

# TIM

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Tangible interface for instant messaging

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## Project description

In this project the team will design an alternative to the GUI-approach of Instant Messaging, using a physical object which reacts in different ways to the digital signals. Sensing these physical actions through the fingers and matched to the visual functionality of the status window. In this way, the interaction between the screen and the physical objects provide a more 'tangible' interaction to emphasize the messaging experience.

The design process should involve the following steps:

1. Define the functional requirements within the current status window.
2. Come up with tangible alternatives for these functionalities. Use different creativity techniques like 'Interaction Relabelling', 'Tinkering' and 'Design Moves'.
3. Integrate the tangible alternatives into several concepts
4. Realize the best concept (both in hardware and software) – Make a good working physical model and GUI screen interface.
5. A preliminary user study to investigate the effects of the tangible extension against the basic GUI.

This project focuses on the tangible interface design rather than programming skills. As required, the students should have done Java A and B, and had finished one of the Java projects before this project. The students will develop further in object-oriented design and programming, Java design patterns and network communication protocols. To reduce the programming workload and to have more time for tangible interface design, the project will provide the students with a full Java implementation of an IM client based on the XMPP (Jabber) protocol. A set of LEGO robotic kit with extra sensors will be provided to the students to implement the intelligence and the mechanism of the objects. Along with the physical model, The students need to implement the behaviour of the tangible objects, and the communication between the Jabber client (GUI) and the objects.

This is the project description. We summarized it and made our own goal:

Our goal is to aim at multiple skills of Instant Messenger users by changing parts of this Graphical User Interface (GUI) into a Tangible User Interface (TUI)

## 1. Abstract

In this project our goal is to aim at multiple skills of Instant Messenger users by changing parts of this Graphical User Interface (GUI) into a Tangible User Interface (TUI).

We did research on tangibility, instant messaging and an existing instant messaging program. From this researched we extracted implication for our concept.

The three concept directions we developed are based on the three main functions of instant messaging; setting and showing status, connecting to other people and sharing emotions. After the interim we integrated these three concept in one final concept. We worked this concept out in lego and programmed it with the aid of jbother in java.

Finally we did a user-test which included also some marketing issues.

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## 2. Introduction

Instant Messaging is a popular means of communication on the internet. Programs like MSN Messenger and ICQ are widely used to exchange text messages within a community of 'buddies'.

The interaction with these programs is through a Graphical User Interface (GUI) augmented with simple sounds to indicate incoming messages. The two main areas of interaction are the dialog window, in which the exchange of messages takes place, and the status window. The status window informs the user about several things. It indicates the status of others, e.g., which of his buddies is online, who is sending a message, if buddies are available or busy, etc. The user can also set his own status through this window, e.g., away, occupied, busy, 'be right back'. Through pull-down menus in this window you can also contact buddies and send them messages or emails.

As a reaction to the dominance of GUI's in human computer interaction (HCI) alternative interaction styles are explored. One of these alternatives is tangible interaction which stresses the importance of the physicality of the interaction. In this approach the physical controls for (digital) input are integrated with the physical representation of (digital) output.

In this project this was our starting point. We did research on tangibility and instant messaging and developed three concept directions depending on the three main functions of instant messaging; setting and seeing status, connecting with other people and communicating emotions.

Our final prototype is a combination of two concept directions (status and connection.) The prototype we produced is made with lego mindstorms and programmed in java with a jabber client. Eventually we also did a user-test and researched the market possibilities.

## 3. Research

### 2.1 Introduction

We decided to research three areas:

- tangibility
- instant messaging (IM)
- an existing instant messaging program and its functionalities

The first area is to get an overall view on tangibility.

The second is to know what instant messaging is from different perspectives. Moreover wanted to look at the advantages and disadvantages of IM to see what has to be in our concept and what can be improved from the existing IM program. We researched an existing IM program to look at the different functionalities of instant messaging to get a feeling for what has to be in the GUI and which functions can be in the tangible interface.

### 3.2 Tangibility [1], [2], [3], [4], [5], [6]

Our definition of tangibility:

Tangibility is a form of human-computer interaction (HCI) in which there is a balance between physical and digital representation (of information) and control of both the computer and the user. The physical- and digital world are linked to each other.

Characteristics of tangibility (that are important in our project) are:

- balance between physical and digital representation and control
- physical and digital information are linked
- physical object embodies representation and control
- output/input controlled by user and computer
- challenging
- intuitive (the control is enhanced by the action possibilities of the product)
- stresses all the skills of people (cognitive-perceptual motor- and emotional skills)
- interpretations of tangible user interfaces can be:

- spatial
- relational
- constructive

### 3.3 Instant messaging [7], [8], [9]

Our definition of instant messaging (IM):

I.M. is a way to send real time private text based conversations over the internet.

Some interesting facts, for our project, about instant messaging are:

- One of the main functions of IM is not talking to people but feeling that you are connected to other people
- People talk to a maximum of four people.

