

Heli Tolonen

**USABILITY STUDY AND IMPROVEMENT OF THE ÄLY EXCEL**

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Heli Tolonen  
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## ABSTRACT

Oulu University of Applied Sciences  
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Author: Heli Tolonen

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Supervisors: Markku Rahikainen and Kari Laitinen

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This Master's thesis concentrates on a particular tool, called Äly Excel, which is used in health care centres in Finland. The Äly Excel is a Microsoft Excel based tool that helps to plan a health care personnel rota. The main goal of this work was to enhance usability of the Äly Excel. The development work was part of the Hyvä Potku project that is managed by Northern Ostrobothnia Hospital District.

To find out the most important usability problems of the Äly Excel, usability tests were carried out in an early phase of the project work. Also, a questionnaire was sent out to gather user experience and possible suggestions for improvements. Once the feedback and user test observations were analysed and agreed with the Hyvä Potku project members, the development of the Äly Excel began. Since the Äly Excel is a Microsoft Excel based worksheet, it was natural to choose Visual Basic as a programming language as Visual Basic Application is part of the Microsoft Office package. New UI features are designed so that they follow well-known usability studies.

In this thesis a usability theory is observed and discussed. The thesis details the software and UI design and why certain decisions were made. The problems faced during the development work are explained. At the end there is a discussion about the future development of the Äly Excel.

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**Keywords:** Microsoft Excel, Visual Basic Application, Usability, Northern Ostrobothnia Hospital District, Hyvä Potku

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## TERMS AND ABBREVIATIONS

Effica	An electronic health record system, developed by Tieto Oyj.
ISO	International Organization for Standardization
Microsoft Excel, Excel	A spreadsheet application, part of a Microsoft Office package. It features calculation, graphing tools, pivot tables, and a macro programming language called a Visual Basic for Applications [1.].
Pegasos	An electronic health record system, developed by CGI.
PPSHP	Pohjois-Pohjanmaan sairaanhoitopiiri, Northern Ostrobothnia Hospital District
UAS	University of Applied Sciences
UI	User Interface
UX	User Experience
VB, VBA	Visual Basic, Visual Basic Application
Äly Excel	A tool that health care personnel is using when planning work shifts for doctors and registered nurses. Originally developed by Hyvä Vastaanotto project.

# 1. INTRODUCTION

The purpose of this thesis work was to enhance a usability of an Excel based tool, called the Äly Excel, used in several health centers throughout Finland. The Äly Excel is a very useful tool among its target users, but its usability was clearly improvable. It is used for planning the daily and weekly task schedules of the healthcare professionals in the health centers.

## 1.1. Introduction to Hyvä Potku Project

The Hyvä Potku project is a continuation of the Hyvä Vastaanotto and the Potku projects. They belong to the National Development Plan for Social Welfare and Health Care Kaste Programme. It is a steering tool that is used for managing and reforming Social and healthy politics. [2.]

The targets of the Kaste programme are

1. Reducing inequalities in wellbeing and health
2. Structures and services of a social welfare and a healthcare are organized in an economical and a client-oriented way

The Hyvä Potku project is managed by the Northern Ostrobothnia Hospital District. The main goal of the project is to augment the availability and enhance the effectiveness of the health care services. To achieve this goal different tools are needed. One of the tools is so called the Äly Excel which is the focus of this work.

## 1.2. Introduction to the Äly Excel

The Äly Excel was created to help the healthcare personnel to plan the daily and weekly task schedules for the healthcare professionals such as the doctors and the registered nurses. Its initial aim is to provide a tool that helps to plan the schedules where a demand and a capacity is in balance, certain exceptional situations can be taken into account and queues in the health care centres can be unravelled [3.]. With this tool the user can see that all of the mandatory tasks have been assigned to someone. This is very important in order to avoid certain queues at the health care service centres.

The original developer of the Äly Excel is Kati Liukko, a medical superintendent from Sipoo. The Äly Excel is further developed by the Hyvä Vastaanotto project and there are many parties that have been enhancing the tool. It is worth mentioning that all the developers so far have been healthcare professionals, not IT professionals particularly. This means that the Äly Excel really serves the benefits of the users as it has been evolved from the actual need.

