

# PARROT



Spring semester 2012

Group: sw601f12

Jakob Jørgensen

Christoffer Ilsø Vinther

Rasmus D.C. Dalhoff-Jensen

Kim Arnold Thomsen





## Study Report

### Department of Computer Science

#### Aalborg University

Selma Lagerlöfs Vej 300

DK-9220 Aalborg Øst

Telephone +45 9940 9940

Telefax +45 9940 9798

<http://cs.aau.dk>

**Title:** Android

**Subject:** Application Development

**Semester:**

SW6, Spring Semester 2012

**Project group:**

sw501e11

**Participants:**

Rasmus D.C. Dalhoff-Jensen

Jakob Jørgensen

Christoffer Vinther

Kim Arnold Thomsen

**Supervisor:**

?

**Number of copies:** ?

**Number of pages:** ?

**Number of appendices:** ?

**Synopsis:**

This report is a fifth semester report for The AAU Department of Computer science, with a focus on Real Time system scheduability in an attempt to successfully build and program a working color sorter. The report contains a series of hardware tests, Real Time System Theory and Practical use, along with a description of the design and a working implementation of our Color sorter.

*The content of the report is freely accessible, but publication (with source) may only be made with the authors consent.*



## PREFACE

This report is written in the sixth semester of the software engineering education at Department of Computer Science, Aalborg University in the Spring of 2012.

The report is written in  $\LaTeX$  and it is documentation for the project, made in the period from first of February until fifth of June 2011. The semester topic is “Application Development”. The main goal is to gain knowledge about how to make a application. This is done through designing and developing a application in android to android based tablets.

The reader is expected to have some basic knowledge about programming application and knowledge of how to code in android.

The following are general unless anything else is mentioned.

- Cites and references to sources are denoted by square brackets containing alphabetic letters followed by a number, like this; [?]. Sometimes it is followed by a comment used to precise the reference, like this; [?, Comment]. The letter and number is corresponding to an entry in the bibliography.
- Abbreviations will be presented in extended form the first time they appear.

Throughout the report, the following typographical conventions will be used:

- Omitted unrelated code is shown as ‘...’ in the code examples.

All code examples given in the report are not expected to compile out of context.

Appendices are located at the end of the report.

The source code for this report is attached on the CD-Rom at the last page of the report. A PDF version of the report is also included at the CD-Rom.

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**Partisipators of the project:**

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Kim Arnold Thomsen

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Jakob Jørgensen

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Christoffer Ilsø Vinther

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Rasmus D.C. Dalhoff-Jensen

# INDHOLD

<b>Indhold</b>	<b>V</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Motivation . . . . .	1
1.2 Target Group . . . . .	1
1.2.1 Working with Children with ASD . . . . .	2
1.3 Target Platform . . . . .	2
1.4 Development Method . . . . .	2
1.5 Problem Definition . . . . .	3
1.6 System Description . . . . .	3
1.7 Architecture . . . . .	4
1.8 Usability Test . . . . .	4
1.8.1 Approach . . . . .	4
<b>2 Analysis</b>	<b>9</b>
<b>3 Application Design</b>	<b>11</b>
<b>4 Implementation</b>	<b>15</b>
<b>A Notes from Interview</b>	<b>17</b>
<b>B invitation to usability test</b>	<b>19</b>
<b>Litteratur</b>	<b>21</b>

## INTRODUCTION

In order to describe the context of the system, we – as a multi project group – will in the following state the motivation of the project, the group of people we are aiming at helping, the technological platform chosen, the used development method, followed by a problem definition, a system description and architecture, and the conducted usability test.

### 1.1 Motivation

As this is a student report written as part of a learning project, we are required to comply with the study regulation. The main areas of focus, according to the study regulation, are: multi-project management and quality assurance in the form of requirements analysis, requirements management, and testing. The goal is to create a comprehensive software system, across multiple project groups, in order to enhance our competences in analysis, design, implementation, and evaluation of software applications in regards to the system requirements[6]. This project builds on top of a previous project, and is further developed, with the aim of having other students continue the development. The goal of the project, we are building on top of, is to create a touch based tablet system to support children and their guardians in everyday scenarios.