With two of them they have a really active conversation

- People talk with persons whom they know in real life too. So they can recognize people and interpret their reactions
- The subject is more important than person
- The most occurring subject is small talk (chit chat) and romantic talk. It is also used as an easy way to talk with the opposite sex
- I.M. is less enjoyable than visiting or telephone because of the more personal approach
- Groupchat isn't used very often
- Most of the people do on instant messaging in the evening

Advantages and disadvantages of instant messaging (with some implications for our concept):

Advantages:

- multitasking
- more persons
- status
- fast
- cheap
- private
- nice to do in your leisure

Disadvantages:

- grammar mistakes
- synchrony problems
- rambling from one subject to another is difficult
- different expectations about attention
- environment is not visible
- surveillance by status

### 3.4 Instant messaging program

see appendix 1

### 3.5 Implications for our concept

**Tangibility**

- make a tangible interface that meets the requirements tangibility

**Instant messaging:**

- The interface doesn't need more than four buddies who are always visible
- The contact has to be more personal
- It has to be fast and it can be combined with other tasks
- Setting status has to be one of the options
- There has to be an abstract representation of the environment

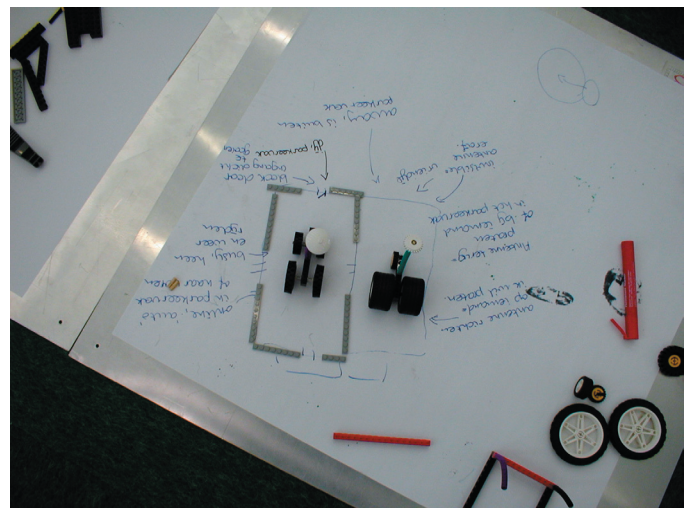
## 4. Creativity session

We wanted to link our research to our creativity session. Moreover we found it important to have a tangible outcome, because that is what this project is about. We choose to do two sessions. One with interaction relabeling and one with tinkering.

Interaction relabeling is about mapping functions of the product you are going to design on an existing object. This way, the group will discover different action possibilities.



The second step is to look at these different action possibilities and combine them in an intuitive way in one 'prototype'. This is what tinkering is about. We did it with lego because our final prototype also has to be in lego.



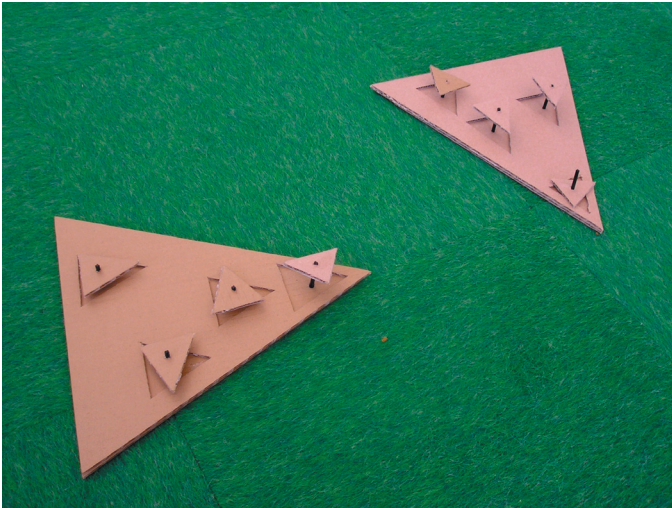


## 5. Concepts

We developed three main concept directions, these are:

- status; changing your own status and buddies changing their status.
- talking; talking and ignoring others
- moods; showing your moods to other buddies

### 5.1 Triangibles (status)



Donald Norman: "The real power of instant messaging isn't the message, but it is the presence detection."

Our concept is based on this idea. You get the feeling of connection with other people but don't know precisely who is online. Although you know the relationship you have with the buddy that is online

Every buddy, your self included, is represented by an arrow. Every buddy can set its status by turning itself towards or away from the user. Somewhere in between means you are busy.

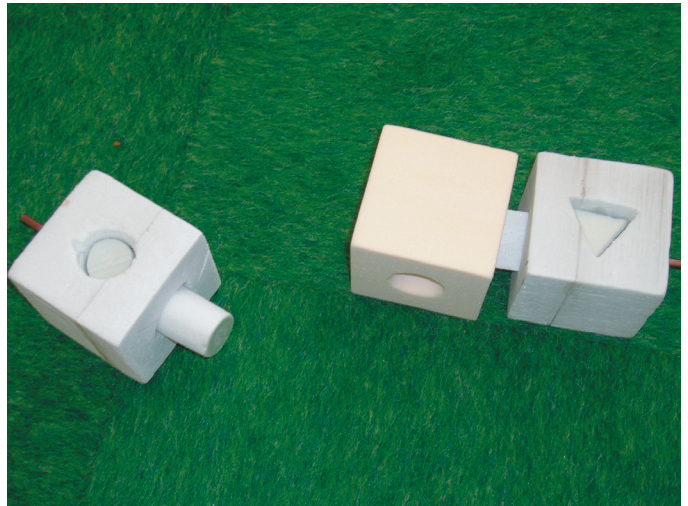
When you are invisible you can take your arrow off the board so you can see the others but they can't see you. When a buddy goes offline he goes into the board. When the user goes offline all the buddies, the user included, sink into the board.

The different distances from your buddy to you represent the relation you have with these people. Good friends are close to you and acquaintances are further away. In this way you can group people.

The arrows have a static link with your buddies and can be personalized.

The functionality to talk to other people is placed in the GUI.

