Understanding users:
A comparative study about informing designers with different information sources

Abstract: Designers need to understand the people for whom they design. In a comparative study we explored how different ways of informing design teams influence their brainstorm sessions on product concepts for a difficult-to-reach user group: children with autism. Teams of designers were informed about this user group in three conditions: (A) only literature, (B) literature + direct contact, (C) literature + video. In one-hour sessions, the teams conducted a discussion, brainstormed ideas, and developed one concept design. The sessions were videotaped, transcribed, and analyzed for signs of empathy. The proposed product concepts were evaluated by parents and teachers of the children. Results show that the B-teams discussed the users most intensively, and produced concepts that fitted the target group best. The A-teams made many false assumptions about the user group. The findings underline that willingness and motivation are key-factors in empathic design.

Key words: empathy, information sources, direct contact, ideation

1. Introduction

In user-centered design, there is a broad consensus that designers should be informed about their user group [e.g., 1-4]. However, less is known about the way in which this informing can or should take place. Designers can learn by meeting (prospective) users themselves. They can also build on the insights of others, by reading literature of experts, or studying field research reports (e.g., personas or video) [11]. These insights involve selection, interpretation, and/or generalization by a third party (user researcher), which can help designers by structuring insights or hinder them by being too abstract. Direct contact brings a rich experience, but typically require a much higher investment in terms of time, effort, and budget.

In this study, we explored how different ways of informing design teams influence these teams' (1) understanding of users and (2) quality of product concepts. This paper aims to provide more insight into the effects of different information sources on designers and their design process.

2. Empathic design

In empathic design, designers attempt to get closer to the lives and experiences of users, aiming to increase the likelihood that products and services fit and enhance users [2]. In design literature, McDonagh [6] defines empathy as the intuitive ability to identify with other people's thoughts and feelings- their motivations, emotional and mental models, values, priorities, preferences, and inner conflicts. Empathy is an individual ability, varying in strength from one person to the other. From experience with others the ability grows over time. However, a designer's empathy level is not only defined by ability. Also a designer's willingness to obtain empathy for users plays a part [3]. For example, a designer who has a personal connection with the user group or a strong commitment to the project is more willing to obtain empathy for these users.

2.1. Empathic design techniques

Kouprie and Sleeswijk Visser [3] report thee main classes of techniques to enhance empathy in design. First, designers can obtain empathy through direct contact with users (e.g., observation, interviews, participation in their activities). The designers see through their own eyes the users' situation, condition, behaviours, feelings, and needs. Many design researchers state their conviction that direct contact is a prime and irreplaceable source for obtaining empathy with users [e.g., 1-2, 4-5, 9]. Still, systematic or controlled comparison studies have not been reported. Second, designers can obtain empathy through communication through another person who has had direct contact. In this practice, user researchers convey designers with stories about the users (e.g., using personas, videos, transcripts). Third, designers can obtain empathy by imagination. The designer steps into parts of the users' experience by simulating the users' condition (e.g., performing role-playing, experience prototyping).

In this paper, we elaborate on informing designers through direct contact and communication, because these involve user data. Informing designers through imagination stimulates designers to imagine the lives and experiences of users without necessarily involving any user data.

2.2. An empathic challenge: Children with autism

The user group in this study was children with a disorder in the spectrum of autism. Autism is an inborn developmental disorder that affects around 91 people in every 10 000. Affected children may display a range of disabilities at many levels, such as impairment in social relationships, communication, and imagination [12]. The official term is 'autism spectrum disorder'. The term 'spectrum disorder' indicates the great variety in ability, needs, and preferences. In this paper, we refer to "children with autism" for short. Most of the children cannot read, write, or speak language. For designers, this user group is an empathic challenge: the experiential world of these children is radically different from children with 'normal' development [10]. With this extreme user group, we expect signs of misunderstanding in the designers' discussions and the designs they produce. Literature is available on children with autism, but much of it is rather theoretical, and does not paint a rich picture of life as is deemed conducive to empathy.