The Äly Excel is a Microsoft Excel based spreadsheet tool (see Figure 1). For every week there is an own worksheet and when a new week is needed, it is copied from the existing base layout. Employee data is set to columns so that one column is reserved for one person. For different purposes there are several versions of the Äly Excel. Depending if one needs to plan a 10, 15, 20, or 30 minutes daily blocks, or a particular length of a day, or a different number of persons whose time schedule is to be planned.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	C
1	7 Pariton		13.2.-17.2.												
2	13.2. MAANANTAI		Name A	Name B	Name C	Name D	Name E	Name F	Name G	Name H	Name I	Name J	Name K	Yht.	
3	maanantai	8.00-8.15	1	2	3	4	5	6	7	8		1	3		
4		8.15-8.30	1	2	3	4	5	6	7	8		1	3		
5		8.30-8.45	1	2	3	4	5	6	7	8		1	3		
6		8.45-9.00	1	2	3	4	5	6	7	8		1	3		
7		9.00-9.15	1	2	3	4	5	6	7	8		1	3		
8		9.15-9.30	1	2	3	4	5	6	7	8		1	3		
9		9.30-9.45	1	2	3	4	5	6	7	8		1	3		
10		9.45-10.00	1	2	3	4	5	6	7	8		1	3		
11		10.00-10.15	1	2	3	4	5	6	7	8		1	3		
12		10.15-10.30	1	2	3	4	5	6	7	8		1	3		
13		10.30-10.45	1	2	3	4	5	6	7	8		1	3		
14		10.45-11.00	1	2	3	4	5	6	7	8		1	3		
15		11.00-11.15	1	2	3	4	5	6	7	8		1	3		
16		11.15-11.30	1	2	3	4	5	6	7	8		1	3		
17		11.30-11.45	1	2	3	4	5	6	7	8		1	3		
18		11.45-12.00	1	2	3	4	5	6	7	8		1	3		
19		12.00-12.15	1	2	3	4	5	6	7	8		1	3		
20		12.15-12.30	1	2	3	4	5	6	7	8		1	3		
21		12.30-12.45	1	2	3	4	5	6	7	8		1	3		
22		12.45-13.00	1	2	3	4	5	6	7	8		1	3		
23		13.00-13.15	1	2	3	4	5	6	7	8		1	3		
24	13.15-13.30	1	2	3	4	5	6	7	8		1	3			
25	13.30-13.45	1	2	3	4	5	6	7	8		1	3			
26	13.45-14.00	1	2	3	4	5	6	7	8		1	3			
27	14.00-14.15	1	2	3	4	5	6	7	8		1	3			
28	14.15-14.30	1	2	3	4	5	6	7	8		1	3			
29	14.30-14.45	1	2	3	4	5	6	7	8		1	3			
30	14.45-15.00	1	2	3	4	5	6	7	8		1	3			
31	15.00-15.15	1	2	3	4	5	6	7	8		1	3			
32	15.15-15.30	1	2	3	4	5	6	7	8		1	3			
33	15.30-15.45	1	2	3	4	5	6	7	8		1	3			
34	15.45-16.00	1	2	3	4	5	6	7	8		1	3			
35														YHT.	KYSYI
36	1	LVO	8	0	0	0	0	0	0	0	0	0	8	0	16
37	2	PTY, KONS	0	8	0	0	0	0	0	0	0	0	0	0	8

FIGURE 1. Screenshot of original the Äly Excel with 15 minutes blocks

The intelligence of the Äly Excel lies under background equations which calculate automatically planned hours and gathers the daily and the weekly summaries (see Figure 2). Figure 1 shows Monday where no plan has been made yet, only example colours are visible. The colours represent



the tasks. This is the initial situation. Even though the colours represent tasks, the Äly Excel uses numbers attached to the colours to calculate the summaries. The user copies the appropriate colour (ctrl+c) and pastes it to the correct timeslots (ctrl+v). The colours themselves are not used for the calculation but they are very essential for the visualization.