### 1.2 Target Group

Our target group is both children and their guardians. These guardians have certain needs for special tools and gadgets that help to ease the communication between them and the children. Five teachers and educators, who work with children, act as customers. They will provide requirements and information about the institutions' way of working to give us an insight into their daily struggles.



### 1.2.1 Working with Children with ASD

This section is based upon the statements of a woman with ASD [3], explaining what it is like to live with ASD, and an interview with an educator at Birken, a special kindergarten for children (see appendix A for interview notes).

People with ASD are often more visual in their way of thinking. Rather than visualizing thoughts in language and text, they do it in pictures or visual demonstrations. Pictures and symbols are therefore an essential part of the daily tools used by children and the people interacting with them. Also, children can have difficulties expressing themselves by writing or talking, and can often more easily use electronic devices to either type a sentence or show pictures, to communicate with people around them. Another characteristic of children is their perception of time. Some of them simply do not understand phrases like “in a moment” or “soon”, they will need some kind of visual indicator that shows how long time they will have to wait.

Different communication tools for children with autism already exist, but many of them rely on a static database of pictures, and often these has to be printed on paper in order to use them as intended. Other tools, such as hourglasses of different sizes and colors, are also essential when working with children, and these tools are either brought around with the child, or a set is kept every place the child might go, e.g. being at an institution or at home.

There exists tools today which helps the guardians in their daily life, although – as stated in Drazenko’s quote – none of them are cost-effective enough to be used throughout the institutions. From the quote, it is clear that there is a need for a more cost-effective solution.

*The price of the existing solutions are not sufficiently low such that we can afford to buy and use them throughout the institution.*

*- Drazenko Banjak, educator at Egebakken.*

### 1.3 Target Platform

Since we build upon last year’s project, we are bound to use the platform they used, which is tablets running the Android operating system.

In this project we have been provided with five Samsung Galaxy Tab 10.1 devices[5]. The firmware on the tablets is version 3.2. This version, as of project start, is the latest stable version available for these specific tablets. [?]

### 1.4 Development Method

As a part of the study regulation we have been required to use the same development method in each individual group. Two methods have been considered, XP (eXtreme Programming) [7], and Scrum [2].

With the knowledge of both XP and Scrum, we decided in the multi project to use Scrum of Scrums, which is the use of Scrum nested in a larger Scrum project [1].

The reason for choosing Scrum of Scrums is that everyone, at all times, will be able to know what the vision of the project is, and how close every group is to achieving their individual goals of the vision.

Another element of the Scrum method is that a close contact with the customers is maintained. This helps keep the product backlog up to date and correctly prioritized. The customers are presented with the vision of the project, as well as showing the latest release when we have meetings with our customers.

We customized Scrum to fit our project. The changes are as follows:

- The sprint length have been shortened to approximately 7 - 14 half days.
- Some degree of pair programming have been introduced.
- There is no project owner because this is a learning project.
- Everyone is attending the Scrum of Scrums meetings.
- The Scrum of Scrums meetings are only held once at sprint planning.

## 1.5 Problem Definition

The problem statement is as follows:

*How can we ease the daily life for children with ASD and their guardians, while complying with the study regulation?*

This problem statement is necessarily vague to allow the individual groups some freedom in their projects, while we maintain the overall structure of the multi project, however there are limiting factors. We are limited by resources and time available, as we are only working on this project for a single semester. However, all work done in this multi project will be passed on to the next line of students, which means we can make a full system design and pass on anything we do not have the time or resources for. This also requires that our work need to be of such quality that it is understandable by students of the same educational level as ourselves.

## 1.6 System Description

GIRAF is a collection of applications, either fully or partially interdependent, for the Android platform, designed to be used by guardians and children. GIRAF consists of five projects with various degree of interaction. These projects are named Launcher, PARROT, WOMBAT, Oasis, and Savannah. Each of the groups have produced individual products, which are parts of a greater project, GIRAF.