### 5.2 Tangiblocks (connection)



Everyone, including your self, is represented by a block. Your block has different shapes of holes and your buddies have different shapes that can move out of their blocks. When they want to talk this shape moves out. You can see it and connect your block to theirs. Another possibility is to ignore the other and put his shape back into the block. When you want to talk you put your block on the block of the other. If he responds the shapes moves out and you are connected. You can see this because a shape on the top of the block moves down.

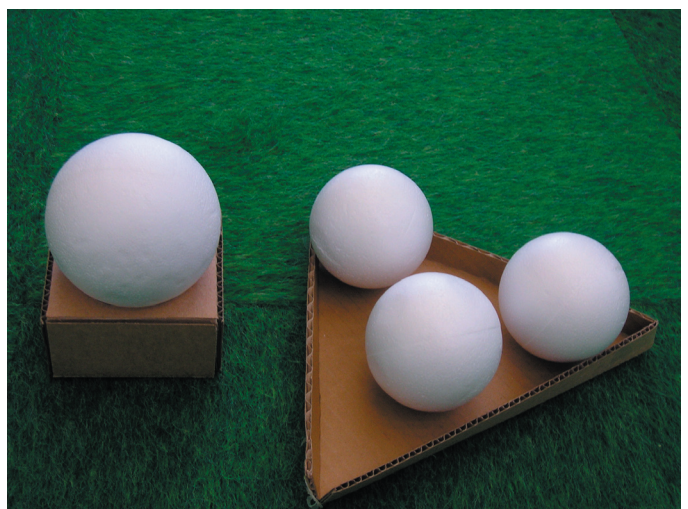
It is also possible to block people. Put them upside down and their shape can't come out.

The movement, when changing status, is also tracked. So you can see the mood of your buddies.

The blocks can be linked flexible to the buddies.

The functionality to set your status and express emotions is placed in the GUI

### 5.3 Tangiballs (emotion)



Everyone, yourself included, is represented by a ball. To log on you put your ball off the other balls and on another platform. So the

buddies who are online are able to start turning around from now on. When you want to talk to a buddy you have to squeeze his/her ball; the conversation screen will pop-up on the GUI. The amount of movement with the ball is, on the buddy's side, represented by the temperature of the ball. So, for example, when you are angry and you throw the ball away your ball, on the buddy's side, will be hot. The research showed that people talk to people whom they know, so the user is able to interpret the movement of the ball of the buddy.

The balls can be linked flexible to the buddies.

## 6. Scenarios

### 6.1 scenario triangibles



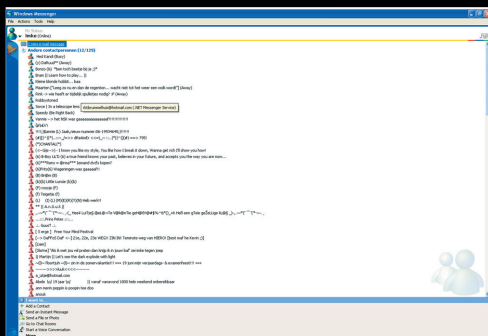
Joep is sick at home and wants to talk with his friends at his study, but everyone is busy.



Joep sets himself to online. His buddies with their status appear



Yvette sees someone comes online



Joep checks who is online



Because he is so bored he wants to talk to Yvette although she is 'just an acquaintance'



Yvette sets her status on away because she is too busy



Yvette decides to set her status to invisible



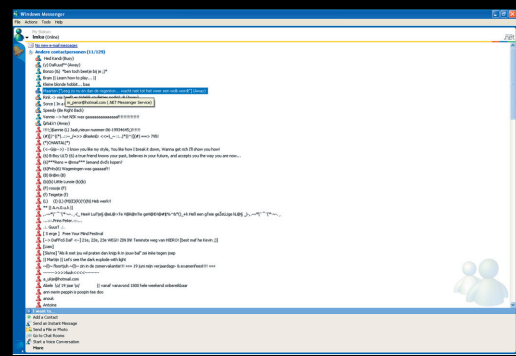
Yvette turns away very fast and then disappears



## 6.2 scenario tangiblocks



Laurens is very busy at school but needs to talk to Maarten because he needs his work to put it in the final report



Laurens sees Maarten is online and links him to a cube. At the same time Maarten sees Laurens comes online and links him too.



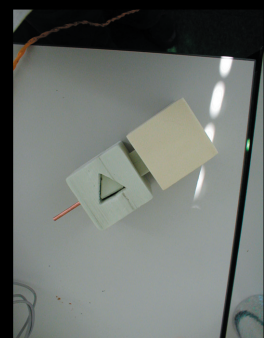
Laurens puts Maarten's cube near his own cube