The daily and the weekly summaries show how many different tasks have been assigned to the employees (columns) per day and per week. They show also how much different tasks are produced altogether. And if the demand ('kysyntä' in Finnish) is filled, the Äly Excel calculates also the balance ('balanssi'). The daily summary is right below the day section and the weekly summary is at the bottom of the table (Figure 2).

		C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
216	14.15-14.30	1	2	3	4	5	6	7	8		1	3				
217	14.30-14.45	1	2	3	4	5	6	7	8		1	3				
218	14.45-15.00	1	2	3	4	5	6	7	8		1	3				
219	15.00-15.15	1	2	3	4	5	6	7	8		1	3				
220	15.15-15.30	1	2	3	4	5	6	7	8		1	3				
221	15.30-15.45	1	2	3	4	5	6	7	8		1	3				
222	15.45-16.00	1	2	3	4	5	6	7	8		1	3				
223													YHT.	KYSYNTÄ	BALANSSI	
224	1 LVO	8	0	0	0	0	0	0	0	0	8	0	16		16	
225	2 PTY, KONS	0	8	0	0	0	0	0	0	0	0	0	8		8	
226	3 PÄP	0	0	8	0	0	0	0	0	0	0	0	8		16	
227	4 SPYY	0	0	0	8	0	0	0	0	0	0	0	8		8	
228	5 RES	0	0	0	0	8	0	0	0	0	0	0	8		8	
229	6 KOUL, KOK	0	0	0	0	0	8	0	0	0	0	0	8		8	
230	7 RUO, KAFFE, LÄES, SIIR	0	0	0	0	0	0	8	0	0	0	0	8		8	
231	8 NLAT, KOULU, HAL yms.	0	0	0	0	0	0	0	8	0	0	0	8		8	
232	EI PAIKALLA	0	0	0	0	0	0	0	0	8	0	0	8		8	
233	Yht.	8	8	8	8	8	8	8	8	0	8	8	88			
234																
235																
236	<b>Viikko yhteensä</b>															
237		Name A	Name B	Name C	Name D	Name E	Name F	Name G	Name H	Name I	Name J	Name K	YHT.	KYSYNTÄ	BALANSSI	
238																
239	1 LVO	40	0	0	0	0	0	0	0	0	40	0	80	0	80	
240	2 PTY, KONS	0	40	0	0	0	0	0	0	0	0	0	40	0	40	
241	3 PÄP	0	0	40	0	0	0	0	0	0	0	0	40	0,0	80	
242	4 SPYY	0	0	0	40	0	0	0	0	0	0	0	40	0,0	40	
243	5 RES	0	0	0	0	40	0	0	0	0	0	0	40	0,0	40	
244	6 KOUL, KOK	0	0	0	0	0	40	0	0	0	0	0	40	0	40	
245	7 RUO, KAFFE, LÄES, SIIR	0	0	0	0	0	0	40	0	0	0	0	40	0	40	
246	8 NLAT, KOULU, HAL yms.	0	0	0	0	0	0	0	40	0	0	0	40	0	40	
247	EI PAIKALLA	0	0	0	0	0	0	0	0	40	0	0	40	0	40	
248	Yht.	40	40	40	40	40	40	40	40	0	40	40	440			

FIGURE 2. Original daily and weekly summary of the Äly Excel

When the weekly plan is ready in the Äly Excel, it is copied manually to the real reservation books, such as Efficca or Pegasos.

This master's thesis work focuses on the usability of the Äly Excel. It was clear from the beginning that the functionalities of the Äly Excel are in place. There is no particular need to enhance the features (such as the weekly summaries or the balance calculation) but there was an apparent need to improve the usability.

Over the time certain usability problems in the Äly Excel have been recognized. Even though the Äly Excel is quite helpful tool, some people might not find the usage very appealing. This is understandable if a person is not familiar with Microsoft Excel. The goal was to make the Äly Excel more user-friendly and less vulnerable. The problems found with the usability of the Äly Excel during the user testing and the interviews are described more in detail in section 3.5.