**Launcher** handles execution of GIRAF apps, and at the same time it provides safety features to ensure that a user that is not authorized to interact with the rest of the system will not be able to do so. When the launcher executes an app, it will provide it with profile information, specifying which child is currently using the app, as well as which guardian is signed in.

**PARROT** is an app which provides access to pictograms – pictures with associated information such as sound and text – which can be used for communication. PARROT also gives guardians functionality for adding additional pictograms, as well as organizing the pictograms into categories for ease of access, based on the needs of the individual child.

**WOMBAT** is an app which purpose is to help the children to understand the aspect of time, by visualizing it. WOMBAT provides different ways of displaying time, as well as the possibility to configure the app for the needs of individual children.

**Oasis** locally stores the data and configuration of the GIRAF platform, and provides an API to access it. The stored data and configurations are synchronized to the Savannah server, if available. In addition, an app is provided for the guardian to access the stored data and configurations.

**Savannah** provides Oasis with a way to synchronize tablets running GIRAF. Furthermore, a website is provided to ease administration of the synchronized data.

## 1.7 Architecture

Our System architecture – shown in Figure 1.1 has been designed with simplicity in mind and was greatly inspired by the MVC pattern. This means that the architecture is divided into three layers. The lowest layer is the database where the information is stored. Above this layer is the controller layer which, in the GIRAF platform, is known as Oasis. The controller is responsible for querying the database for information needed in an app and the controller is also responsible for storing information in the database. The last layer is the apps. This division of layers give the GIRAF platform a low cohesion which makes it easier to work with individual parts of the platform independently.

We have chosen to redesign last year's architecture [?] to make it easier to work with. We have simplified the architecture because we feel it is unnecessarily complex.

## 1.8 Usability Test

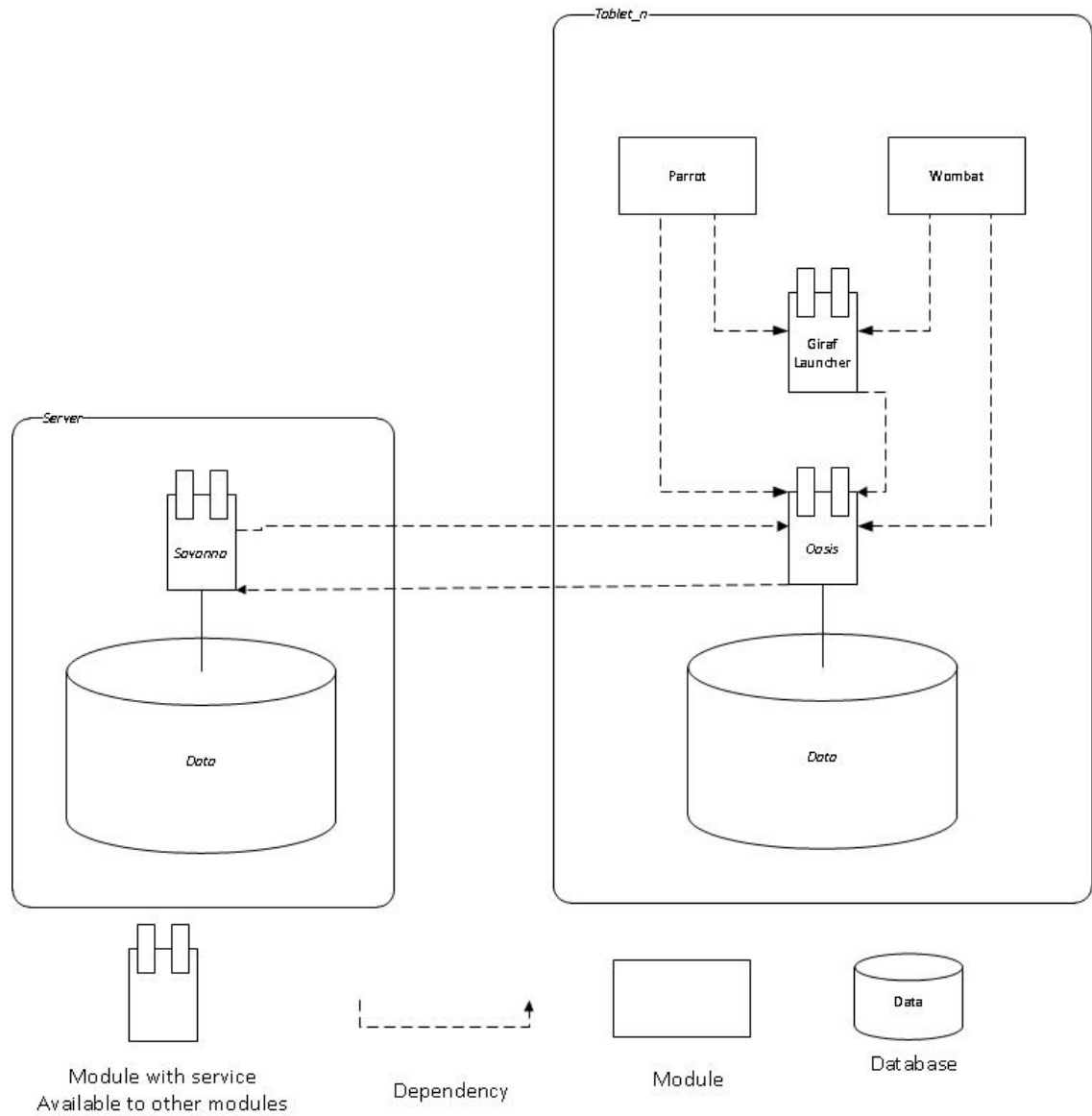
As stated in the motivation, quality assurance through testing of the system is required. Therefore a usability test was conducted in order to measure to current usability of the GIRAF platform as a whole, as well as of the individual parts of the platform. Furthermore, the next wave of developers will immediately be able to start correcting the found usability issues.