3. Comparative study: Informing designers

In this study, we explored how different ways of informing design teams influence their understanding of users and quality of concepts for these users. Before the sessions on product concepts for children with autism, the teams were informed about their user group based on three conditions. In order to evaluate the empathy level of the design teams, we analyze the teams' discourse during the sessions. The amount of time spent on discussing the users was taken as an indicator of empathy, because direct measurements of empathy are difficult [3] (see paragraph 3.1). In order to evaluate the quality of the generated concepts we ask parents and teachers of children with autism to evaluate the teams' concepts on how well they fit the experiential worlds of these children, because they can provide expert judgements (see paragraph 3.2). Overall conclusions are summarized in table 1.
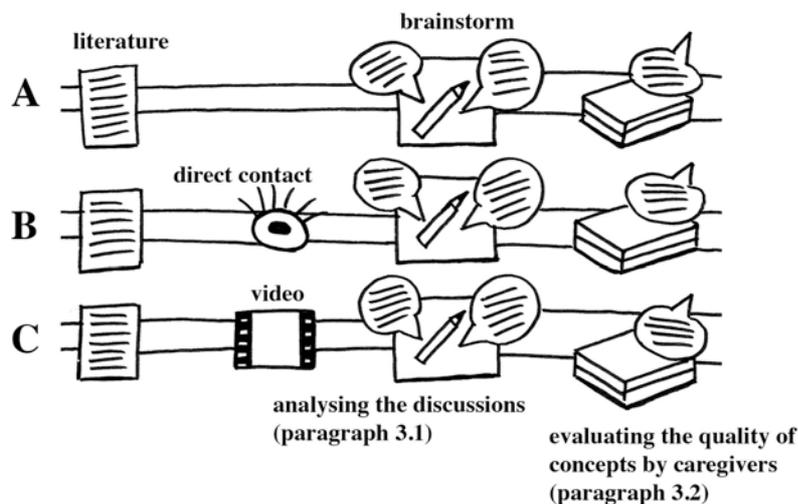

Figure.1 An overview of the study. For each condition (A, B, and C) two teams performed a one-hour session. The teams' discourses during the session were analyzed on indications for empathy and the six concepts were evaluated by parents and teachers of children with autism.

We expected that the B-teams obtain more empathy for their users and design product concepts that better fit the users than the A- and C-teams. Also, we expected that the C-teams obtain more empathy and design better product concepts than the A-teams, because video conveys more facets about the users' experiences than what can be described in literature. For instance, an abstract notion as 'the child with autism is easily distracted by sensory stimuli' gets empathic meaning when you can see (or witness) what level of stimulation it was, how distracted the child was, and how difficult it was to regain its attention.

All teams followed the process as depicted in Figure 1. The teams were informed about their user group under three conditions (A, B, and C). The actual session was similar in setup for all teams.

One week before the sessions, the facilitator informed the designers about their user group and provided them individually with literature about autism. This was a 4-paged text document from the website of the National Autism Society in the UK [14]. This text contained an explanation and characteristics, such as their difficulty with social communication, social interaction, and social imagination combined with examples. The teams did not yet receive their design assignment to prevent them from thinking ahead about design solutions. They were instructed to only use information provided by the facilitator to avoid disturbing influences.

Three days before the sessions, the teams were informed about their user group under the three different conditions. Teams A1 and A2 did not receive extra information (condition A: literature only). Teams

B1 and B2 conducted 30-minute observations of five autistic children at school (condition B: literature + direct contact). Team B1 observed the children in a language lesson. Team B2 observed the children during the activity of eating fruit. They could take notes, ask questions to teachers, and discuss their observations afterwards. Team C1 and C2 watched videos of these 30-minute observations (condition C: literature + video). Team C1 watched team B1's observation of the language lesson. Team C2 watched team B2's observation of eating fruit.

3.1 Evaluation of the design sessions

For each condition, two design teams performed a one-hour session in which they designed a concept for a lunch product for children with autism (see figure 2.). The teams consisted of two or three international M.Sc. design students of the faculty of Industrial Design Engineering (Delft University of Technology). They volunteered in the experiment and were informed about their user group and assignment one week before their sessions. In order not to direct the teams' curiosity towards searching sources of information themselves, the facilitator did not ask for each designers' experience with autism at forehand.