Before this work was assigned to the thesis writer, a project plan (Appendix 1) with a preliminary task list and a time schedule was written. It was based on the request for offer and additional discussions with the Hyvä Potku project members. The request for offer included the following demands [4.]:

- The background equations must be protected so that the users cannot modify them. This was the essence and the minimum demand.
- The user could only modify the names of the employees, the colour codes, the captions of the tasks, the daily planning area, and the demand values.
- Possibly an electrical calendar where every employee can modify their absence and holidays.
- The employees should be able to modify their absence information and take a look at the Äly Excel yet modification rights are only with assigned persons.
- An integration to the electronic health care system (such as the Effica) is the future vision, but it is not in the scope at this point.
- The Äly Excel should be usable in the beginning of 2015. The Hyvä Potku project continues to October 2015 whilst the Äly Excel testing is done among the project members.
- There will be no personal data what so ever nor the planned system communicates with the existing patient information system.
- There are different versions of the Äly Excel and the planned solution should apply to all of them.
- If some other solution comes up, we are willing to hear from that, too.

### **1.3. Implementation approach**

There were, of course, many ways how to proceed this task. This master's thesis is approaching the task from the usability point of view. It is important to find out what is the opinion of the users and potential users. That is why the user testing and the questionnaires were used before designing a new layout. That way a valuable user experience and opinions were revealed. Based on the feedback and reflecting the usability theory, the new layout and simple yet alleviating features were designed. Arguments why every single solution was made can be found in an appropriate chapter.

Certain challenges occurred when recruiting volunteer testers. Understandably, this kind of request for favour is not very tempting. The pilot testers were the members of the Hyvä Potku project and were the first volunteer participants. On the other hand, the actual users were a bit difficult to find. Maybe the reasons were of lack of time. Or if the users felt that they do not have time for this, even though they realize it is an important matter to do.

## 2. USABILITY THEORY

In this chapter the usability theory is observed. There are no strict rules to follow when designing an interface but there are certain studies and background information which are good to know when planning and designing an interface. The studies show that human nature is what counts. Designing an interface is not a simple task and all the features can be done in several ways where any other solution is not necessarily better or worse than the other.

A user experience (UX), on the other hand, is a broader concept which encompasses not only the UI, but also company's services, products and overall usability [5.]. This master's thesis focuses on more closely on the UI rather than the UX. All in all, the definition of the usability cannot be compressed to one or two words. In the next sections more detailed definitions are discussed.

### 2.1. Definition of usability

Jacob Nielsen, a Dutch web usability consultant [6.], has defined five usability attributes that associates to the usability [7.].

- **Learnability.** A well designed system is such that a user can learn its usage easily and is able to start to work with it. A learning curve describes how fast the user learns to use the system in certain efficiency.
- **Efficiency.** This attribute is used for measuring how effective the used system is for fulfilling the user's task point of view. In other words, how effectively the user can perform the duties.
- **Memorability** describes how easy it is to re-learn the system after a while. If the system is easy to learn, usually its usage is easy to recall also. But, according to Nielsen, the system learnability does not refer to its memorability as it is not the same to return to the system than facing it for the first time.
- **Errors.** A system should be designed and implemented so that the user makes as few errors as possible because every error slows down the user's interaction. A system error rate is measured by counting the number of errors that the users are making. Some of the errors are minor and does not affect highly on the performance. But some errors are destructive and those errors must not occur at all or maximum on a very rare basis.
- **Satisfaction.** How pleasant the system is to use. This is a subjective point of view. Can be measured by simply asking the users' opinion by conducting a short questionnaire.

## 2.2. UI design basics

The definition of the usability can be defined as follows: *it is user friendliness of an object, service, application, tool or anything a human interacts with [8].*

Usability – ISO 9241 definition [9.]:

*The **effectiveness, efficiency and satisfaction** with which specified users achieve specified goals in particular environments.*

**Effectiveness:** *the accuracy and completeness with which specified users can achieve specified goals in particular environments*

**Efficiency:** *the resources expended in relation to the accuracy and completeness of goals achieved*

**Satisfaction:** *the comfort and acceptability of the work system to its users and other people affected by its use*

The usability has many definitions as there is no single truth. One must remember that either is better than the other and they are not competing with each other, but on the contrary they are supplementing each other.