### 1.8.1 Approach

The test group for the test is the five contact persons. We assess that they, as a test group, are representative. We base this on them being a mix of pedagogues and teachers, with varying computer skills.

Even if they have some knowledge about the overall idea of the GIRAF platform, and although some of the contact persons had previously informally used some aspects or parts of the system, they had not been exposed to the platform as a whole, and therefore still are of value.

The invitation sent to the test persons can be found in Figure B.1.

**Figur 1.1:** The GIRAF architecture

Based on the fact that the test should be short and the test group is small, the Instant Data Analysis (IDA) method for usability was chosen. [4]

A traditional video analysis method could have been used, but was not estimated to be time-effective enough to be chosen.

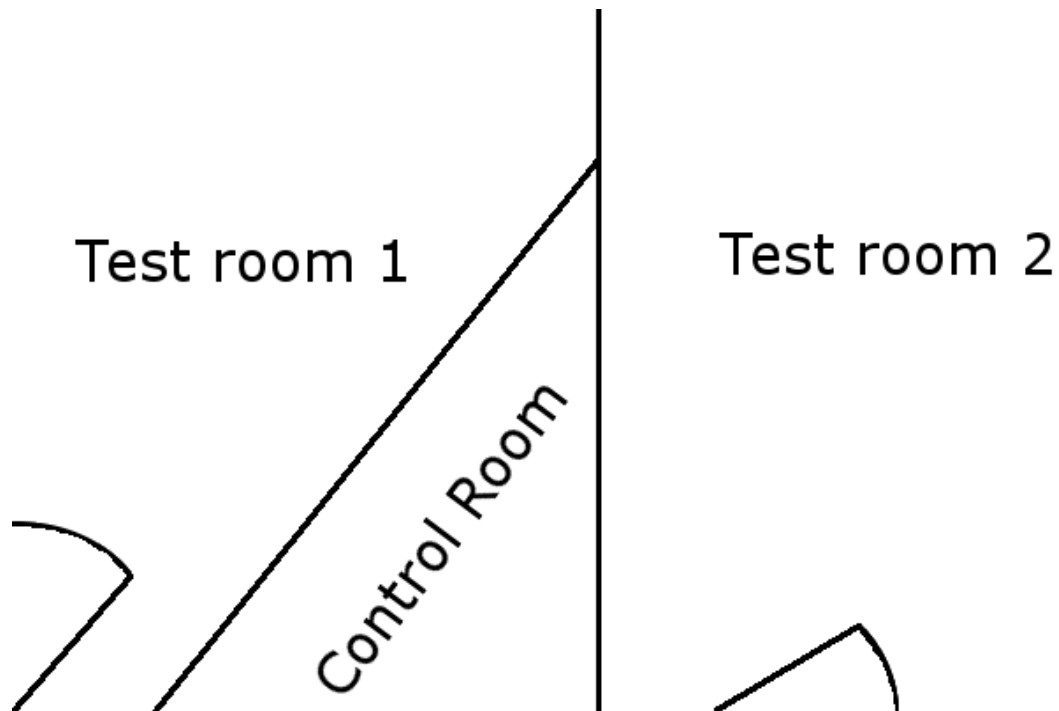
### **Setup**

The usability test is divided into two tests: a test of the three applications, and a test of the two administration applications – tablet application and web application. Each test is assigned a team to accommodate the need to run two tests simultaneously. The teams are made with respect to the criteria of the Instant Data Analysis process.

Each team consisted of:

- 1 x Test Coordinator
- 1 x Test Monitor
- 1 x Data Logger
- 2 x Observers

The usability lab on Aalborg University is designed with two rooms for usability testing and a control room to observe and record the tests. The two test chambers were assigned a test each and the control room were used to observe both tests as seen in figure 1.2.



**Figur 1.2:** An overview of the usability lab at Cassiopeia, Department of Computer Science, Aalborg University.

As an precaution, all tests were recorded on video and audio.

#### Execution



**Figur 1.3:** The schedule of the usability test.

The tests were conducted according to the schedule in Figure 1.3.

Briefing, debriefing, and questionnaire documents can be found in ??, and the results of the test can be found in ??.

## KAPITEL 2

### ANALYSIS

To get a greater knowledge of how to work with children with autism and which tools are in use in the daily work with the children, we have been in contact with Tove Søby, a speech therapy consultant that works with children with autism.