Figure.2 A design team in their brainstorm

Procedure

In a one-hour session, each team designed a concept for a lunch product for children with autism. First, the facilitator instructed the team to design a lunch product for children with autism, fitting their needs and preferences (5 minutes). Then, in the discuss-phase, the team could discuss their user data together (10 minutes). Next, in the brainstorm-phase, the facilitator invited the team to start generate, select ideas, and elaborate ideas into a final concept (35 minutes). Finally, the team presented their product concept to the facilitator (10 minutes). All sessions were videotaped, transcribed and analyzed. The amount of time spent on discussing the users was taken as an indicator of empathy, because direct measurements of empathy are difficult [3].

Results

The transcripts of the sessions show that the B-teams discussed the users more often than the A-teams. The A-teams referred the most of all teams to literature and generated most ideas. The A-teams only discussed users in the discuss-phase of the session. For the B- and C-teams literature played a minor role in their discussions. The B-teams discussed the users for a long time, even in the brainstorm phase. Team C1 did not often discuss the users, while team C2 discussed them even in the brainstorm-phase. The two C-teams differed in their brainstorm-phase. Team C1 was generating ideas most of the time, while team C2 was discussing the users more often. This section describes the course of each brainstorm.

Team A1

In the discuss-phase, the team discussed children with autism in general, probably because their only source was literature. Before the facilitator instructed the team to brainstorm, the team already started thinking about solutions. In the brainstorm-phase, the designers made wrong assumptions about the user group. For example, *"I think they always go to normal schools"*. Another designer mentioned an idea about a timer in the lunchbox: *"This helps not to forget their lunch"*. Even though a timer on itself could be a good idea for these children, you

would not use this as an argument if you had observed the structured days of these children. Moreover, one designer referred to a movie about amnesia and said: *"I thought people with autism also have memory problems"*. They largely based their ideas on their imagination instead of the literature.
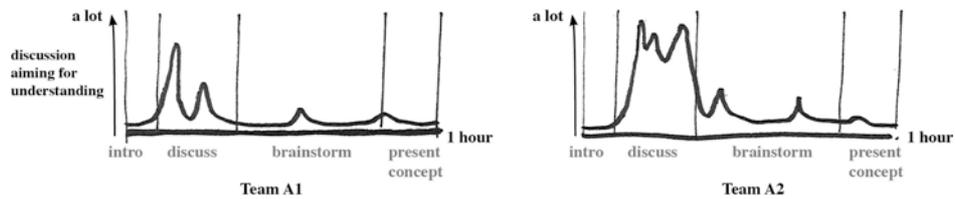

Figure. 3 An impression of the amount of discussion in time during the sessions of team A1 and A2.

Team A2

Coincidentally, one of the three designers had a far acquaintance that had an autistic child. Therefore, this team should be considered partly as a B-team. This designer added real life examples to the characteristics of the user group, because she was acquainted with one autistic child. In the discuss-phase, the team discussed how this specific child fits the literature. They generated ideas for this child instead of children with autism in general. However, they were uncertain about the characteristics. For example, one designer wondered out loud: *"Do they have any physical disabilities?"* The designer without prior experience based their ideas on the literature and their imagination, while the designer who met this autistic child once based her ideas on this one contact.

Team B1

In the discuss-phase, this team discussed their observations about the children and teachers from the school. Also, they mentioned the literature about three times. Their ideas were based on these findings from observations. And even during the brainstorm-phase, they kept referring to their visit. They thought of their own youth to come up with ideas for the kind of food that can be put in their lunchbox. Moreover, they involved findings from their observations, such as learning to speak, routine, the use of pictograms, and rewards in their idea development.
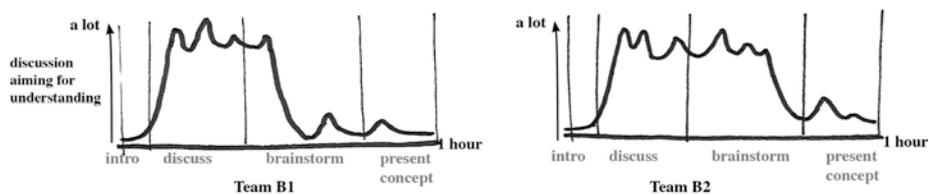

Figure. 3 An impression of the amount of discussion in time during the sessions of team B1 and B2.