Ben Schneiderman, an American computer scientist, has defined Eight Golden Rules of Interface Design [10.].

- **Strive for consistency** covers the overall appearance. Boxes, colours, fonts, the way of navigating, prompts and menus should follow the same pattern in similar situations throughout the system.
- **Cater to universal usability.** A system should be designed so that both novice and expert needs are taken into consideration. For example adding extra hints and help texts for the novice users, and for the more developed users more advanced features such as shortcuts.
- **Offer informative feedback.** A system should provide feedback to the user at any time. No matter if the action is minor or major, yet a convenient feedback gives the user a feeling that something is really happening.

- **Design dialogue to yield closure**, meaning that every group of actions should end clearly and the system should give the user an indicator that the actions are accomplished. The action series should have a beginning, a middle and an ending points.
- **Prevent errors**. A systems should be designed so that the users cannot make errors. But, when an error happens, the system should provide a simple and an advisory way to the user to correct the mistake. For example, if some detail in a form is missing, the system should pinpoint that part precisely and let the correct information still be left at the form.
- **Permit easy reversal of actions**. The simplest example is to provide a “Cancel” button next to an “OK” button. Meaning that the user can interrupt the action if needed. And even if the user has already hit the “OK” button, there still should be a way to undo the action. The undo feature encourages the user to explore a terra incognita as the user has a feeling that the actions are reversible.
- **Support internal locus of control**. The user needs to have a feeling being in charge.
- **Reduce short-term memory load**. Humans has a limited capacity of remembering matters in a short-term memory. Keeping that in mind, the UI designers should avoid such interfaces which requires a lot of remembering. This also applies to the fact that it is easier for the humans to recognize than to recall. So, instead of making the users to remember, offer a ready-made lists or equivalent that helps the users to achieve the goal.

Jakob Nielsen have also assessed 10 principles, or heuristics, for evaluating the usability of an interface [11.].

- **Visibility of the system status**. The user should always see what is going on.
- **Match between the system and the real world**. Pay attention to the language, phrases and words, make sure that they are what the humans’ use, not a computer language. Let the information appear in the same order as they would in a real world context.
- **User control and freedom**. Allow the users to cancel or reverse the action.
- **Consistency and standards**. Use standard actions, phrases, methods and language. Make sure that the meaning, or the appearance of something remains the same throughout the system.
- **Error prevention**. First of all, design the system so that the user cannot make errors. If an error still happens, offer the user an easy and a guided way to fix the situation.

- **Recognition rather than recall.** Do not make the humans to remember as the humans' short-term memory is quite poor. Instead, provide information where the user can recall the needed facts.
- **Flexibility and efficiency of use.** Provide different kinds of methods to complete a task for both novices and the expert users.
- **Aesthetic and minimal design.** An irrelevant or a rarely needed information should not be present at all the time. It confuses the user.
- **Help users recognize, diagnose and recover from errors.** A clear, a human-understandable and a precisely indicating error message with a suggestion of a recovery is recommendable.
- **Help and documentation.** Even though the system should be so designed that the user does not need a help documentation.

### 2.3. Design rationale

A design rationale is an exact documentation of decisions made and alternatives of the solutions designed to the system [12] [13]. Its goal is to help the designers and the specialists to understand the decisions made in a previous design phase. It should explain why the decisions were made and what were the alternatives and the trade-offs considered. And even if there is no explicit reason for some conclusion, it is valuable information and it should be documented anyway. If the system is later under a development, the initial design decisions could be very valuable.

This thesis is the design rationale of the new version of the Äly Excel. The implemented solutions and the alternatives are explained in Chapters 4, 5 and 6.

### 2.4. UI Psychology

According to Sinkkonen et al [12] every person is an individual human being with unique qualities and features. The way the humans perceive this world, products and systems is due to combination of several attributes. Such attributes are for example inborn features like senses, memory and basic needs, cultural structures like the spoken language, and the corporate culture like how the humans are expected to behave. Other prominent figures are the personal capabilities, tasks to perform,

the situation and the environment. These factors make the usability design very difficult if the purpose is to plan a system that is equally usable to all. It is very essential to understand how a user behaves. Sinkkonen et al. [12.] have examined how the people act, what are the ways people operate and how this information is utilized on the usability point of view. In this work as many aspects as possible are taken into account, such as minimizing the memory load, in the layout design and in the information structure.