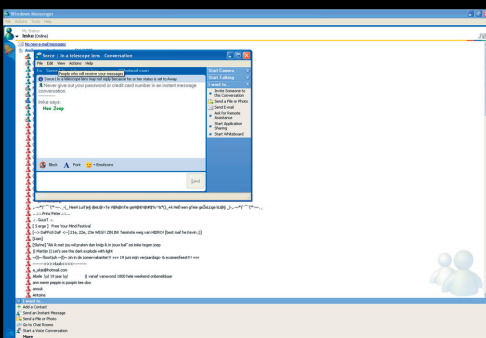
Maarten sees Laurens wants to talk



Maarten accepts the conversation



Laurens sees Maarten accepts the conversation



Laurens gets the work he needs



Laurens ends the conversation



Maarten sees the shape moves back into the block



When Maarten wants to talk again Laurens doesn't accept



The cubes are shut away from each other



Finally Laurens blocks Maarten

### 6.3 scenario trangiballs

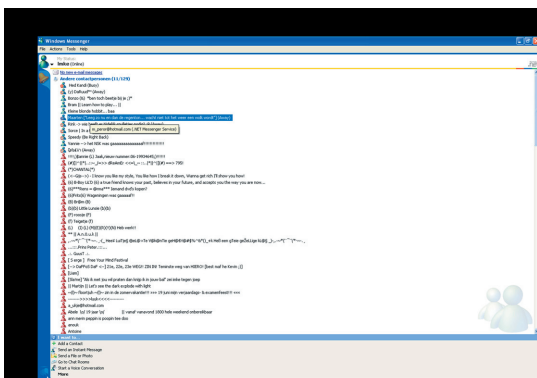


Wiebe his girlfriend has just broke up with him. He is very angry and when he arrives at home he wants to talk to his best friend Erik to explain what happened.

Offline



Wiebe sets his status to online



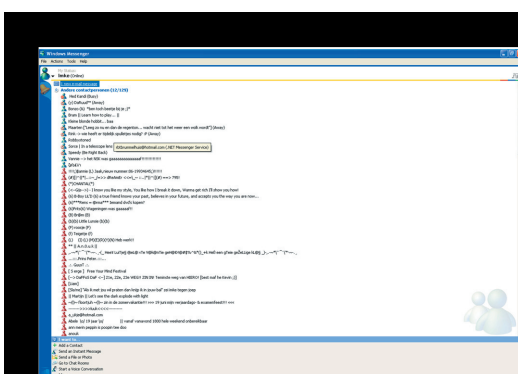
Wiebe sees Erik is online and links him to a ball



Wiebe sees his own status and his friends status



Erik sees someone comes online



Erik checks out who of his linked friends it is

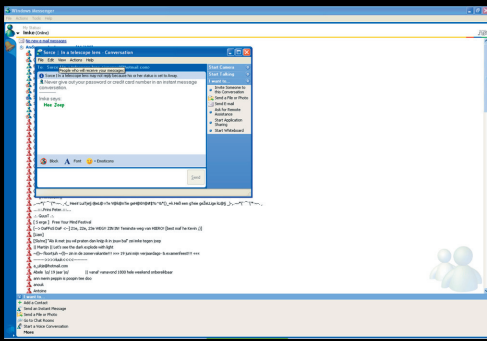


Wiebe interacts with the ball of Erik very roughly



The ball of Wiebe starts shaking and becomes hot





They have a conversation...



Wiebe gets feedback of his own behavior by his own ball.



Wiebe has cooled down

## 7. Final concept

### Frameworks

After the interim we decided to integrate the connection and the status concept. We left the emotion concept because it also has a lot of disadvantages, isn't an option which will be used often and is difficult to implement.

We did another brainstorm and the outcome was 'Frameworks!'

The 'Frameworks' consist of one own station with a frame and at least one frame representing a conversation. Every buddy, yourself included, is represented by a card. All the cards are stored in your own station. These cards contain information about the buddy.

### 7.1 Cards

You can make these cards yourself or get it from your buddies. A buddy can make a card especially for you. It is also possible to make a card of your buddy if you won't see him for a long time. You can change/make these cards the way you like it. Although there are a few restrictions; e.g. about the place where the e-mail address has to be written down.

Of course these cards can contain much more information than only the information needed to chat. So it is possible to put your e-mail address, telephone number or website on it.



### 7.2 Station

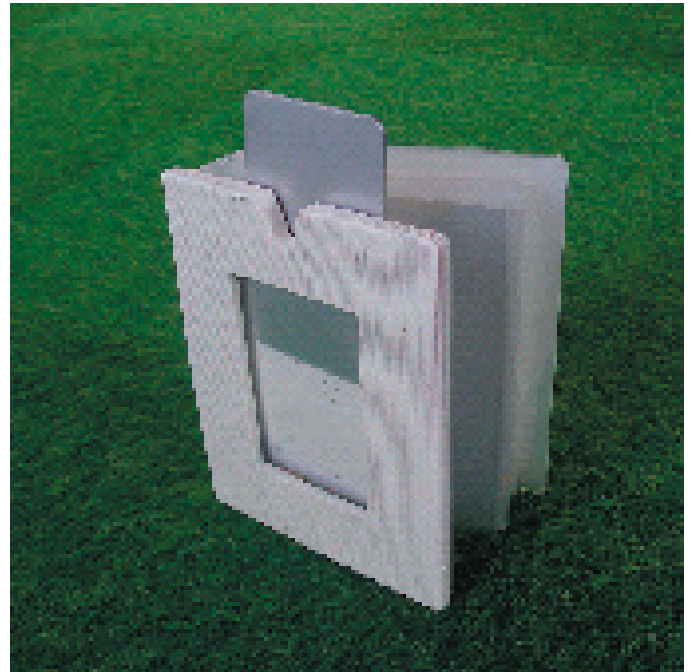
When you sign in you push your own card in your station. Automatically jbother pops up and you can sign in. You can set your own status by changing the height of your own card.

The cards of your buddies are in the different pages of the station itself.

The status of the buddies is represented by their height. The higher the buddy the more available the buddy is. When a buddy wants to talk the card lights up to get your attention.

It is also possible to group your buddies by the different place they have in the station.

The station is personalizable. That means that when you buy it, it is white and you can draw your own painting on it.



