

User Evaluation of an Input Device

Marie Lindvall

Master Thesis
Department of Design Sciences
Lund Institute of Technology, Lund University



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Summary

In this master thesis work a new input device for mobile phones, here called Tilty, has been tested and evaluated. Tilty is an input device with which you can press in the centre and on the four “corners” (compass direction).

At first an affordance test (affordance is the relation between perceived and actual properties of an interface detail) with Tilty, affixed on a piece of plastic, was made to investigate how the end-user would perceive it and its functions, without giving them any information beforehand or feedback during the test.

Then the real test prototype, a mobile phone with Tilty replacing the joystick, was built. Iterative usability testing was performed during the design phase, where the mapping of Tilty’s functions to the GUI objects (Graphical User Interface objects) in the existing user interface was done.

At last a final usability test was made. This test checked if the participants would know how to use Tilty when they did a few general tasks with the phone. In this test an unmodified mobile phone, with joystick, was compared to the new prototype – to evaluate which was best for navigation in a mobile phone and to identify issues pros and cons.

The result of this master thesis work is that mobile users prefer Tilty to the joystick. The motivation from the test participants was that Tilty was more usable and “cool”.

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Introduction

The purpose of this master thesis work was to find out if Tilty was a good alternative to the joystick and the arrow keys as an input device for mobile phones, from an end-user usability perspective.

The background is an earlier investigation, which was evaluating four types of input device. The participants of that test were all very excited over Tilty. They thought it was easy to use, fun and a very interesting button. Therefore Sony Ericsson decided to follow it up and this master thesis work was born.

In the earlier investigation the test equipment used was a handheld “box” on which the input device was mounted, connected to a PC monitor, on which a simple user interface application was displayed. To get the most out of a new usability test it was decided that we should build in Tilty in a real mobile phone.

At this time T68 were in the final stage before launching, so T68 was chosen as the platform to perform this work on. Also, T68 has several applications with two-dimensional navigation, which were to be used to test this two-dimensional input device.

This report is disposed almost in the same way as the work during the period of this master thesis work. This was done to simplify for you to understand how, and in which order, my work was done.

Chapter one includes a description of how my work was organized.

Chapter two contains a general description of the input device

Chapter three is about the sample that was used in user test 1.

The prototype, for user test 2 and 3, is described in chapter four.

In chapter five, six and seven you can read about the three tests during the work. For each test are method, results and analysis described.

Chapter eight is an evaluation in terms of REAL – relevance, efficiency, attitude and learnability.

Chapter nine contains the final discussion. This chapter includes a summary of the analyses in the earlier chapters and some recommendations.

In the last chapter a glossary is presented.

In references you can read about where I got my information.

The appendices contain questionnaires and full results are presented.

1. The Work Process

To be well prepared on the topic of input devices, the work started with reviewing several different input devices on mobile phones available on the market (not only Sony and Ericsson phones). Many books were read to ensure high-quality usability tests (see references). When it was time for the tests, the many years of experience among employees in the department proved very valuable for the design of the test, the test methodology, and review of the test materials.

After the introductory phase, it was time to build the prototype, a T68 with Tilty replacing the joystick. In parallel with the design of the prototype, the affordance test (test 1) was prepared, accomplished and analysed. After that, simultaneously with the construction of the prototype, the mapping of the GUI objects started and the final usability test was prepared. The users were identified, the tasks were created and the recruiting of participants started.

As soon as the prototype was built the software department started the programming of Tilty's signal decoding. Simultaneously, iterative usability testing (test 2) of the GUI mapping was performed, to identify any potential problems and be able to fix them as soon as possible.

When the new prototype was completed the final usability test (test 3) started. The last phase of the thesis work was to evaluate the results. One good set of metrics when evaluating usability of a design is REAL – Relevance, Efficiency, Attitude and Learnability (Löwgren, 1993). Relevance stands for how well a device serves the users need, Efficiency is a measure that states how fast the user can carry out her/his tasks using a device and how often the user do mistakes. Attitude is the users subjective feelings about the device towards and after the test and Learnability views how easy the device is to learn for initial use and how well the users remember the skills over time. This is used in this work when the last evaluation is made, after all the user tests.

2. Tilty

Tilty is an input device with flat tiltable surface. It can be pressed at five places: in the center and at four places along the edge, at each of the compass directions (north, south, east and west). However the centre press is not a mechanical feature but a software feature with some limitations (see chapter 4). Presses in the four compass directions are referred to as up, down, right and left. There is a distinct click (tactile feedback) when you press.

3. The Sample

The first Tilty sample, which was mounted on a piece of plastic and used in the affordance test (user test 1), did not have centre press (because no software). It just supported the four press points in the "corners". The size of the plastic is: length = 6.5 cm and the width = 3.2 cm. There were printed arrows for up, down, right and left.

4. The Prototype

The prototype, which has been tested (user test 2 and 3), is a T68 where the joystick was replaced with Tilty.

This phone is working in the same way as a normal T68 with a joystick except on one point (see table 1).

Table 1: A comparison between the functions on Tilty and the joystick

Function	Explanation	Tilty	Joystick	Comment
Horizontal movement	Right and left	x	x	
“Vertical” movement	(towards and away from screen)	x	x	
Centre press	Press	x*	x	*Software feature
Total functions		5	5	

The prototype support centre press, not through a mechanical fifth press point, however, but accomplished through software. When more than one “press point” is pressed down simultaneously the software interprets the signal as a centre press.

The prototype mappings connected each press up or down with one step in the phone menus, just like a joystick.

5. Affordance Test (user test 1)

This test investigated the participant’s behaviour with just the input device – not connected to a computer or a phone. This because they should get as little feedback as possible so that the first actions they thought of and did could be checked out. All in terms of Donald Norman’s (1998) “affordance” which brings up the importance between the perceived and actual properties of an interface detail – in this case an input device for a mobile phone.