Based on the meeting with Tove, we have learned that one of the tools used in the communication with children with autism is pictograms. The pictograms are used in a schema for the day, where all their daily activities are listed as pictures. This gives the children the possibility to go to their schema and see what they are going to do next. The pictograms are also used for direct communication with the children. The pictograms are used by the children to construct sentences to communicate with others, and also to try to teach them to speak if that is a problem for the specific child.

In the use of pictogram, the problem is that they are very space-occupying, and the tools are not very practical to move around, since they consist of a bookcase full of folders with pictograms. Another problem is that when new pictograms are needed, the personnel that needs the new pictogram has to print them out, cut them out in small squares, and laminate them. So in addition to the folders taking up a lot of space, it is also time consuming to produce new pictograms for the children.

We have also learned that there are various degrees of autism, and how it affects the individual child. This is not in focus of our project, but as the children can have various degrees of autism this means that the children are not the same, as mentioned in the introduction, the target group. This means that the tools will need to be able to adapt to the needs of each individual child.

Therefore, based on what we have learned from Tove and from our own research, it would be practical to have a digital version of the pictograms. So that rather than having a lot of boards



and a lot of books filled with pictograms for the children, they would only need a few tablets with the same functionality, just converted to a digital version.

## APPLICATION DESIGN

Based on the original design for the Digi-Pecs application, modified by the information gathered in the previous chapters, we have come up with the general idea for how we want the design for PARROT to be.

First of all, we want the application to be safe, simple to use, and easy to remember.

By *safe*, we mean that the users of the system should only have access to their own area. For instance, a child user should not (commonly) have access to the options and administration parts of the application, while guardians should not have access to the profiles of other guardians, or children not under their supervision.