### 7.3 Frame

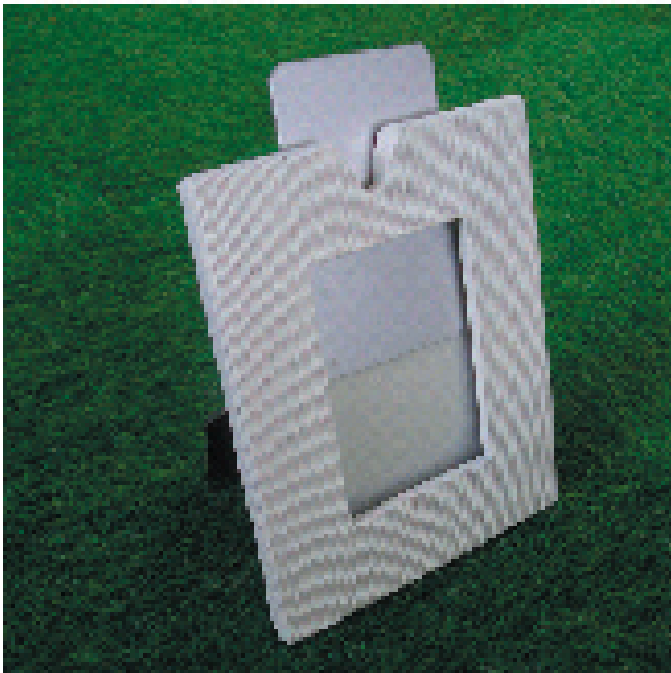
When a buddy wants to talk you, you can put his/her card in a conversation frame and talk to the buddy by pushing the card down. When the buddy talks the frame lights up. Here the status of the buddy is also represented by the height of the buddy.

When you want to talk to a buddy you also put a buddy in a frame (see above.)

When a conversation is refused the card jumps out of the frame

You can group your frames any way you want it.

The frame is personalizable.. That means that when you buy it, it is white and you can draw your own painting on it.



## 8. The LEGO

We decided to build our prototype in LEGO because it is quick and easy to handle.

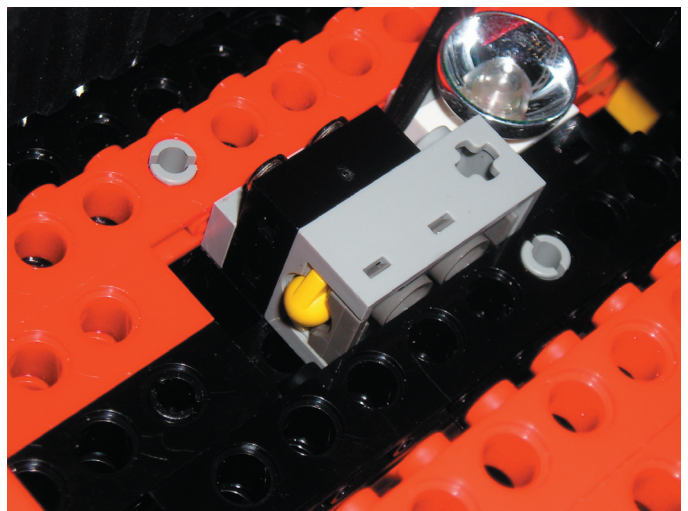
We wanted to make four prototypes; two stations and two frames. So we could really work with it.

We wanted to control two prototypes by one RCX. Our prototype needs the following functions:

- the computer can track the height of the card
- the computer can move the card up and down and fix it on one place
- the user can move the card up and down and fix it on one place
- a light can go on

### 8.1 Tracking height of the card

We decided to work with a combination time- and pushsensors to track the height of the card because this is the most precise and reliable option. The time sensors track the time the caterpillar moves. In this way it counts the height of the card. The push sensor tracks whether the card is totally pushed down or not. A rotation sensor is not reliable and lightsensors are not precise because you have to place a sequence of them to track the height. This would limit the possible height just because we don't have an infinite amount of lightsensors. A second reason was that we just didn't have enough sensor ports for doing this.

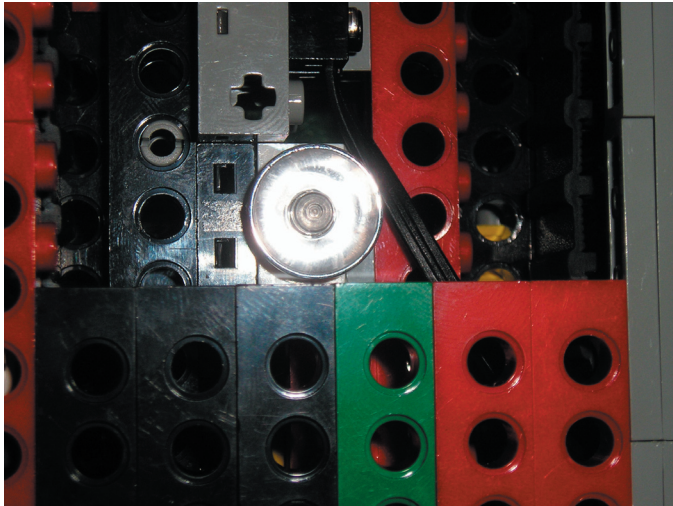


### 8.2 Control height of the card

Here we had a problem. We wanted two things; the user had to be able to move the card but it may not fall down because of the gravity. That's why we choose to work with a caterpillar and a wormwheel and skip the part of tracking the height after the user set his status. The wormwheel makes that the card can't fall down because by this wheel the caterpillar wheels can't be moved by anything else than a motor. Although at the same time it is possible for the user to move the card because the (s)he pushes the card down while letting it glide along the caterpillar wheels. A disadvantage is that the