5.1 Methods

The participants in the test were recruited through the Intranet of Sony Ericsson, friends and relatives. They were in different ages, male/female, technically/non-technically education and work, high/low mobile phone experience and right/left handed (table 2). Preferably there are at least three in each as suggested by Dumas and Redish (1999). The whole register of participants is viewed in table 2 and as you can see there the ideal about at least three in each subgroup failed in the subgroups with different ages.

Table 2: Participants in the affordance test and the criterion they were recruited from.

Nr	Age	Male/Female	Technical education or work	Mobile experience	Right/Left handed
1	20-29	Male	Yes	High	Right
2	20-29	Male	Yes	High	Right
3	30-39	Male	Yes	High	Right
4	20-29	Male	Yes	High	Right
5	30-39	Male	Yes	Middle	Right
6	20-29	Male	No	High	Right
7	20-29	Male	No	High	Left
8	10-19	Male	No	Middle	Right
9	30-39	Male	No	Middle	Right
10	20-29	Male	No	Middle	Left
11	20-29	Female	Yes	High	Right
12	20-29	Female	Yes	Low	Right
13	30-39	Female	No	Middle	Right
14	20-29	Female	No	Middle	Left
15	20-29	Female	No	Low	Right
16	50-	Female	No	Low	Right

When the participants came into the testing room, a normal conference room, they were told about the obligation to preserve secrecy and what would happen in the test. They were then asked to think out loud through the whole test.

They were showed the sample, which was Tilty on a piece of plastic (chapter 2), and an image (computer rendering) of a phone with a Tilty.

The test included four phases:

- looking only
- unguided exploring - touching allowed
- act on small scenarios they were given
- comment on the sample and its behaviour.

The test is viewed in appendix A.

After the test a drawing of the participant's hand (left or right, depending on which one was used) and also one of their thumb, in profile, was made. This makes it possible to relate the size of the participant's hand and thumb to their comments and questions. At the end they answered a background questionnaire (appendix K) on user profile, mobile phone experience, etc.

5.2 Results

Here are the most important results that were learned from the test. One can read the full combination in appendix B.

- When the participants were just looking and touching at Tilty they thought they could press the centre (≈ 11 of 16) and at the four point of the compass (10 of 16).
- Everybody but one (15 of 16) manoeuvred Tilty with the thumb.
- Ten of the participants did a long press down when going down in a long list.
- Most of the participants (13 of 16) discovered the printed arrows on the casing adjacent to Tilty and it helped them (8 of 16) to find out which properties Tilty has. However, they also said that they thought that the arrows are not necessary for knowing what to do (10 of 16).
- Most of the participants (14 of 16) wanted a confirm in the centre of Tilty.
- The results and comments didn't depend on either the hand or the thumb size.

5.3 Analysis

When the participants were looking and touching at Tilty most of them thought they could press “the corners” and the centre. This version of Tilty is only supporting pressing “the corner”. It appeared that the affordance of the input device gives the users a wrong idea of what they can do with it, since this sample did not support centre press. Therefore it would have been good if the input device could include even the centre press - if it's possible, or changing the appearance of the input device.

Everybody but one of the participants used the thumb when they manoeuvred Tilty. Out of this the conclusion was made that the future users will use the thumb.

The printed arrows, which are placed at the four points of the compass, were often noticed and “used” but most of the participants thought that they do not need them on a real mobile phone. Therefore it is better not to mark these out on the phone and instead distinctly mark them out in the manual or perhaps using a piece of protective sheet, like the one on the display when you by a new mobile phone.

6. Iterative Testing of GUI Mapping (user test 2)

GUI object stands for Graphical User Interface objects and it is simply explained those thing you se on the display. This test was performed to investigate the mapping of Tilty to the GUI objects on a T68. Mapping is one of Norman's expressions explained as “the relationship between the function's looks and use and the result in the world” – reality and control.

The goal for this test was to get an “easy to understand” prototype to use in the final usability test. After iterative testing of the software, with a few participants, a final version was implemented.

6.1 Methods

The four participants in this test were chosen inside Sony Ericsson from the following criteria; two novice and two technically interested people.

The novices were asked to be in the test for checking how easy the mapping was to understand, and the two technically interested for coming up with new ideas or solutions. This was a good idea but it didn't work like that – instead it was the novices that came up with several new ideas.

This test was a short, iterative testing process, which means that the four participants who were in this test did some small tests over a period of a week. The prototype used for this test, just as in the final test (test 3), was the prototype but the software implementation was modified slightly between the tests.

At the first small test every participant did a number of tasks that they were given. Out of the comments they gave and the notes that were taken during the tests - the mapping was changed. Then the same participants tried the phone again, but this time they only tried out the changed task/tasks, and made comments like “the first version was better” or “I want to have them both” and so on. This process was repeated until the participants were satisfied with the software and everything worked like it should. At the end of the first test the participants answered the same background questionnaire as in the affordance tests.

The software was only changed two times before a good version of it was found. The two test forms can be viewed in appendix C and D.

6.2 Results

As being mentioned earlier the prototype was made from a standard T68 and the software is the same with few exceptions. Everybody understands how to use the device and they thought it was very natural movements.

From the tests two more design improvements (wishes) were identified but unfortunately these were too time-consuming to implement before the final test. The first wish was what should happen in time and date. The participants want to change hours, minutes, years, month and days – not digits. For example change the days in the date from 1 to 31 instead of counting up the first digit, from 1 to 9, and then the second.

The last wish is about phone number input. They want it to be possible to step back in the phone number they just entered, and make changes without clearing the whole number. Today there is no key that supports moving in numbers (in standby) because the keys are all occupied.

This test also confirmed the first test's results when maneuvering Tilty. Everything that was tested in these both tests showed the same results. They thought that Tilty supports pressing in the four point of the compass and press confirm in the middle. Note that the prototype in this test didn't have the printed arrows that showed how the device worked.

6.3 Analysis

The result from the test was multiple design improvements, some that was implemented, and some that weren't, due to time constraints. Of course the ideal way to follow up the test is to test all alternatives until the perfect GUI mapping was found, but this was not possible. So the ideas that could be implemented were implemented and a second test was done. This second test just confirmed that the ideas were good and no more ideas came up so no other tests were performed.