Team B2

In the discuss-phase, this team only referred to their observations from the visit. They did not refer to the literature at all. They discussed the specific children and teachers they met at the school and based their ideas on their observations. In the brainstorm-phase, the team got stuck in discussing the use scenario. They did not know and could not reach agreement on whether the children would carry their own lunch to school or that a parent or teacher does this.

Team C1

In the discuss-phase, this team discussed children with autism in general and not the children they saw in the movie. They started sketching before the facilitator instructed them to do so. The team had difficulties to come up with ideas for the user group; the facilitator mentioned this team was not that motivated during their session, because of their passive attitude. In the last part of the brainstorm-phase, the team had most ideas. These ideas were not based on the movie. As inspiration, the team used their own imagination and their experience with 'normal' children.
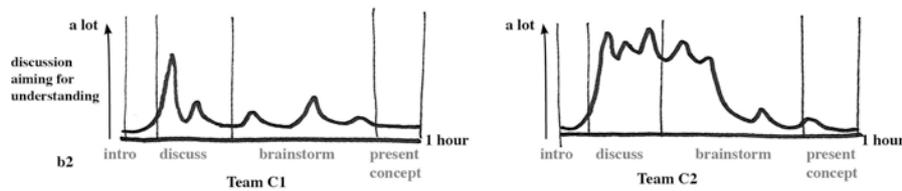

Figure. 5 An impression of the discussion about users in time during the sessions of team C1 and C2.

Team C2

In the discuss-phase, this team discussed their observations from the video. The team discussed the characteristics of each child and teacher in the video. Two times they referred to the literature. The team's discussion about the user group continued in the brainstorm-phase. Their ideas were based on their findings from the video and the document. The designers were often referring to the activity of eating of fruit, because this is what they saw in the video. During the first part of the brainstorm-phase, their discussions were about the design criteria for the children and the teachers. The last part was mainly about the detailing of the product.

Discussion

As expected, the desired order of sources to evoke discussion about these users is: (B) visiting them, (C) watching a movie, and (A) reading a document. The B-teams were actively involved in empathizing with their user group and had a common ground for discussion. These teams gathered their information with their team in the situation and had the opportunity to share and discuss their observations during the 30-minute bus trip back home. Interestingly, the B- and C-teams considered parents and teachers during the session. These teams considered them as part of the context of product use, while the A-teams only discussed the children.

The B- and C-teams hardly referred to the provided literature in their discussions. Observing users in a real situation or on video makes more impact on designers than reading literature.

The A-teams had the least information to discuss. Both teams started to generate ideas before the brainstorm-phase started. They easily made (wrong) assumptions to start ideation. Apparently, the designers automatically filled in their knowledge gap to continue their session. Interestingly, the designers who met the children had more problems in quickly making assumptions. For example, team B2 discussed a long time about who would carry the lunchbox to school. The B-teams wanted to get the details right.

3.2. Part 2: Evaluation of the concepts

To assess which team produced better fitting designs, three parents and two teachers of children with autism were asked to evaluate the six concepts. Parents and teachers are experienced with these children, and therefore can provide a good indication on whether a product concept fits the user group. An independent illustrator made drawings of the six concepts to visually elaborate them all on the same level, preventing variation of drawing skills between the design teams from influencing the evaluation. The designs are shown in Figure 6.

Procedure

The parents and teachers blind-reviewed the six product concepts by means of a questionnaire, in which they for each concept were instructed to study the drawing, the description and the argumentation of the design team. Next, they were asked to what degree the concept fits the needs and preferences of children with autism or not, and to explain their motivation. Finally, they were asked which concept they think fits children with autism best.

Results: quality of concepts

In general, they evaluated the concepts of the B-teams more positive than the C- and A-teams. In fact, as we expected, the concepts from the A-teams were evaluated relatively negative. The concepts of the C-teams ended up in the middle according to the caregivers.