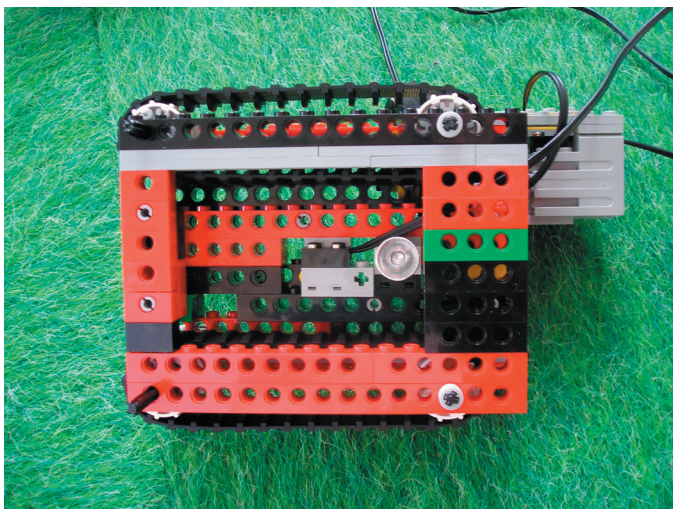
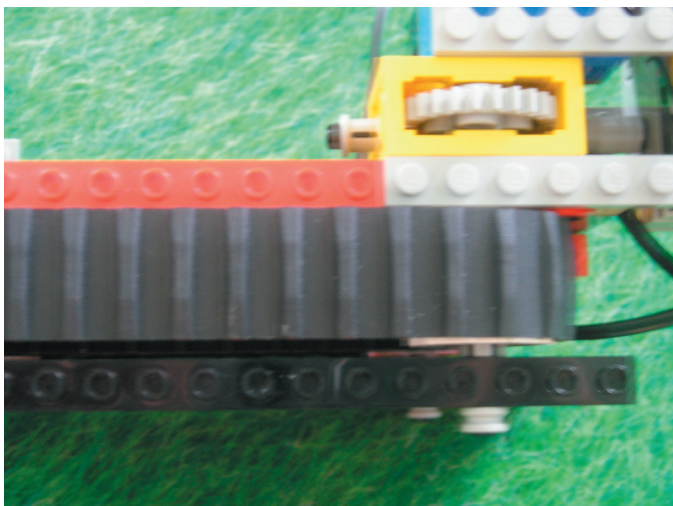


motors won't move in this way and the height can't be tracked. So, in our prototype, the user still has to set his status on the GUI.



### 8.3 Light

This is not a matter of lego, but more of the programming. But of course the light has to be integrated in the prototype.



## 9. JBother

Jbother is a Java instant messenger service. Jbother consist of a lot of different classes and it's not just one code. To let the RCX of lego mindstorms communicate with the Infrared (IR) port on the computer this port has to be imported and new classes should be opened. To avoid a lot of codes to import the Mindstorm classes every time it was easier to make just one class (rcx.class in the dc140 directory) that imports them all. This class is opened every time Jbother starts communicating with the RCX. It imports the following classes:

```

import java.io.DataInputStream;
import java.io.DataOutputStream;
import java.util.Vector;
import josx.rcxcomm.RCXPort;

```

The different actions when the computer should send a message to the RCX are in different Java files of Jbother. The next actions have been defined

Buddy available □ motor A position high  
 Buddy away □ motor A position low  
 Message incoming □ Motor B on for x times (when Sensor 2 == 64% □ motor B off □ open chat)  
 Self available □ motor C position high  
 Self away □ motor C position low

Motor A: Conversation frame motor  
 Motor B: Light on Conversation frame  
 Motor C: Station motor  
 Sensor 2: press sensor inside Conversation frame

To every action described above there is a number connected. After importing the main class :

```

import nl.tue.id.dc140.RCXListener;
import nl.tue.id.dc140.RCX;
import josx.rcxcomm.*;
import java.io.*;
the code for the action can be send to the RCX:
RCX rcx = RCX.
getInstance();
rcx.addRCXListener(this);

```

```
rcx.send('codenumber');
```

On the RCX is a new code which connects a certain action to the send number. It also shows the performed action on the screen of the RCX. The code on the RCX is a try – catch method. This means it tries to connect to the RCX. Only if there's a good connection it was perform an action. An example of a code / action:

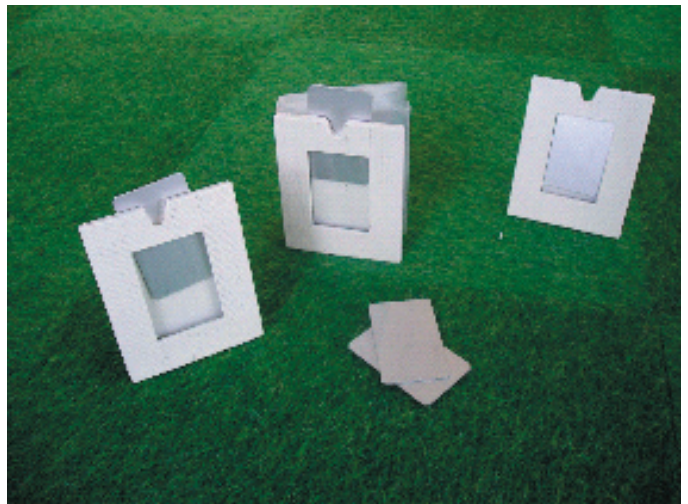
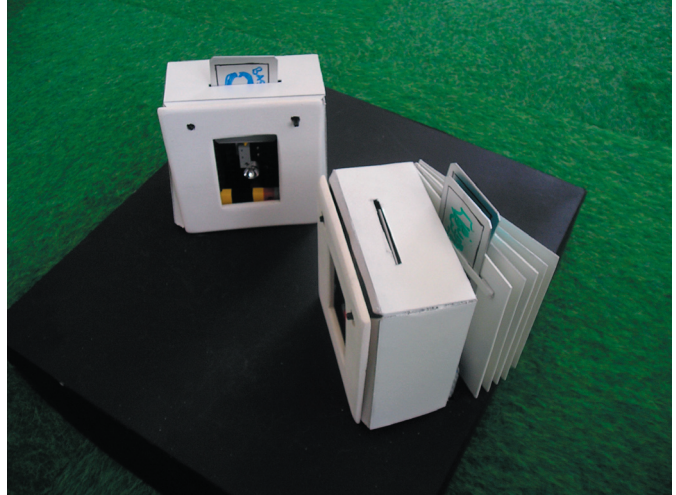
```
if(command == 1){  
    Motor.A.setPower(6);  
    Motor.A.forward();  
    sleep(3000);  
    Motor.A.stop();  
    LCD("1");  
    command = -1; //reset  
command.  
  
    }else if (command ==  
2){  
    Motor.A.setPower(6);  
    Motor.A.backward();  
    sleep(3000);  
    Motor.A.stop();  
    LCD("2");  
    command = -1; //reset  
command
```

Here you can see how the different actions are defined. Line 1 recognizes the command number. Line 2 – 4 define the action on the motor, line 5 makes the action number show on the RCX screen and the last line resets it after the action have been performed.

## 10. Shape of the prototype

We made two prototypes. One half implemented prototype with lego, programmed in java with a white cardboard shell. Another prototype that looked like how the real product has to look like, but totally not working.

PHOTO PROTOTYPE 1



We made the second one because the shape of the first one is not the shape of the real product. And in this case the shape is very important because it enhances the action possibilities of the product.

We choose this shape because:

- The form meets the our requirements
- The station and the frame look like a photobook and a photoframe. These two objects are clearly linked to each other and so the different parts of our prototype aree
- The frame and the station have clear links with the cards because the shapes fit into each other
- People are familiar with the shape of the product on their desktop; it is normal to have photoframes on your desktop



## 11. User-test and Marketing

We did a user-test with five users. The test consisted of two parts. One part was a task; one with the GUI and one with the TUI. The other part was a questionnaire with, in particular, marketing questions.

### 11.1 General comments

When doing this usertest a few things got my attention. In the GUI it was very unclear what the status of the buddy was. The tooltip showed it, but only one user did this, probably by accident. When you are busy and want to let your buddies know that you are busy, it was quite vague.

Some users set their state to DND and did not give in any reason like busy or something. Others set their state to away and gave in as reason busy or working.

In the tangible interface people directly knew how to login. The user thought that when the card was fully inserted, you were fully available for chat. But when they looked at the buddy status they were thinking about their own status. Maybe my own status should be totally up to be available.

Another thing that was not quite clear was that you can only have one conversation in one frame. When they wanted to talk to another person, they just put them in the conversation frame and forgot to take the old one out. I think this was because we only had one conversation frame.

One user found it odd that you had to take your buddy away from yourself and put it into another frame so you can talk to it. But when you see the conversation frame and only as that, the system is intuitive.

### 11.2 The outcome

GUI					TUI				
--	-	+/-	+	++	--	-	+/-	+	++
Fun		III		II				III	II
Price	IIII				II	III	II		
Home	I			II II				III	I
Office		II	I	I I	I	III	I		
Public	I		II	I I	I		II	II	
					0	1	2	3	4
Boxes							II	III	I

Fun factor:

People think the tangible user interface is more fun to work with than the graphical user interface. Comments on this topic were that the GUI works faster and the TUI is too laborious.

Price:

People do not want to pay for a messenger client itself. This is because they believe that other ones are free. They forget all the banners and pop-ups

that this version does not have. For the TUI they are willing to pay. The one that said 0-15 meant 10-15 euros he said in his comments. The price people are willing to pay lies between 10 and 100 euros. Most of them wrote in their comment 35 to 75 euros because of the gadget factor.

Usable at Home:

Most of the users think the software can be used at home, not for some special reason just because it is an instant messenger. The tangible interface is unanimously suitable for a home situation. The users see it more as an add-on to an exciting system, like a gadget.

Usable at Work:

The system itself is too laborious and too distracting from your work to really use in a workspace. The GUI version fits more in a workspace because of the messenger service without any flashing colours and function that have no use at the office.

Usable on Public Computers:

The GUI is suitable for this because of the simplicity. The TUI is too complex and taking all your cards with you all the time is unhandy, especially when you have more than 100 buddies. Some users thought it could be used in flexible workspaces because of the personal cards and the basic frames that everybody can use. The only thing that is different are the cards.