A test like this is a good thought but maybe it should be done with just the software programmer, a usability person first and then invite one or two test participants. Many thoughts and ideas from the participants were the same and probably they could be found with just a software programmer and a usability expert.

One other thing that was noticed during the test was that the test participants didn't have so many ideas that we expected. Probably it depends on the prototype – people are hesitant to give suggestions because the prototype seems to be complete. Tests like this should be done with an earlier prototype, one that doesn't look finished and complete.

7. Usability Test (user test 3)

This test is the big one and it's from this test that the most conclusions and discussions are going to be made. The goal for this test is to see whether Tilty or the joystick is the best – the most usability friendly and most attractive input device.

The detailed test plan follows in the next paragraph and the full combination of tasks is to be read in appendix E.

7.1 Methods

In this test the test objects were a normal T68 and Zizzi. Every other participant started with the DiscJog phone and the other with the T68.

The users

In this test 12 users from the ages between 16 and 40 were selected outside Sony Ericsson. Half of them were women and half men - half of the women were left-handed and the other half right-handed, the same for the men. They were all mobile phone users but they had never used the T68 before. The list of all the participants can be seen in table 3 (on next page).

Table 3: Test participants in the usability test

Nr	Female/Male	Age	Right/Left handed	First phone
1	Male	20	Left	Tilty
2	Male	46	Right	Joystick
3	Male	26	Left	Tilty
4	Male	33	Left	Joystick
5	Female	33	Left	Tilty
6	Female	38	Right	Joystick
7	Female	29	Left	Tilty
8	Male	24	Right	Joystick
9	Male	23	Right	Tilty
10	Female	16	Left	Joystick
11	Female	27	Right	Tilty
12	Female	22	Right	Joystick

Introduction

Welcome the test participant to the test and asked if he/she would like some coffee or need to visit a rest room before the test starts.

In the test room:

- Introduced myself and told the test participant about the test room and the control room. Gave the participants a small background for the test and told him/her that we were videotaping.
- Told him/her to read carefully through the non-disclosure agreement (appendix M)
- Told him/her to read carefully through the video consent form (appendix L)
- Explained the background questionnaire (appendix K)
- Asked for looking at his/her mobile phone and wrote down which navigation device he/she had for normal use.

Then left him/her for signing and filling in the forms and went to start the video taping.

When the test person were ready the test started.

Told him/her that we were testing the prototypes and not him/her, and they were asked talk loud through the whole test.

Baseline task

The test participant played with the phone for about 5 minutes and after that he/she was told how the keys (yes, no, c, option key and the navigation device) worked. OBS! It was noted if they found out how the keys worked by themselves or not!

Warm up task

The test started with the first “warming up task”. He/she got the task on a small paper so that he/she could read it on his/her own. When the test pilot were done with this task the real tasks starts.

Directions for each task

Told the test participant the heading of each task – they read the task loud – and then he/she was given the task on paper (the test instructions, in appendix E, were cut in pieces – one task on each paper). On the test instruction paper “the right way” was given to help him/her to find the way to the application. Before they started with the task number six and seven they got a little information about how the application works:

Task 6)

“Now you are going to write an SMS with T9 on. Unlike the normal way to write an SMS you only have to press once on the keys for each letter when you write a word, and the phone guess which word you want to write. In most cases the phone guesses right, but in some cases it guesses wrong. If so, you have to choose the right word among some alternatives. You can only choose a different word as long as the word is underlined. Do you understand?

No – Take the explanation once again in other words.

Ok – then you can start with the task:”

Let the test participant read the task:

Task 6a

Writing an SMS with T9 on.

“You are going to invite one more person to your beach party tonight and you decide to send Leo an SMS with the text:

Hi Leo! I am having a party at the beach tonight and I would like to see you there! Show up around 8.00pm... ☺/ your name

Her/his phone number is: 070-223 66 58”

Messages – SMS – Write new

If he/she got stuck when writing, he/she was told once again how T9 worked. If the test participant got problems with the input of symbols, he/she were told to try again until he/she didn't do any progress. Then the test participant was given some hints of where to find it.

Task 7)

“Now you are going to draw a picture. First I'm going to tell you how the application works. You see a white square on the screen – that's the area in which you can draw. Option key = save, zoom and so on, * = changing the size of the pen, 0 = changing the “speed” of the drawing, # = black/white color, 5 = lift the pen, c (short press)= erase the last line and c (long press)= erase the whole paper.

Do you understand?

No – Take the explanation once again in other words.

Ok – then you can start with the task:”

Let the test participant read the task:

Task 7

Draw a picture.

*“Draw a picture with a table and beside that a chair - like the one below.
When you are ready save the picture as Table”*



The right way:

Fun & Games – Draw picture

If he/she got stuck when he/she draws, once again he/she was told how it worked.

End of each task

After each task, the test participant was given an end-of-task scale (appendix F), also on a small piece of paper (one scale on each paper), to fill in. And then they got the next task. After the eight tasks on the first phone, he/she filled out the Usability and Experience form (appendix G and H). When they were done they were offered a break before starting with the next phone.

Second phone

Everything went on in the same way with the second phone. Observe that the first test pilot started with phone A (a standard T68 as shown in picture 6) and after that phone B (the “Tilty phone”), the second test pilot started with phone B and so on...



Figure 6: The phone A with Joystick – T68

After the test

When the test participant was ready with both phones, he/she filled out the end-of-test questionnaire (appendix I) and he/she were asked questions that showed up under the test, and of course he/she could ask questions he/she had.

During the test

Wrote down observations. Through the whole test it was observed how the test participant was using the navigation control:

- Did he/she do lots of pressing when moving far or do he/she make a long press?
- Did he/she use the navigation control for things that could be done with the keys?

Also worth to observe was the test participant's reactions on the different tasks and steps.

7.2 Results

The two input devices were experienced as almost equally good – both when evaluating the device's usability, the participants experiences and their thoughts and feelings when talking loud. The most important results are listed below, if you want to read the full combination of the results you find them in appendix J.