For the system to be *simple to use* and *easy to remember*, we want the application to have a relatively simple user interface. Especially because the application is meant to be used by children with autism. Furthermore, the reason for making this application is to make the daily use of pictograms easier. This goes for the guardians as well. If they can't use the system, the children will not be able to learn how to use it.

It is not our thought that the system has to be intuitive, but it is our opinion that if the user is provided by a short demonstration or manual, they will master the concepts of the application in no time.

Designing the user interface has been an iterative process, such is the method of SCRUM. We started by having a look at the design from the report of the previous year (we were unable to see the actual design) and compared it to the tools shown to us by Tove Soby. We decided that we wanted our design to look and feel like the real thing, so we drew up a quick sketch of how the system would look in our opinion.

As seen in the picture, we wanted a speech board to show the current available pictograms, a sentence board to put the pictograms on to create a sentences, and a number of tabs representing different categories of pictograms. We also put a play-button on the design, so that the user could press it to play out the sentence.

The reason for this choice was based on the idea of having the system be as close to the exist-

ing tools as possible. The guardians already have speechboards and sentence boards, and they have lots of folders containing pictograms organized into different categories. This is why we went for the tab style of the categories, as that would make it look more like a folder.

As we began implementing the system, we realized that we had to make several changes. First of all, the size of the initial sentenceboard was too small, it would have to be bigger in order to make the pictograms easily visible. Also, we had to change the design from tabs to buttons, as we discovered that Android does not natively support vertical tabs. We also removed the play-button, mainly because our contact said that she would rather have the ability to play each pictogram one at a time, than only the ability to play the entire sentence. Also, the button took up a lot of the already limited space on the interface.

After the designing of the speech board, we turn continued the parts of the application that is restricted to the guardians for the children. we had to make the design so that the options and the administrations where easy to acces for the guardian when they need to make changes for the specific child that is using the application.

Ww tried to get se what the application from last year did but this was not possible so we began to search for other ways to do so, we can up with that we would use tabs so that we would get a tab for the speech boad, a tab for options for the colors and a tab for the administrations for categories.

The design for the administration for categories we look at have choose to split the tab in three part, first we needed at list over existing categories and a list view to select between the different profiles next a view for all the pictograms that is available the last part is where the information for the category is being given this would which pictogram that should be the button logo, the color for the category and name.

Now we had been through the design for the application, we also have a lot of features for the application:

- **Drag and Drop:** This feature allow the user to choose a pictogram and drag it to it's destination and drop the pictogram. We choose this feature for the application because that we what the application to simulate how the pictograms are used normally, meaning that the user has some pictograms and can "take" a pictogram and put it on the sentence board.
- **Sound:** This feature enable us to play the audio track that is a part of the pictogram. The feature was chosen because we need a way so the user of the application can play the sound of the pictogram.
- **Action Bar:** This feature allow us to use tab in the application. We are using this feature so the options and administrator for categories would be easy to access for the guardian.
- **Color Picker:** This feature gives the user a color scheme so the user can choose which color the speachboard tab should have and the color picker is also used when the guardian chooses color to the categories. we use feature because one of main point in our application is that we can adjust the application to each child.

- 
- **Showing Pictogram:** This feature takes the pitograms that is a part of the the users profile and put it into the pictogram grid in the speech board tab. this feature is important for it is the part that gives us our pictogram.
  - **Sentence Board:** this part of the speech board is where the user can drag pictogram down onto and arrange the chosen pictograms so the user can make a sentence and it is also where the user can play the audio track in the pictogram. This feature is essential for our application since that is it all this application is about.
  - **Database:** This is where the the profiles and pictogram path are stored on the tablet to be used by the application.

So this design ?? we got is controlled by our contact Tove and she gave a positive feedback so we put our design in to production.



# KAPITEL 4

## IMPLEMENTATION

test





## NOTES FROM INTERVIEW

*This is notes from an interview with Mette Als Andreasen, an educator at Birken in Langholt, Denmark.*

Når tiden løber ud (kristian har tage et billede):

Færdig - symbol

Gå til skema - symbol

Taget fra boardmaker

Kunne være godt hvis man kunne sætte egne billeder ind som start/stop symboler.

