digital information. Later in this chapter I attempt to frame the objects that represent feelings of Robbi as “phicons” which can be arguably linked.

Semiotics describes a sign as something that stands for something else. Icons or phicons are one of the sub-categories of “sign”. In the article “Demystifying semiotics: some key questions answered” (2002) Rachel Lawes shows an example of a golden package of the cookies and people seeing this product as luxury because the sign of “golden” is usually coupled with luxury. Culture here is understood as the way people communicate with each other through language, visuals and sounds, both consciously and unconsciously. The meaning of a sign can be really different from person to person so the same sign can stand for different things depending on the person’s cultural and social background. At the same time culture is changing with time so the author argues that nowadays a golden package probably would not mean this luxury product anymore as today it becomes more and more common that the luxury food products have very simple and inexpensive package. There are other classical examples that are more time-proof such as the color white to mean purity, light and marriage in western European culture though in Indian culture that would mean death. Lawes is writing about semiotics in
marketing but those principles can be widely used whenever a user/consumer is facing an object, product or artifact physical or digital that creates some kind of communication between the user and this artifact. By communication I mean the moment when the user is looking at the artifact without necessarily interacting with it because any sensory impulse is a certain sign for a human that can be interpreted.

The phicons that are used with Robbi to represent different feelings are purposely made to be very vague visually so that their semiotic meaning can vary drastically. The point is to allow children to interpret the sign in a way that is very personal for them so that it is not only defined by culture in the meaning of communication with other people but also by some kind of inner culture that is influenced by a child’s emotional and mental condition. For a child of mental health care there is a culture that consists of the environment, people’s presence, everyday routine, family and society, traditions, etc. (see chapter 2, figure 1) that influences their mental state in some cases together with physiological reasons. The mental state and personal psychological characteristics (that can vary a lot from an ordinary child with similar cultural settings) create what I would call “inner culture” that makes this particular child an interpretant. According to the Peirce triad of semiotics (Mick, 1986) shown in figure 10, we leave an Object open-ended and assume that any sign can stand for any object so that the user can decide for him what the object that is represented by this sign is.

Fig. 11. Peirce’s triad of semiotics applied for the Robbi project

Exactly the same thing happens in relation to the image of the facial expression of the toy. This image represents a facial expression that for the designer and for the psychologists can be related to a certain feeling, emotion, fear or thought. However, for the child, for his semiotic paradigm the interpretation of this sign might be different. So assigning the visuals of facial expressions does not underlie any specific “object”, any defined meaning that we assume the child will get. The object of the sign “facial expression” is also left open-ended and up to the interpretant to decide on its meaning and to discuss it.
The concept of avatar as representation of self

The concept of Robbi is a representation of one’s identity similar to the idea of an avatar in virtual worlds of computer- and video games. People present and express their identity through interactions with the other and with the surrounding world.

Avatar as an important feature of video- and computer games is usually defined as a virtual body that is controlled and customized by the user (Ducheneaut, 2009). This concept is applicable for this project as well since we create a representation of person’s identity and emotions visualized as a human-like creature. The main purpose of an avatar in a computer game setting is communication with other users and with the interface. At the same time Ducheneaut says that it is a “tangible” representation of a user’s identity. The word “tangible” is used in this article in a figurative way, while Robbi makes this tangibility literal. Most of the computer game users are creating avatars as idealized identity of themselves so that in many cases it can even help people with low self-esteem (Bessiere, 2007). At the same time the users who project their idealized self onto the avatar feel stronger emotional attachment to it and it allows a way of identity exploration for those with low self-esteem. As the users are emotionally attached to their avatar at some point they tend to behave at his idealized self that can be seen as a positive influence.