Joystick:

- + One button supports both navigation and confirm
- + Discreet
- + Easy to understand
- + Easy to use
- + Good distinct feeling in the thumb

- Have to go back to the starting position between the moves
- Easy to do an incorrect press
- Pain in the thumb

Tilty:

- + Easy to understand
- + One button supports both navigation and confirm – good
- + Easy to do things with precision
- + No pain in the thumb

- The confirm doesn't answer on command
- Have to be bigger than the joystick
- Slow

All of the participants found out how the joystick worked – up, down, right, left and confirm but some of them wanted to move on the diagonal, witch you can't. The same result from Tilty shows that only 10 of 12 found out the full functionality; two didn't find the pressing in the center.

Long press (press and hold) wasn't used on either. The participants thought the rate was too slow when they pressed a long press.

To come to the menu many of the participants pressed up/down on the joystick, this move takes you to the phonebook and not to the menu which was a bit irritating (the right way is press accept in the center or move the joystick sideways). With Tilty they pressed sideways and came into the menu directly.

When the participants were asked to choose which input device they'd liked best, all of them said Tilty. Please observe that many of them pointed out that both devices were good but Tilty was easier to use so that's why they choose that one. This results is the same as that the Usability and Experience forms showed – the devices both got high scores but Tilty got the highest.

7.3 Analysis

Out of the test the conclusion can be made that the joystick and Tilty both are good and that people like them. The fact that all participants choose Tilty as the one they liked best, is of course something to notice and think about, but one needs to be careful not to rush to conclusions. This is a new device and no one has ever seen it before, so maybe that makes everybody like it.

This test also showed that the synchronisation of Tilty and the screen update speed were very important.

Printed arrows, or some other printed indication to show how Tilty worked, were not perceived as important. Just mark it out on a protective sheet of plastic on Tilty (such as the one on the display), on the box to the phone or in the manual was the suggestions from the participants. Some of the test participants said that if the phone should be marked out with arrows there is an imminent risk that the user takes it as a sign of their stupidity.

8. Conclusions in terms of REAL

The test results in the different tests are of course very important to consider but as a final step an evaluation in the terms of REAL makes a good conclusion. REAL stands for Relevance, Efficiency, Attitude and Learnability and supplements the other results well.

8.1 Results

These results summarizes all the three tests:

Relevance – *How well the device serves the users need.*

Both the joystick and Tilty serves the users needs well – there are no unnecessary functions and none of the devices are missing any important function.

Efficiency – *States how fast the user can carry out her/his tasks using the device and how often the users make mistakes.*

The speed of the task completion is as fast as the user wants it to be, if they press many times on the direction they want to move in. This is equal for the two devices.

When users do a long press and moves in a constant speed both devices are slow which is somewhat annoying (the auto repeat speed was the same for both devices).

The frequency of mistakes is almost equal for the two devices but in different ways. The joystick often misunderstands the user when they want to confirm an action and this is perceived as a very irritating aspect. With Tilty the users sometimes go too far in lists – this mistake is not experienced as big, in most cases the participants didn't notice themselves.

Attitude – *The users subjective feelings about the device towards the test and after.*

As being viewed in the tests Tilty get the highest point in this category, all the participants thought this was a “cool” device. The joystick is viewed as a very common device.

Learnability – *How easy the device is to learn for initial use and how well the users remember the skills over time.*

The final last test showed that all the participants found out how the joystick worked and that the information was remembered through the whole test. Tilty wasn't as self-explanatory, two of the participants didn't find out all its functions. But when they were told how it worked all 12 of them remembered it, and used it, throughout the test.

The REAL process is thus a good conclusion of the three user tests. Both the devices are good but there are some small differences that can be decisive:

- the confirmation on the joystick
- the attitude among the users.

9. Discussion

The three user tests complemented each other very well. The first test, the affordance test, was done to investigate Tilty and its properties. It became a very interesting phase of the work, much more than expected. An affordance test with only the interesting input device on a piece of plastic is important for discovering the test participants first thoughts and feelings – this could never be done with a working phone where the display gives information to the user. A test like this gives the developers some hints of what to think about when implementing the new input device into a phone.

When it comes to the iterative testing (user test 2) it became obvious that the results of the test might have been better, if a less “good looking” (complete and finished) prototype had been used. This makes probably the ideas from the test participants more inventive and imaginative.

The last test – the usability test – is the most important of all the three tests. This test should be done on people with different mobile phone experiences, ages, gender, and preferably in different countries. Otherwise it’s a risk that possibly differences between the population and countries would show up too late for changes.

Almost everybody of the total of 34 test participants thought that Tilty was a “cool button” but some (two participants) wonder “why a button like this?” One idea is to use Tilty in “cool phones”, such as game/play phones. The existing joystick is good but maybe a bit too common for fashion-conscious youngsters.

Tilty is a good candidate to the joystick but there is still much to do. The synchronisation of Tilty to the screen update speed is a very important part for the future development.

Worth to mention is that the work with Tilty just has begun. Much more is to be tested and evaluated before any decision can be taken about if it is a good and usable input device for mobile phones. Test that’s more realistic like a few people have the phone for normal use for about two weeks, followed by interviews and filling in forms and so on – gives more useful and essential information.

10. References

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11. Glossary

GUI – Graphical User Interface object, reusable across the software applications in the phone.

Tilty – Input device, see chapter 2

Affordance – The importance between the perceived and actual properties of an interface detail (Norman, 1998)

Mapping – The relationship between the function's looks and use and the result in the world – reality and control (Norman, 1998).

SMS – Short Messaging Service

Appendix A – Affordance test questionnaire (user test 1)

Please observe that the test was only done in Swedish!

My name is Marie Lindvall and I do my master thesis work on the department of usability. I have invited you here today to get your opinion on an input device for mobile phones. It's not you I test - it's the input device and how it works. I want you to talk loud all the time and say what you think.

Check out:

Is the thumb or the fingers used?

Is one or two hands used?