## **2.5. Usability testing**

The purpose of the usability testing is to evaluate the system or the product [14]. It is used to ameliorate the profitability of the products [15]. Improving the profitability means that the potential users are satisfied with the product, they feel it is easy to use and the design of the product is useful and distinguished by the target audience.

Despite of many good arguments why to conduct the usability test, not even the most careful controlled tests guarantee that the product is usable. Jeffrey Rubin et al. [15] identifies the reasons:

- A testing situation is not a natural situation. It is always a factitious situation and thus not reflect the real use of the product precisely.
- Testing does not guarantee that the product really works.
- It is difficult to identify the actual target persons of the product. So it is a challenge to find these actual end users to participate the usability testing session.
- The usability testing is not in all cases the most effective way to evaluate the product. In some cases it could be more efficient in terms of time, accuracy and cost to hire a heuristics expert to evaluate the product.



### **3. USABILITY STUDY OF THE ÄLY EXCEL**

This chapter describes the tests that were performed in order to find out the usability problems in the original version of the Äly Excel. Since there was only one administrator (the thesis writer) who designed and run the tests, one must keep in mind that different results may have been found if someone else performed the tests. This is due to the fact that the usability testing is strongly dependent on the administrator who is carrying out the tests [16.] [17.]. Also, there are no common standards to follow when performing the usability tests.

#### **3.1. Test planning**

The aim was to find out the most important usability problems and the usability problems of the initial Äly Excel. Even though there are as many ways of the usage of the Äly Excel as there are the users, there are not that many use cases which can be defined separately. Every user has the same goal, which is to plan the weekly workload for the health care personnel. There are, however, different persons with varying experience and technical Äly Excel skills working with the tool. By testing these versatile experienced people most of the usability problems was revealed.

The Äly Excel is a plain Excel sheet, with not so many functionalities. The purpose was not to test the Microsoft Excel functionalities, only the Äly Excel. The effectiveness was measured how well the person can perform the tasks. Time spent tells how efficient the tool is and a satisfaction is revealed before, during and after the testing session by interviewing the test person.

#### **3.2. Description of usability testing session**

The testing procedure started with asking a permission from the user the willingness to participate in the test and also an approval that the testing session can be recorded with a camcorder (Appendix 2). After the permissions preliminary questions were asked for discovering some details about the background of the tester (Appendix 3). The purpose of these questions was to find out if there were any differences rising up with respect to the person's age, the profession or how experienced the person is with the computers and Excel.

Written instructions were handed to the test person (Appendix 4). Test equipment, in other words, a computer with the Äly Excel and all necessary peripheral equipment such as a mouse or equivalent, were ready and the test could begin. It was strongly emphasized that thinking aloud is very desirable.

The test session was recorded, and the test administrator was sitting next to the test person and wrote down observations about the test situation. When the person was ready, opinions about the testing situation were asked and how the user feels about it and if there are any questions to be asked. After all this, the camera was switched off, the person was thanked, and a little gift for participating the testing session was given.

A question form was sent in advance to the test users (Appendix 5). It was one way to get background information and the user opinions. A Webropol questionnaire was made to the Äly Excel users who were located throughout Finland. The answering rate was 18,5% and according to the answers, no new proposal or usability questions raised. That consolidated that no more than five testing persons were needed, like Jakob Nielsen states [18].

### 3.3. Test persons

According to Jakob Nielsen five users is enough to test a system [18.]. Based on that theory, five volunteer test persons were chosen. They all had a different kind of experience with the Äly Excel as well as the computers. First two test persons were the Hyvä Potku project members who do not use the Äly Excel in their every day work nowadays. However, they have a relatively long history with the Äly Excel since they have been using it since beginning. The Äly Excel was implemented about two years ago. These two persons were nominated as the pilot testers hence they were also testing the test procedure and commenting the questionnaires.