A paper Presenting Identity in a Virtual World through Avatar Appearances by Neustaedter and Fedorovskaya (2009) showed that not every user of an avatar identity idealizes it. There are two groups of gamers: first create an improved version of self, something that they fantasize or wish to be while the others’ avatars look as realistic as possible and while creating them the user is trying to make an avatar resemble of him/herself. This point is also relevant to the settings of a conversational psychotherapy session where usual discussion goes from self-identity as “how I feel and see myself”, “how others see me”, “how I would like to feel, behave and look like”.

Prototyping

Visualization of the feelings, affects and emotions

Prototyping is an important part of the current project. There was no access to the user so there is a need to test the method that was used during the design process. Creating a high
fidelity prototype that can be tested in the real-world settings is a right decision in this case. The first stage on the prototyping is to prepare all the images that are going to be used as facial expressions. The images for the prototype were created according to the classification of affects by Silvan Tomkins. It is a classical psychological theory that explains emotions and physical representations of the emotions through bodily reactions, facial expression and body language (Kelly, 2009).

Positive:
Enjoyment/Joy
Interest/Excitement

Neutral:
Surprise/Startle

Negative:
Anger/Rage
Disgust
Disssmell (reaction to bad smell)
Distress/Anguish
Fear/Terror
Shame/Humiliation

According to this classification all humans have the same 9 affects that can be expressed through different emotional state. To specify the terms “feeling”, “emotion” and “affect” it is reasonable to use Kelly’s (2009) definitions. Feeling is the inner biological trigger that results in one of nine affects that can be described through clear and specific words. Emotions are more personal and not so literal expressions of the affects. For example the affect of being angry can result in screaming, sweating and cursing for one person and in just a meaningful gaze for another. The concept of Robbi represents feelings as the phicons, small objects that can be placed inside and emotions as images of facial expressions at the screen (hereafter referred to as: items). Affects that are in between feeling and emotion are something to discuss for the patient and psychologist, to articulate it through an engaging conversation.

For the prototyping the affect categories were not used literally. Some facial expressions of the emotions can mean different for different people in different situations and state of mind, especially for children with unstable psychological condition that is why the categorization is not particularly important here. Each category of the affects can have many sub-categories of the emotions characterized by intensity of the emotion or other nuances. According to the discussion with participating psychologists, two buttons can be useful or not depending on the particular situation. For instance some children cannot define the categories clearly so the
white button would not make any sense for them, while for other children the category of the affect is more relevant than particularities of an emotion. The prototype was created in such a way that the red button that switches the emotions can be used just to go through all existing facial expressions and the white button is not necessary in this case.

All the 24 images used for the prototype are represented in Appendix 1.

**Physical prototyping**

In order to prototype Robbi (figure 11) I am using a physical prototype based on the Arduino. The materials for the prototype are following:

- Arduino Uno board
- Arduino TFT screen
- Arduino prototyping shield
- battery 9v
- 2 buttons
- Wires
- micro SD card
- bitmap image files
- MDF 4 mm
- magnet and hinges
- rope and wooden beads
- acrylic spray paint
- objects to represent feelings: a cotton ball, a stone, a shiny ball, a spiky object, a feather, a puzzle detail, an eraser rubber, a bandage, a candle.

The main goal of the prototype was to execute it at as high level of fidelity as possible to get better, seamless experience during the user testing where it was impossible for me to make any observation. To do this, the prototype was created in a visual design, ergonomics, weigh and size that would be child-friendly though taking into consideration all the electronics and possibilities of Arduino-based prototyping.
When using the prototype powered by the 9V battery the first action is to open the bottom part and place an object inside. As the bottom part is closed and the wires are in contact, the circuit is closed and a random facial expression is shown on the screen. A magnet at the place of metal contact works just to keep the bottom part closed and to keep one of the contacting wires fixed. The randomness of the facial expression is based on the idea that for different people an object placed inside can represent completely different feelings and emotions but when a user realizes that there might be a connection between inner object and a facial expression, he/she starts thinking and discussing this connection. The objects used for the prototype are a bandage, a stone, a cotton ball, a textile pad, a spiky stony half-sphere, a rubber eraser, a candy, a dice, a battery, a siny ball, a feather and a candle (figure 12).
During the discussion the facial expression can be changed using the buttons that are also connected to the Arduino board and enable switching through each image or through categories. The names of the images with facial expressions are based on the following system:

pic0000.bmp, pic0001.bmp, pic0002.bmp, pic0003.bmp
pic0100.bmp, pic0101.bmp, pic0102.bmp, pic0103.bmp

and so on where the first two digits mean the number of the category and the second two digits stand for the number of the image so that there are 6 categories with 4 images in each of them.