Look:

Show a data made picture of a phone with Tilty and the real input device on a piece of plastic.

What do you think you can do with it?
How do you use it?

Feel:

What do you think you can do with it?
How do you use it?

Do:

Think about a menu (x-dir.):

Move one step in the menu.

Think about a menu (y-dir.):

Move two steps.

Think about a written SMS:

Move three steps forward on the first row:

Move down two rows:

You are in the phonebook (with 150 names) and the highlight is on Anna:

Move quickly to Ola:

Answer questions:

- Is Tilty the right size for a mobile phone?
- Which material do you want it to be in?
- What about the resistance?

- **What about the placing of Tilty?**
- **Where do you want to confirm?**
- **When did you discover the arrows?**
- **Did the arrows help you to find out what to do?**
- **Do you think the arrows are needed?**

About you personally:

- **Hand size** (make a drawing)
- **Thumb size** (make a drawing)

Comments:

Appendix B – Results of the affordance test (user test 1)

Please observe that the test was only done in Swedish!

These results follow the test sheet as much as possible. The digits are how many of the participants who did/comment and so on.

Check out:

Is the thumb or the fingers used?

Thumb: 15 **Index finger and thumb:** 1

Is one or two hands used?

One: 15 **Right:** 14 **Left:** 1
Two: 1

Look:

Press (Yes): 12

Press in the corners: 8

Maybe press?: 1

Double click = confirm: 1

Double click = another page: 1

Push the button: 1

Navigate in four directions: 2

2 dimensions: 1

Quick and easy: 1

Feel:

Press (Yes): 11

Press the centre?: 1

Press in the corners: 12

One click/ menu step: 2

Confirm = right & back = left: 1

No double click: 1

1 dimension: 1

Do:

Think about a written SMS:

Move three steps forward on the first row:

Move down two rows:

Press = sentence for sentence: 1

Press ⇒ = End on that row: 1

Press ⇐ = Home on that row: 1

You are in the phonebook (with 150 names) and the highlight is on Anna:

Move quickly to Ola:

Long press: 10 Many short press: 6

Answer questions:

- **Is Tilty the right size for a mobile phone?**
It's small, suit after the phone: 1
Too small: 1
It's fine: 13 (but bigger for games: 1)
Too big: 2

- **Which material do you want it to be in?**
Rubber/plastic: 3
Doesn't matter: 1
Same as the other keys: 3
Metal: 9 (OBS! Nickel allergic sufferer)

- **What about the resistance?**
Too large: 3
It's fine: 13

- **What about the placing of Tilty?**
Good, one hand grip: 2
Good: 10
Not good, place it on the side: 1 (if in the middle of the phone - the phone has to have a waist)
Good, or beside the 5:th: 1
Beside the IR: 1
The left side of the phone: 1 (a left handed)

- **Where do you want to confirm?**
In the middle: 14
In the middle or on YES: 2

- **When did you discover the arrows?**
 Didn't (you told me): 3
 When I felt: 5
 Direct (but they didn't help): 2
 Direct: 6

- **Did the arrows help you to find out what to do?**
 Yes: 12
 No: 4

- **Do you think the arrows are needed?**
 Yes, they make use: 4
 Yes, for the old people: 2
 I don't know, maybe in the manual or on a protective sheet: 4
 No: 6

- **Hand size** **Big: 3** **Little: 13**
- **Thumb size** **Big: 3** **Little: 13**
- **Thumb flexibility** **High: 5** **Low: 11**

Comments:

One click = one step: 2

The "click" is good: 11

The "click" is too distinct: 2

Want to have confirm in the middle: 7

No distinct position when you press: 2

Regulate the volume if the phone is in "stand by": 1

Regulate the volume when talking or playing music: 1

Acceleration?: 1

Obedient/control: 6

Cool, want to have!: 6

Good: 7

Natural: 2

Tempting: 1

Funny: 1

Practical: 3

Good not to have to move the thumb: 3

As a think for stress relax: 1 **OBS!**

Ergonomic?: 1

Perfect to play with: 1
Not playable: 1
Playable: 1
Too slow for games: 1
Many new games (if the button isn't so slow) like cars...: 2

Strange, rigid, clumsy: 1
The joystick is better: 2
Sharp: 1
Plastic surgery: 2
Tired in the thumb (it has to be stretched): 1
Boring: 1
Unnecessary: 1

An easy changeable front to the button: 1

OBS! Right and left handed does the same! (Except extreme left handed)

Go back to standby!

- Go to “unsent” and read your SMS!

Before:

After:

Go back to standby!

- Play “Tetris”!

Before:

After:

Go back to standby!

- Play “Erix”!

Before:

After:

Appendix D – Iterative test form 2 (user test 2)

Please observe that the test was only done in Swedish!

Now I've done some changes with this phone, and I want to test them on you again. As last time it's important that you talk loud – nothing is unimportant.

- Explore standby!

Do you remember how it works the last time? Which version was best?

- *Go to “set time” and change the time to 19.45!*

Do you remember how it works the last time? Which version was best?

- Go to “SMS” and write: I am here and you are there – boring so come here!

Do you remember how it works the last time? Which version was best?

- Play “Erix”!

Do you remember how it works the last time? Which version was best?

Appendix E – Usability test questionnaire (user test 3)

Please observe that the test was only done in Swedish!

Warming up task

Call me and say hello!

My number is 070-223 66 58

Task 1

Adjust the ring volume of the phone.

“You are on a train station and are waiting for an important phone call. You want to make sure you don’t miss the call, what do you do?”

Settings – Sounds & alerts – Ring volume

Task 2

Edit a phone number.

“You need to edit Pauline Andersson’s number to add a country code ,+46, at the beginning of the number. You don’t remember if you placed her at P or A so to be sure you don’t miss her you start looking at A. When you find her you find that you have spell Pauline wrong – please change that to.”

Phonebook – Manage contact – Edit contact

Task 3

Change the time and date settings of your phone.

“Correct the time and date on your phone.”

Settings – Time and date – Set time/Set date

Task 4a

Schedule a meeting in the calendar.