**Pilot tester #1** is a 37-year-old registered nurse. The tester has been using computers for 25 years and is using the computers in a daily basis. The tester is quite familiar with the Äly Excel and has been using it already for two years. The tester's opinion is that the usage skills of Microsoft Excel are not very well, and everything the tester knows about Excel has been learned by doing.

**Pilot tester #2** is a 38-year-old medical doctor. The tester has been using computers for 25 years, though past 15 years more regularly. The tester uses the computers on a daily basis. The tester is familiar with the Äly Excel and have used it already two years. Not at the moment though. The

tester has not used Excel much and everything she knows and have learned is because of the usage of the Äly Excel. The tester has not taken any official Excel courses either.

**Test user #1** is a 54-year-old practical nurse. The tester has over 30 years of experience with computers. The computers are used at work on a daily basis. The user has the experience of the Äly Excel since autumn 2013. Excel itself is a bit unfamiliar and more training with it is wished by the user. That way the Äly Excel usage might become more flexible.

**Test user #2** is a 57-year-old registered nurse (RN). The test user has 30 years' of experience with the computers and is using them in everyday work still. The tester has used the Äly Excel for half a year, since spring 2014. The test user is familiar with the Microsoft Excel.

**Test user #3** is a 42-years-old practical nurse. The tester has used computers almost for 25 years. The computers are part of the user's daily work. The test user has over one year of experience with the Äly Excel. The user considers herself not being very good with Excel and wishes to have at least some basic training about Microsoft Excel.

### **3.4. Use cases**

There was really only one case: filling the Äly Excel as it normally is done. The pilot users do not use the Äly Excel in their daily work at the moment so they were given a so called dummy case what in this case means that they took one of the templates and started to plan a week from the scratch.

The actual test users conducted the tests as they were done in the ordinary work. The difference was that the observer was sitting next to the tester during the performance and some additional question forms were asked to fill in. These sessions contained also more free speak as some clarified questions was asked.

### **3.5. Testing session, usability findings and usability problems**

Due to the usability tests, several usability problems were found. In Table 1 the findings are introduced and the preliminary solution suggestions are presented. This was the starting point of designing the new version of the Äly Excel where the usability problems are fixed. As the project went further, some of the suggestions proved to be correct whereas some proposals needed a little bit of adjustment. For example, number 2. *Namecell*: There are not a longer cell nor an angled text, but there are a double high cell with text lining.

In the section 4.2. a final implementation is introduced. Some of the usability problems are solved, yet some proved to be too difficult to implement in this timeframe and this environment.

TABLE 1. Usability findings of the Äly Excel

#	Subject	Description	Solution suggestion
1	Availability	The Äly Excel is available in a website, but the user have to have a user account to that site.	Moving the Äly Excel templates to an area that is available for all the potential users
2	Namecell	The user needs to use abbreviations of the names because the name cell is too small.	A longer name cell and perhaps an angled text
3	Usage of a mouse	A mouse usage is quite high when using the Äly Excel. One have to make quite accurate actions with the mouse. And if the mouse is not good enough or the user has accustomed to a different mouse, using the Äly Excel could be quite difficult or at least more arduous.	The Äly Excel is designed to use with a mouse (not intentionally). Some helpful, ready-made automated tasks can be added, such as command buttons to add a new column etc.
4	Starting from the scratch	Starting to plan a new schedule from the plain template is laborious as the users need to add proper persons, add proper task descriptions and make a plan for a basic week (which is an ideal situation that everyone is at work).	Depending if there are many ways of using the Äly Excel, some ready-made template (or maybe an example) could be available.
5	Time blocks	The user has difficulties to see the proper time when colouring the time blocks. This comes more obvious when colouring the time blocks far away from the time definition column.	When selecting a starting point, the time information is highlighted. Also adding a time definition column to the other side of the day, too.
6	Copying	At least in some templates the users need to add the same information to every weekday, even if the information	The data is copied automatically to the other places, too