The white button placed on the right hand side switches through the categories while the red button on the left hand side switches image by image starting from the current category. The battery is placed in such a way that during the user-testing week the psychologist will not need any assistance from the designer and can handle changing the battery and switching the device on and off on their own. The Robbi prototype is made of light 4mm MDF material with the height, width and depth of 154mm, 100mm and 55mm relatively.

The concept prototype leaves a certain extent of openness to the psychologist to modify the content according to the use case. I was trying to embed the open-source philosophy even for the people that are very far away from the technology in their everyday life and professional practice. The concept encourages the psychologist to become designers in some sense not only through concept development but also while using the product. All the images are place on the micro SD card that together with the software allow adding and removing images. For example
if the therapists are dealing with a very special situation where a particular context of the problem is important, they can add images that represent an emotion which fits the context and the child’s state that was not considered in the 24 images that are used for the basic version. The same is applied to the items: anything that fits the size of the bottom box can be used to represent the feeling and to complement Robbi. All those manipulations also refer to such approaches as “design-in-use” and “continuous design and redesign” (Binder et al., 2011) that allow users customize and appropriate the devices while using them. Another term “metadesign” (Binder et al., 2011) means that users are involved in the design process but remotely in time and space not like traditional participatory design methods when a professional designer and a user are collaborating. The concept of Robbi includes all these ideas at some level. To see if the design-in-use is actually happening and how the stakeholders react to the interaction the prototype is being tested.
6. Testing and evaluation

In order to conduct unbiased and objective evaluation of the results of the project the psychologists used a survey developed together with the designer. This type of survey has been used in a similar design setting by Coyle and Doherty (2009) to test a computer game for children mental healthcare without any direct access to the user. The evaluation criteria followed the design criteria to conduct a proper evaluation of the intended results. The statements of the survey had to be judged on the scale “Strongly agree – Agree – Neutral – Disagree – Strongly disagree”. This is the list of the evaluation statements:

- Robbi is a useful “icebreaker”.
- Robbi is a useful “icebreaker”, but it is also more than that.
- Robbi can have a positive impact on the client-therapist relationship.
- The interface distracts the client from constructive beneficial therapeutic conversation.
- Robbi is appropriate for this age group.
- Robbi was appropriate for this diagnosis.
- The two buttons were used successfully.
- Using Robbi helped me to increase the amount of conversation between me and the patient.
- Robbi was used clients were more enthusiastic about sessions than is usually the case.
- Client could successfully use Robbi as a representation of him/herself.
- The inner feeling and outer facial expression concepts were understandable for the patient.
- Client could easier identify him/herself with Robbi than with usually used paper cards.
- It was easy and useful to switch between faces.
- I have used more “feelings-objects” than were in the kit.
- Robbi complemented my traditional ways of working with clients.
- I would like to continue using Robbi with this kind of clients.

After each therapy session the psychologist filled in the survey according to his/her experience, mentioning age of the child and the diagnosis. The survey did not have a goal to evaluate clinical impact on the patient rather to test the aspects of the interface design, further possibilities of development and weaknesses of the concept and applicability of the design. Appendix 2 contains full transcripts of the surveys.
The user tests and surveys were followed by the discussion of the experience. According to the survey results and to the discussion with the psychologists it was possible to interpret their observations of a child using Robbi and to get their own feedback on the functions, usability and the concept in general. The psychologists liked the fact that the Items were abstract enough and it allowed every child find some relations to the objects in a very personal way. A spiky half-sphere represented a fear for one patient while for another it was a symbol of his messy, overwhelming thoughts. Presence of the inner feeling and of the emotional expression made children more engaged and interested. From the therapists’ point of view the fact that the object is made as a toy, is tangible and gives some feedback (is interactive) gives children better playful experience and more fun during the session. The process of interaction between child, feeling-objects and Robbi is fruitful for the therapists as they analyze the way a child chooses an object, react to the objects and how he/she defines the related facial expression.