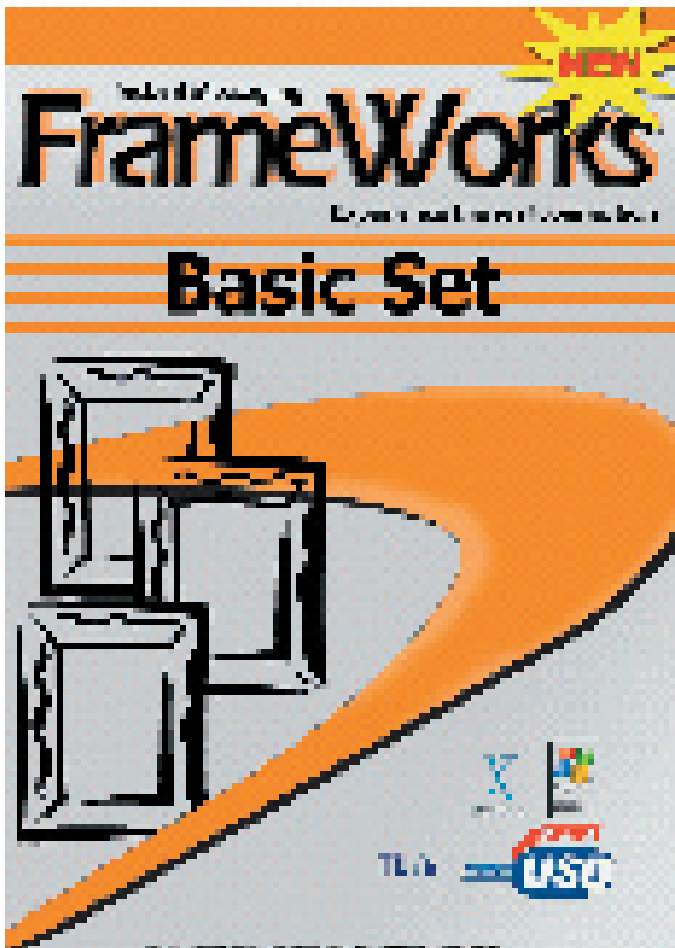
Frames:

People are willing to buy more conversation frames because one is not enough. Users forget to take the old one out when starting a new conversation. More frames are required according to most users. In common 2 or 3 extra frames are needed.

### 11.3 Marketing

From a marketing point of view we decided that in a basic set there is one station, one frame and twenty-five cards to keep or give away. In the test people said that, on average, they want three or four frames. So that means that they will spend money on extra frames. The cards can be bought in sets of 10 pieces.

This will be the box of the product.



## 12. Advantages

The product aims at multiple skills of people, instead of the GUI which aims just at the cognitive skill, by tangibility.

The product is customizable; the user can sign/draw his/her cards, frames and station the way (s)he wants. Another advantage is that the user can recognize different persons/conversations on it.

There can be a physical exchange of personalized cards. This increases the feeling of connection to other people because the user really meets his/her buddy. Moreover the buddy put effort in personalizing the card for the user.

Cards can be used for other purposes. Other data can be written on the back of the card. When the user puts the card backwards in the frame this data can be read and, if it is possible, linked. For example webpage address, telephone number, e-mail address etc.

The product does not limit the maximum of buddies in opposite to our first three concepts which did. The user can have as many cards as (s)he want. The cards of the buddies with which the user talks can be in the frames. The cards which the user uses in the station and the cards which are never used in a drawer somewhere behind.

### **13. Future**

When we would have the possibility to go on with this project we would investigate the following four areas:

Card recognition. There has to be write recognition in the system to identify the buddy and possibly his webpage address, telephone number, e-mail address etc.

Compatible with other I.M. Systems. From a marketing point of view it would be strange if our Frameworks are only compatible with Jabber. We would like to make it compatible with the most common used IM programs so the user can keep on working with the IM program (s)he likes.

Size and material. The not-working prototypes give an idea about the shape and the size of the real product. But they don't consist of the right material. It would be nice if the movement can not only be tested in the half-working prototype but also in a prototype which has the right size and material.

Integrating technology. A lot of technology still has to be integrated when we want to make it as small as our not-working prototypes. For example a microcontroller, servo motors, leds etc.



## 14. Literature

1. Brygg Ullmer and Hiroshi Ishii (2001). Emerging Frameworks for Tangible User Interfaces. Human-Computer Interaction in the New Millenium pp. 579-601.
2. Kees Overbeeke, Tom Djajadiningrat, Caroline Hummels and Stephan Wensveen. Beauty in usability forget about ease of use! Department of Industrial Design, Delft University of Technology The Netherlands
3. Dan Maynes-Aminzade, Beng-Kiang Tan, Ken Goulding, Catherine Vaucelle. Hover: Conveying Remote Presence. MIT.
4. Hiroshi Ishii and Brygg Ullmer (1997). Tangible Bits: Towards Seamless Interfaces between People, Bits and Atoms. the Proceedings of CHI pp 22-27.
5. Scott R. Klemmer, Jack Li, James Lin and Scott R. Klemmer, Jack Li, James Lin. Papier-Mâché: Toolkit Support for Tangible Input. Group for User Interface Research Computer Science Division University of California
6. The design of every day things. Donald. E Norman.
7. Amy Volda, Wendy C. Newstetter, Elizabeth D. Mynatt (2002). When Conventions Collide: The Tensions of Instant Messaging Attributed. *CHI 2002 pp* 20-25
8. James D. Herbsleb, David L. Atkins, David G. Boyer, Mark Handel, Thomas A. Finholt. Introducing Instant Messaging and Chat in the Workplace. Bell Laboratories, Avaya Communications, School of Information, University of Michigan
9. Amy Quinn, Bonka Boneva, Robert Kraut, Sara Kiesler, Jonathon Cummings, Irina Shklovski. Teenage Communication in the Instant Messaging Era. Human Computer Interaction Institute Carnegie Mellon University, Sloan School of Management Massachusetts Institute of Technology.

## 15. Appendix 1

### STD of Jbother; java based jabber client