Team A1: A lunchbox with a help screen
The team motivated in their description: *"Our lunchbox was just a lunchbox, because children with autism want to feel as normal people"*. The speech therapist reacts negative on this statement: *"I don't think these children feel as normal people. Moreover, I think a screen doesn't work, because these children have difficulties doing two things at the same time, such as eating and playing, or eating and watching TV"*. Also a teacher thinks this idea does not fit the goals for the children. One mother said this idea fits her child a little: *"I think it's a good idea for a toy, but not for eating. It would distract him from eating. Showing an example of how to play with a toy could be a good idea."* Also the other mother thinks learning while eating is too distracting.
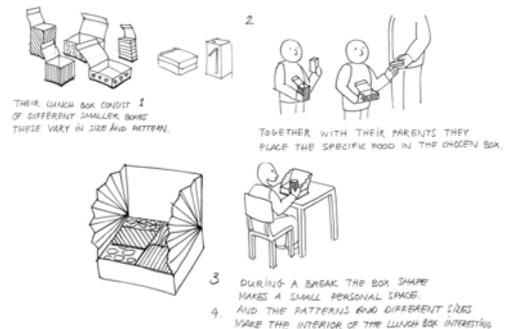
Team A2: Boxes in a lunchbox for clarity
Although one designer had prior experience on autism, the teachers said this idea does not fit children with autism at all. The therapist motivated: *"This box is so interesting, that it becomes play material. For some children, eating is impossible like this. However, filling the little boxes together with a parent or teacher and putting them in a big box is fun and educational. I can imagine this can be used for other activities than eating a meal"*. One Mother thinks this idea fits her child only a little bit: *"My son likes to eat food separately. For example, he eats meat separate from potatoes. This gives a feeling of control and safety. I like the idea of a screen to make a private space; I can imagine the children like this. But the separate boxes distract my child too much. He can put them in a row or build a tower without actually eating"*. One mother thinks it is a bit complicated: *"For many children this would be too chaotic, too many options, but I do like the screen. It provides a quite place."* One mother actually likes this idea a lot: *"For some children this screen is nice, and the children can practise choosing. This is good, because often children with autism have difficulties choosing something"*. The screen was the idea of the designer with prior experience on autism.
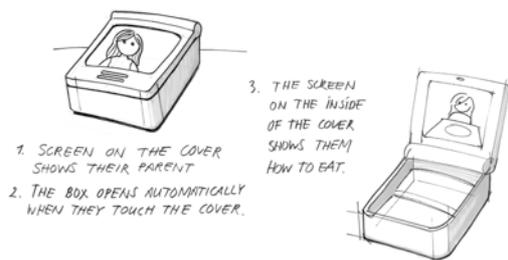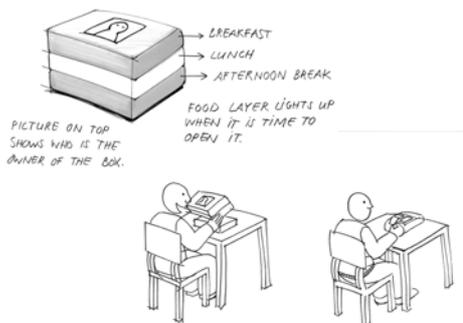
1: A lunchbox with a help screen (Team A1)

The lunchbox has a screen on both the inside as the outside, aiming to show the children how to eat.

2: Boxes in a lunchbox for clarity (Team A2)

The lunchbox can be filled with little boxes for each type of food to make rules between parent and child about the content.
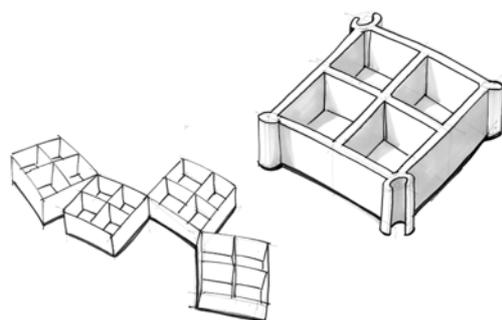
3: A layered lunchbox (Team B1)

The lunchbox has a separate layer for each snack moment. The top layer lights up when it is time to eat. After eating, the layer goes to the bottom.
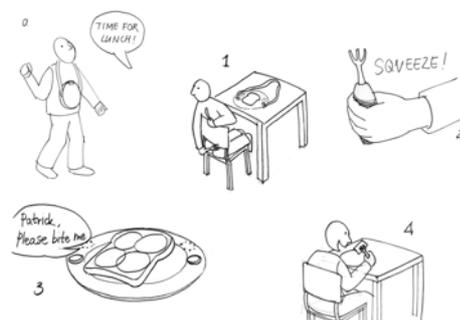
4: Match to open the lunchbox (Team B2)

Children can open the lunchbox by matching the right icons to the icons on the box.