“You are going on a business trip to London the 19 January 2002. The trip starts 7.30 in the morning and you will return home the 21st of January at two a clock in the afternoon. To be sure you don’t miss the flight you want to set a reminder 1 hour before “

Organizer – Calendar – Add appointment

Task 4b

Look in the calendar.

“Go into the calendar find and look at the appointment you just added.”

Organizer – Calendar – View month

Task 5

Choose ring signal.

“Change the ring signal to some you like.”

Settings – Sounds and alerts – Ring signals

Task 6a

Writing an SMS with T9 on.

“You are going to invite one more person to your beach party tonight and you decide to send Leo an SMS with the text:

Hej Leo! Jag ska ha strandfest ikväll och jag skulle vilja att du kom! Kom vid

20.00... ☺/Ditt namn

(Meaning: Hello Leo! I am having a beach party tonight and I would like to see you there! Show up around 8.00 pm... ☺/Your name

Her/his phone number is: 070-223 66 58”

Messages – SMS – Write new

Task 6b

Edit an SMS.

“You want to invite Paul (and his girlfriend Anne) as well, so you send them the same SMS (but with the names changed). You remember that she always is late, so you invite her one hour before just to be sure she shows up at the right time!

Her number is: 070-223 66 58”

Messages – SMS – Sent items

Task 7

Draw a picture.

“Draw a picture with a table and beside that a chair - like the one below.

When you are ready save the picture as Table”



Fun & Games – Draw picture

Task 8

Playing games.

“Play Tetris.”

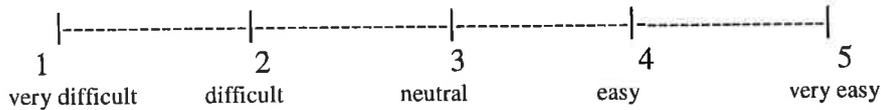
Fun & Games – Games – Tetris

Appendix F – Level of difficulty scale (user test 3)

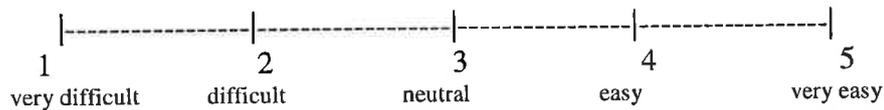
Please observe that the test was only done in Swedish!

On a scale from 1 to 5, rate the level of difficulty for this task (e.g., 1=the task was very difficult)

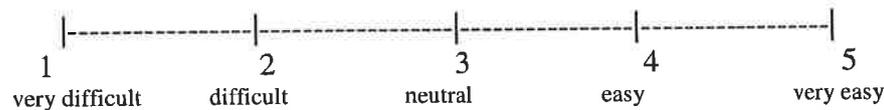
Task 1:



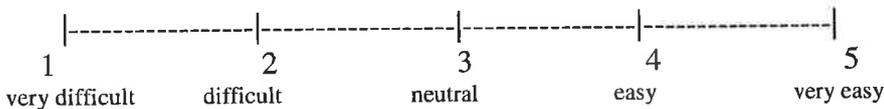
Task 2:



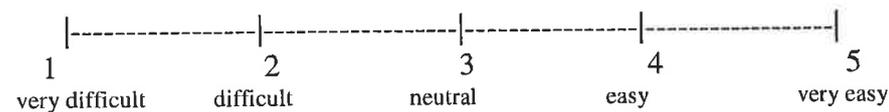
Task 3:



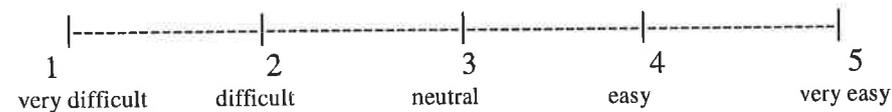
Task 4a:



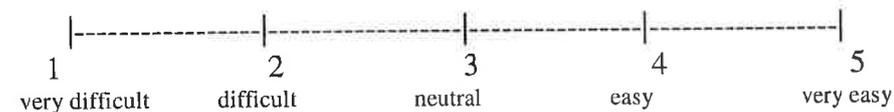
Task 4b:



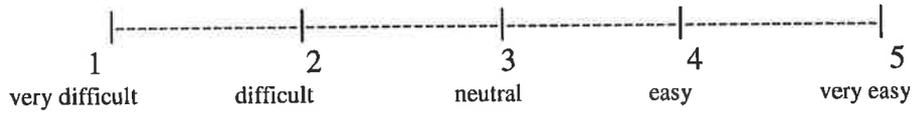
Task 5:



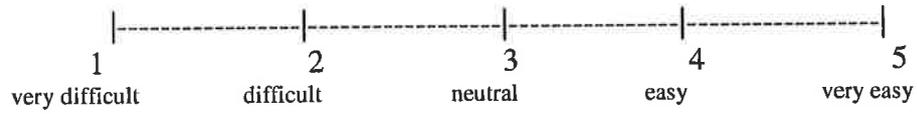
Task 6a:



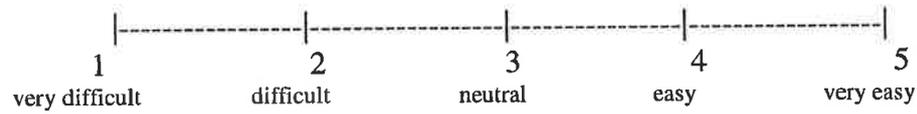
Task 6b:



Task 7:



Task 8:



For the test you need two of this form!

Appendix G – Usability feedback form (user test 3)

Please observe that the test was only done in Swedish!

Please indicate your agreement with each of the ten statements below. Mark your response in one of the boxes with a ✓. Note your immediate reaction, do not think about each statement for a long time.