Rød farve = nej, stop, aflyst.

De har sådan et ur på 60 minutter hvor tid tilbage er markeret med rød, og så bipper den lige kort når den er færdig.

Det ville være fint hvis de kunne bruge sort/hvid til dem der ikke kan håndtere farver, men også kan vælge farver.

Stop-ur:

en fast timer på 60 minutter + en customizable som ikke ser helt magen til ud, som f.eks, kan være på 5, 10 eller 15 minutter for en hel cirkel.

timeglas:

skift farve på timeglassene, men ikke nødvendigvis gøre dem større. Kombinere med mere/-mindre sand. Eventuelt kombinere med et lille digitalt ur, til dem der har brug for det, skal kunne slås til og fra.

Dags-plan:

ikke særlig relevant til de helt små og ikke særligt velfungerende børn. Men kunne være rigtig



godt til de lidt ældre.

En plan går oppefra og ned, og hvis der så skal specificeres noget ud til aktiviteterne, så er det fra venstre mod højre ud fra det nedadgående skema.

Til parrot:

Godt med rigtige billeder af tingene, som pædagogerne selv kan tage, eventuelt også af aktiviteter, så pædagogerne kan have billeder af aktiviteter som de kan liste efter skeamet.

Der var mange skemaer rundt omkring, og der henviser det sidste billede i rækken til næste skema, som hænger f.eks. på badeværelset eller i garderoben.



## INVITATION TO USABILITY TEST



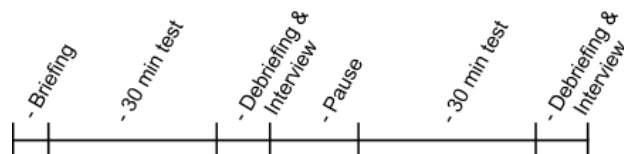
Kære ekspert

Vi vil gerne inviterer dig til at deltage i den første brugervenligheds test af GIRAF, en Android applikation bygget til børn med autisme. Formålet med denne test vil være at undersøge hvor brugervenlig applikationen er og hvor nemt eller svært det er at bruge den. Derfor er det helt fint hvis du aldrig har set eller hørt om denne applikation før nu, da vi gerne vil observerer, hvordan første gangs brugere så vel som brugere med kendskab til applikationen, har det med denne applikationen.

Bemærk venligst at vi er ikke tester din kendskab til applikationen eller evner med en tablet, men derimod om GIRAF applikationen er nem at bruge, vi har kun interesse i at kende til de svagheder der ville være i applikationen. Dette betyder også at du ikke kan give nogle forkerte svar, da du er ekspert.

Derfor vil vi gerne inviterer dig ud i vores brugervenligheds laboratorie, hvor vi kan studere din brug af applikationen. Under brugervenligheds testen vil du blive givet en række opgaver, som skal udføres. Yderligere vil du blive bedt om at tænke højt og fortælle alle tanker, indtryk og valg du tager ved brug af applikationen under testen. Under testen af applikationen vil der blive optaget både video og lyd, til at studere testen senere.

Dagen kommer til at bestå af:



Vi vil meget gerne høre fra dig hvis du har lyst og tid til at deltage i denne brugervenligheds test, den 22/5 - 2012, på Aalborg Universitet.

For at vide hvornår på dagen du kan komme vil vi gerne, at du går ind på denne side (<http://www.doodle.com/d2h6swgbtsdf6z2b>) skriver dit navn og vælger det tidspunkt på dagen du helst vil komme, dette er svar nok for at vi ved du gerne vil komme.

Kommentarer og spørgsmål kan sendes retur til den mail invitationen kom fra.

På forhånd tak,  
Android projektet  
Software 6. semester  
Aalborg Universitet  
Selma Lagerlöfs vej 300, 9220 Aalborg



**Figur B.1:** Invitation sent to the test persons of the usability test.

## LITTERATUR

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