5: A social lunchbox (Team C1)

This lunchbox makes lunch a social activity. When all lunchboxes are linked, they change colour to indicate it is time to eat.

6: Attention to the food! (Team C2)

This lunchbox aims to help the children keep their attention to eating by reminding them each time they are distracted.

Figure.6 Drawings and descriptions of the six product concepts, used to evaluate with parents and teachers.

Team B1: A layered lunchbox

Unanimously, all caregivers think this idea fits children with autism best. One mother explained: *"This lunchbox is most effective for eating lunch. It's important that a child can eat independently in an easy way. You can as a parent yourself determine how you can best use it for your child, because each child is different"*. The therapist said: *"This lunchbox is very practical. It is well structured, visual and tactual. The lunchbox indicates the order and enlarges the independence of the children. In the morning, they can take out all their food at once, instead of one by one. This saves time and provides more independence."* The teacher agrees: *"Working downwards is a good idea, just as the pictograms on top of the box. I would match them with the ones on the plan-board."*

Team B2: Match to open the lunchbox

Some caregivers found this idea matches children with autism for sure. Others think the idea fits the children a little. The teacher thinks the idea is good: *"It is concrete and visual. Many children enjoy puzzling."* A mother agrees: *"It looks nice, and it is a little game to invite for lunch. It is important to change the pictograms regularly to keep the box interesting"*. The other mother motivated: *"The lunchbox is challenging and elicits moments for language and asking for help.*

However, the teacher does not entirely agree: *"Many children experience soft material as unpleasant. This could in the end have negative effect on eating. Moreover, with this lunchbox the children can learn, but I think eating itself can be challenging enough. Therefore, relaxation should be most important, not learning something during lunch"*. Another mother thinks this idea fits the children a little bit: *"I would adjust the pictures to the content of the lunchbox. And if there is sound, I would add for example 'enjoy your meal'. In that way they learn to say that themselves"*.

Team C1: A social lunchbox

Some caregivers disliked this idea, because the children will not understand and enjoy the social aspect. For example, one mother said: *"Children with autism do not want to be social. They (mostly) do not like others to be near their food"*. The speech therapist and one mother like this idea a little. The mother wrote: *"I like the idea of the separate compartments for the food, this will work. Linking the boxes is a bad idea. The children dislike to share, especially their food. While my son is eating, I would not stimulate sharing, because my child should feel safe. Finally, I do like the idea of a sound when it's time to eat. I think the teacher would set this time"*. The therapist said: *"Through linking the lunchboxes, the children come close to each other. Sharing food is in our situation not practical, except when a joint prepared bread meal takes place. A sound to announce lunchtime can result in a lot of commotion"*. On the contrary, one mother actually likes the idea, because it stimulates them in something they are not that good at. She explained: *"The lunchbox seems technological, and this will interest the technicians among the autists. Linking supports the feeling of togetherness, although it can frighten a child to be connected to someone else. This should be introduced well. The sound can be fun, but disturbing for others"*.

Team C2: Attention to the food!

Three caregivers liked this idea. For example, the therapist said: *"Indeed, we remind children over and over that they are eating. The children will focus at the lights in the fork, but it might cause them to pinch their fork all the time. It would be great if the lights turn on when they put something in their mouth. However, the risk might be*

that they put too much per time in their mouth. Some of the children in my class already do this". One mother wrote: *"I like the idea. I have to tell my son over and over he should take a bite. I like the fork, but it should not be too much fun, because that distracts from eating. Pinching the fork with a light is nice too, even though I wonder if the light stays off when that compartment is empty"*. Another mother agrees: *"I like to give my child something to play with that causes effect! Especially when they hear something like eat this sandwich"*. The teacher and another mother think the idea only fits a little. The mother wrote: *"This idea would only fit those children who are quickly distracted"*.