	Strongly disagree			Strongly agree	
1. I like to use this phone frequently	<input type="checkbox"/>				
	1	2	3	4	5
2. I find the phone unnecessarily complex	<input type="checkbox"/>				
	1	2	3	4	5
3. I think the phone is easy to use	<input type="checkbox"/>				
	1	2	3	4	5
4. One needs support of a technical person to be able to use this phone	<input type="checkbox"/>				
	1	2	3	4	5
5. I find the various functions in this phone well integrated	<input type="checkbox"/>				
	1	2	3	4	5
6. I think there is too much inconsistency in the functions of this phone	<input type="checkbox"/>				
	1	2	3	4	5
7. I would imagine that most people would learn to use this phone very quickly	<input type="checkbox"/>				
	1	2	3	4	5
8. I find the phone very cumbersome to use	<input type="checkbox"/>				
	1	2	3	4	5
9. I feel very confident using the phone	<input type="checkbox"/>				
	1	2	3	4	5
10. I needed to learn a lot of things before I could start using this phone	<input type="checkbox"/>				
	1	2	3	4	5

Comments: _____

Thank you! Your response will be confidential.
For the test you need two of this form!

Appendix H – Experience feedback form (user test 3)

Please observe that the test was only done in Swedish!

Please indicate your agreement with each of the ten statements below. Mark your response in one of the boxes with a ✓. Note your immediate reaction, do not think about each statement for a long time.

	Strongly disagree			Strongly agree	
1. This navigation device works exactly as I want it to work.	<input type="checkbox"/>				
	1	2	3	4	5
2. I should never use this phone more than I'd have to.	<input type="checkbox"/>				
	1	2	3	4	5
3. This navigation device is fantastic.	<input type="checkbox"/>				
	1	2	3	4	5
4. If I owned a mobile phone with this navigation device, I would use it – but without any enthusiasm.	<input type="checkbox"/>				
	1	2	3	4	5
5. I think this navigation device is well placed on the mobile phone.	<input type="checkbox"/>				
	1	2	3	4	5
6. I found it boring to use this mobile phone.	<input type="checkbox"/>				
	1	2	3	4	5
7. If I owned a mobile phone like this, I would think it was fun to explore it.	<input type="checkbox"/>				
	1	2	3	4	5
8. I think this navigation device is ugly.	<input type="checkbox"/>				
	1	2	3	4	5
9. I would like to use a navigation device like this in a mobile phone.	<input type="checkbox"/>				
	1	2	3	4	5
10. I would never recommend this phone to a good friend.	<input type="checkbox"/>				
	1	2	3	4	5

Comments: _____

Thank you! Your response will be confidential.

For the test you need two of this form!

Appendix I – End of test questionnaire (user test 3)

Please observe that the test was only done in Swedish!

1. Please indicate some *advantages* to using the navigation control on phone A:

2. Please indicate some *disadvantages* to using the navigation control on phone A:

3. Please indicate some *advantages* to using the navigation control on phone B:

4. Please indicate some *disadvantages* to using the navigation control on phone B:

5. Please indicate which navigational control that you *overall* liked best.

- Tilty
- Joystick

Please explain

Appendix J – Results from the usability test (user test 3)

Some advantages to use the joystick:

One button supports both navigation and confirm 3
Fast 3
Small 2
Discreet 2
Easy to use 4
Easy to understand 4
Beautiful 1
Easy to go to the menu 2
Good distinct feeling in the thumb 2

Some disadvantages to use the joystick:

Too small 1
Easy to do a wrong move 9
Ugly 1
Can't go on the diagonal 1
You have to go back to the starting position 3
The thumb hurts 4
Hard to navigate to the left (left phone hand) 2
Slow 1
Too cheap 4
Not good for long nails 2

Some advantages to use Tilty:

Easy to use 1
Logical 1
One button supports both navigation and confirm 4
Not too big 1
Nice design 1
Easy to reach the menu 3
The thumb doesn't hurt 3
Fast and slow – just the way you want 1
Easier to do things with precision 4
Good for playing 1

Some disadvantages to use Tilty:

Smaller Yes and No keys 1
Doesn't answer on command - confirm 10
Looks clumsy 1
Have to be big like this 2
Can't go on the diagonal 1
Hard to know how the mapping is in the menu, but you learn 1

Find out how the Tilty worked:

Everything 10

Not the pressing 2

Find out how the joystick worked:

Everything 12

Some observations when using Tilty:

- All wanted a better confirm in the middle
- Half of the participants wanted a faster software
- Easier to find the menu because moving sideways was a natural way (with a joystick the up/down toggling was the most natural but then you find the phonebook!)
- In the Time and Date they pressed on the digits.

Some observations when using the joystick:

- Almost everybody (9 of 12) accidentally press confirm when they thought they pressed in another direction – an irritating factor!
- Some of the participants (3 of 12) found it irritating that they have to go back to the starting position when changing the direction.
- The most participants didn't use the long press when going far in lists (to slow) - 6 of 12 said they get tired in the thumb.
- Hard to go sideways - they felt like they pulled the phone out of their hand.
- The alternative words in T9 were easy to find with but they came into the alternative list in the wrong order.
- Hard to find the menu because toggle up and down is the natural way (but then you find the phonebook!)
- When going to the right (phone hand = right) or to the left (phone hand = left) some (3 of 12) had to take the other hand for help – unnatural movement for the thumb.
- The thumb hurts when playing/using the phone a long time (4 of 12).

All 12 participants choose Tilty as the best device for navigation.

Some of the explanations:

If I have to choose one - I liked Tilty best because that one can all the things that the joystick can and look nicer 6

Little bigger – easier to use 2

The design 2

Easier to understand 1

The joystick is good but this one is better 6

Data from the usability and experience feedback form:

On the forms the maximum points are 100. The averages for the two devices are both high, the average for each device and form:

The usability from: Joystick = 79 Tilty = 84

The experience form: Joystick = 75 Tilty = 83

- The results do not depend on if the participant gets the phone as the first or as the second and not on the test participants gender. Only small differences between ten of the participants – the remaining two had very low points without any specific reason, perhaps they just judged more critically.
- This shows that Tilty got the highest point - both when the participants looked at the usability and their experience. Observe that the points are almost equal... just as the participants opinion when the talked loud!