For those children who have severe problems in verbal communication Robbi was a better help than illustrative emotion cards as Robbi involves more levels of expression, not only the emotion but also an affect and a feeling. Using the props and Robbi a child can visualize the process of the evolution of his/her emotional state.

The interface was user-friendly and engaging in general. The buttons were not however used appropriately and for most children the category button did not make much sense. It would be much better to have “back” and “forward” buttons as it is hard to go through 24 images again just to come back to the previous image.
7. Discussion

The method that was explored in the current project can be definitely used for very different settings that involve people’s traumatic experiences or victimization that they cannot or don’t want to talk about such as working with various activists groups (illegal migration, women abuse, violation of human rights). In such settings the experts and activists who are closely involved with the situation but are not directly experienced can become co-designer and proxies as their opinion is very strong and they are mostly engaged with the situation on a very emotional personal level. This engagement is slightly different from the experience of the psychologists because they are professionally interested in treating a child whereas an activist or a volunteer feels the problem as a part of his/her personal life. However the level of engagement can be comparable in these two situations.

A very interesting question that has been brought up in this project is: who is a real user when working with the experts and other stakeholders? In the beginning of the idea was that the psychologist are only a proxy, a reflection and objective information source. From the first meeting it became more and more clear that the design that is being developed has to meet a need of encouraging communication from the kids’ side but his need is actually a need of psychologists because they are a part that is lacking this communication while children in fact are not interested in this communication, they do not feel this need.

In terms of open content philosophy the project can be evolved further. For example the doctors can create an online database of the images of facial expressions (emotions) that they create by themselves, together with their patients or parents that would allow exchange of the content and modify Robbi according to each particular situation.

Concerning both hypothesis that were stated in the chapter 1 there is no disproof or at the same time there is no direct approval as Robbi complements and enriches the therapy sessions, makes them more playful and unconventional. There is a need of long-term observations and testing to get clear results about the impact of Robbi on the engagement in conversation and self-representation. First time introducing a new “toy” to a child is always something exciting and is accepted with bigger enthusiasm than old materials. From the current and previous projects I see it as an issue for the future research on interaction design for children and methods of user testing.

Another area for the further research that is relevant to the topic is an impact of sensory input for the settings of children mental healthcare. Given project involved mostly tactile input for the feeling-objects such as soft or hard materials, shapes and texture of the objects. Colors and smells could be another strong embodiment of the certain feelings but it requires very careful
and thoughtful handling in this type of settings as senses can trigger also very traumatic and extremely strong feelings for people with psychological states or disabilities.

In general, the project showed some useful results. The changing perspective on the end-user was a red thread throughout the project and still remained slightly blurry as there is perhaps no defined answer to this question. The method that initially intended to have a child as a user actually helped to realize that the person we are designing for is a psychologist first of all. That could be another promising perspective of the further research: a design method that helps to identify, clarify and bring together the needs of different stakeholders.
8. Acknowledgements

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- the programming prodigy Xun Yang for his help with soft- and hardware and his optimism and other people at STPLN Malmö / Arduino.
- all the children around me that give me a reason to be a designer.
References


10. Firth, N., Computers diagnose depression from our body language, New Scientist, Volume 217, Issue 2910, 30 March 2013, Pages 18-19


Appendix 1

Imagery of the facial expressions used for the Robbi prototype
Appendix 2

Evaluation surveys transcripts
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