Table 1. Summary of the results from paragraph 3.1 and 3.2

Conditions	Design teams	Understanding	Ideation	Motivation	Caregivers' opinions
Condition A: literature only	Team A1	Making wrong assumptions about the users	Extreme ideas	Low motivation	No fit
	Team A2				A little fit
Condition B: Literature + direct contact	Team B1: Language lesson	Many discussions about the users	Detailed product	High motivation	Good fit
	Team B2: Fruit eating activity				Best fit
Condition C: literature + video	Team C1: Language lesson	Little discussions about the users	Extreme ideas	Low motivation	Low fit
	Team C2: Fruit eating activity	Many discussions about the users	Detailed product	High motivation	Good fit

Discussion

The order of the quality evaluations on the product concepts corresponded to what we expected on the basis of the information sources: (B) visiting them, (C) watching a movie, and (A) reading a document. Especially, the A-teams made many wrong assumptions resulting in product concepts that do not fit the needs and preferences of the user group. The A-teams were not aware of the limitations of their user group. Therefore, these teams could use their own imagination leading to more extreme ideas. They were not led by the existing solutions for the user group, such as the use of pictograms to structure the child's day. The ideas of the B-teams were directly related to their observations. For example, one designer mentioned the lunchbox should say the name of the food each time a child picks something out of it. He based this on the observation that the teacher kept repeating the word *'banana'* when the boy ate his banana. The B-teams discussed and detailed the product in such a way, that it would fit the children they observed. Team B1 and C1 observed a language lesson, while team B2 and C2 observed the activity of eating fruit. Interestingly, these two different subjects had different effects on the session. Observing the language lesson resulted in ideas about the structure of the product, while observing the children eating fruit resulted in ideas about eating. According to the parents and teachers, team B2 and C2 designed better product concepts for children with autism to eat their lunch.

4. General discussion

As the results show, direct contact brings most inspiring and lively discussion about the user group within the design teams and leads to product concepts fitting the users needs and preferences. Although we expected this at forehand, we learned nuances we did not know before. The understanding and quality of product concepts also depends on the designer's skills, willingness, and prior experiences. These variables are difficult to quantify. Of course, skills or prior experience could not be influenced and we did not select designers on these qualities, but willingness to empathize with users seemed to be different in the three conditions.

We noticed some differences in the designers' attitude and atmosphere in the six different sessions. Visiting the school made them apparently function better as a team. These teams have a shared experience: they observed the same activity, in the same room, with the same children. Moreover, in practice, these designers would be already willing to learn, because they took the time and effort to learn about their users. The B-teams were visibly more motivated during the session than the A-teams.

Video has great value in bringing empathy to design teams as well, because it can help designers in communicating the contact to other designers and using their insights from this contact in their design process. However, the designers should be willing and motivated to learn about their users. When observing in real, a designer is actively involved in the data collection. However, when observing a movie, a designer could also take a more passive role. This was clearly visible in the two C-teams. Team C1 was less motivated than team C2. This lack of motivation of team C1 might be due to the fact that the children were not that active in the video of the language lesson. Moreover, the camera was pointed at the teacher who actively taught the children the difference between 'warm' and 'cold'. The design team could not clearly see the children's reactions to this lesson. On the contrary, the movie of team C2 showed the children in their activity of eating fruit. In this activity the children were active. So, seeing the children in active behaviour seems to relate to the motivation and willingness of the designers as well.

5. Conclusions

In this paper, we described our findings of an experiment in which we explored how the way of informing a design team influences their understanding of a user group and quality of product concepts. Compared to informing designers by video or literature, direct contact with users brings most empathy and leads to product concepts fitting the users needs and preferences best. Also video can bring empathy to design, as long as designers are willing and motivated to learn about users. This willingness and motivation appear to be key-factors for empathy, automatically stimulated by direct contact.

Unfortunately, direct contact typically requires a much higher investment in terms of time, effort, and budget. When this is not available, communication techniques, such as video can support a design team, provided designers are stimulated for motivation and willingness.

In further research, we explore the role of direct contact in a design process, and how this contact can be effectively brought to understanding and used in a design project [9].

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