Appendix K – Background form (user test 1, 2, 3)

Please observe that the test was only done in Swedish!

Name:

Date:

1 Do you have/use a mobile phone? Yes No

If "No" - Go to question 2.

If "Yes" - **Which brand(s) and model(s) do you have experience of?**

Name all you can remember and underline the one(s) you use today.

.....
.....
.....
.....
.....

When do you start using a mobile phone? Year/month:

.....

How pays? Private Company Both

How often do you use your mobile phone?

Only rarely

Each week

Each day

Have you used you mobile phone abroad? Yes No

Do you regularly use your mobile phone to others than dialing, calling and take calls? Yes No

If "Yes" - which functions do you use?

Phonebook (saved numbers)	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Send messaging (SMS, e-mail)	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
"Eurovoice"	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Divert calls	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Restrict calls	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Conference calls	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Change ring and other signals	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Insert owe melodies	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Alarm	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Calculator	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Voice control	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Data- and fax calls	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>

Profiles	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Calendar	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
“Synch.” phone against computer	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
WAP (“internet in phone”)	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Check the call timers and calling cards	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Games	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>
Others:	Often <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Never <input type="checkbox"/>

Have you today, or have you had earlier, some accessories to your mobile phone?

- Portable handsfree
- Desk stand
- Vehicle charger
- Vehicle handsfree
- IR plug in
- Vibrator
- Chatboard
- FM-radio
- Other:

2 Do you use a cordless phone (home or at work)? Yes No

If “Yes” – Which brand(s) and model(s) do you have experience of?

.....

3 Do you use a PDA (for example a Palm pilot)? Yes No

If “Yes” – which brand and model?

.....

Do you “synch.” Your calendar to your computer? Yes No

How do you write in you PDA?

- By “normal” keyboard
- With T9
- With a pen and a special alphabet

4 Do you have any computer experience? Yes No

If “Yes” – since when?

How often do you use your computer?

- Each workday
- Each week
- Only rarely

Do you use email? Yes No

Do you use the Internet? Yes No

Do you have a technical education? Yes No

If "Yes" - specify:

.....
.....

What do you work with today?

.....
.....
.....
.....

Do you have reduced vision (glasses...), hearing, colorblindness, or other handicap (valuable for some tests) - please note that:

.....
.....
.....
.....

I am left handed right handed

When I use my mobile phone I'm holding it in: (one or more marks)

- in the right hand and press the key with the left
- in the left hand and press the key with the right
- in the right hand and press the key with the right
- in the left hand and press the key with the left

Date of birth:

Mark those languages you know well:

- Swedish
- English
- French
- Spanish
- German
-
-

What expression you think describes you best?

- I'm interesting in new technique and I like to explore new products.
- I use new technique but without any enthusiasm.
- I avoid new technique as much as possible.

When I buy a product (for example a mobile phone, camera...), which of following statement describes best how you use the manual before you starts using the product?

- I don't read the manual before I start using the product.
- I read the manual carefully from folder to folder.
- I scan the manual.
- I just read the parts of the manual that interests me.

Appendix L – Approving form for video taping (user test 3)

Only in Swedish because the test was done in Sweden in Swedish.

Avtal mellan Sony Ericsson Mobile Communications, Nya Vattentornet, 221 88 LUND, representerat av Användbarhetslabbet, och underskrivande testpilot.

Bakgrund

Underskrivande testpilot kommer att delta i ett användbarhetstest, som kommer att genomföras av Användbarhetslabbet. Användbarhetslabbet kommer till viss del att dokumentera studien genom videoinspelningar. Underskrivande testpilot kommer att spelas in på video.

Godkännande av intern visning av videoinspelningen

Underskrivande testpilot godkänner att Användbarhetslabbet, utan kompensation, kan använda videoinspelningen för att göra en undervisningsvideo. Underskrivande testpilot godkänner också att denna video används när Användbarhetslabbet ger interna kurser eller presentationer av Användbarhetslabbet.

Ingen, förutom Användbarhetslabbet, får använda videoinspelningen utan underskrivande testpilots medgivande.

Avtalet gäller från och med denna dag.

Lund den

Lund den

Underskrivande testpilot

För Användbarhetslabbet

Namnförtydligande

Namnförtydligande

Appendix M – Non-disclosure agreement (user test 1, 2, 3)

Only in Swedish because the test was done in Sweden in Swedish.

Avtal rörande användbarhetstest vid Sony Ericsson Mobile Communications

Jag, _____ (Namn) _____ (Personnummer)
intygar härmed att jag har accepterat att delta som testpilot i ett användbarhetstest. Som
testpilot kan jag komma att ta del av konfidentiell information rörande Sony Ericsson
Mobile Communications eller andra bolag inom Ericssongruppen.

Jag är medveten om att jag inte under några omständigheter får lämna några uppgifter om
Sony Ericssons produkter och verksamhet till obehörig person utan Sony Ericssons skriftliga
godkännande. Med *obehörig* avses här alla personer inom och utanför Sony Ericsson, vilka
ej direkt är engagerade i testet.

Efter utfört test skall jag återlämna all utrustning och dokumentation som erhållits av Sony
Ericsson.

Jag förbinder mig att följa dessa föreskrifter, och är medveten om att överträdelse av
tystnadsplikten beträffande konfidentiell och/eller företagshemlig information kan medföra
laga påföljd.

Jag godkänner vidare att Sony Ericsson dokumenterar testet genom en videoinspelning. Jag
förstår att denna inspelning endast kan visas för personer involverade i produktutvecklingen
och inte kan användas för något annat syfte utan mitt skriftliga medgivande.

Jag ger också Sony Ericsson äganderätt och exklusiv nyttjanderätt till de eventuella idéer
och förslag som jag bidrar med i samband med testet.

Jag förstår att mitt deltagande är helt frivilligt och att jag kan avbryta när jag vill.

Sony Ericsson Mobile Communications behåller originalet av detta dokument och såsom
testpilot har jag fått en kopia.

Lund den

Bevittnas av ansvarig person:

Underskrivande testpilot

För Användbarhetslabbet