		is the same and in the same place in every day. For example the names and the task descriptions.	
7	Confused by the template #1	The templates are designed so that there is one example colour in every column that represents an employee. Planning starts by copying one of the colours to the appropriate cells. One colour equals one task entity. When the planning proceeds, all the colours are mixing. The problem is that at some point the user does not remember anymore which of the cells the user has modified and which cell colours are originally from the template. Originally the colours have been put there for checking that the equations are correct.	The initial colour differs from the colours that are used in the tasks. There might be a background pattern or a completely different colour that is not used in the task descriptions
8	Confused by the template #2	When assigning a particular task to someone, the user needs to change the colour from that employee which had that colour in the template to avoid confusion.	See Suggestion #7
9	Wrong place to check	A summary is a very important part of the Äly Excel. It is located at the bottom of the sheet, right below Friday. It looks almost the same as Friday's summary. There is a slight possibility that the user checks the summary not from the weekly summary table but the Friday's summary table.	One solution is to highlight it or design it so that it clearly differs from the other summaries. But even a better solution could be that the summary is moved to the top of the sheet (see also #11)

10	Equations	<p>The Äly Excel is based on the equations that calculate the hours that are assigned to the every task. If there are any mishaps what so ever in those equations, the Äly Excel does not calculate right and the big picture is not valid anymore. The problem is also that the cells are not protected in any way, so the user can modify inadvertently those equations. User must trust the template so that the user does not need to think whether the calculations are right or not.</p>	<p>Protecting the equations so that a regular user cannot change the equations by accident. This can be done by locking the appropriate cells and then protecting the worksheet.</p>
11	Scrolling #1	<p>As described in point #9, there is the important summary table at the bottom of the sheet. It is used constantly to check whether the tasks are reasonable way planned. The problem is that the user needs to scroll up and down all the time when checking the weekly summary.</p>	<p>Moving the summary to the top of the sheet and freeze the panes so that it is visible at all the time. This solution, however, might not be good, if the screen is too small and the user cannot see the whole day. Can it be on the right and then froze?</p>
12	Duplicating a sheet	<p>Once the base week has been planned, the user usually duplicates the sheet, renames it and starts to make the plans where the user is taking into account any exceptions and absences of the employees. There have been observations that after eight copied sheet the equations are not calculating right.</p>	<p>Copying the sheet can be automatized so that the user needs to push only one button. Equation problems must be examined and figured out what is going wrong.</p>

13	Data to the Effic	After the user has made the plans, the user needs to open another application where to enter the planned time schedules. This happens by copying by hand the information from the Äly Excel to another system.	In an ideal world the Äly Excel and the Effic (and any other system) are talking to each other. Meaning that they share an interface and all the data is passed automatically. This might be the future solution, but impossible at this time frame.
14	More colours are needed	If there are not enough colour codes available in the template that the user choose, adding the colours and the tasks can be problematic. One has to make sure that all existed and new equations are still working bullet proof. If there are not enough colours, the plan will not be as accurate as it can be, and causes more memory load to the user, as the user needs to remember what tasks had been planned because they are with the same colour as some other task entities.	The form should be designed so that there are very easy way to add colours and codes. Maybe one command button that asks the colour and task name. Yet there must be found a golden rule how many colours are enough and what is too much. Too many colour codes make the Äly Excel too complicated, confusing, and unclear.
15	More employee columns are needed	The same as at point #14: the user needs to add more employees to the template. How to add the columns and be sure that the equations are still working?	Same as at point #14. A simple command button available that adds the column and makes sure that the equations are in place.
16	Different block length than in template	Depending on the employee's profession there are certain tasks that differ from the basic task length. For example, the doctors have a 20 minutes lunch break, yet most of the tasks take 15 minutes. One needs to remember this	This might be difficult to solve, unless the time blocks are shortened to five or even to one minutes.

		inconsistent block when entering the data to another system.	
17	Scrolling #2	If the user has a small display (as it is often the case when using a laptop), one has to scroll a lot. If one day barely fits into the screen, the user needs to scroll to see the colour codes. OR remember the colours by heart.	Reorganizing the data on the screen. Can the colour codes be beside the table? Is it possible to make the content smaller yet it is still readable?
18	Notes or remembering?	There might come up a situation that a task is better to design after another. However, if the task is not that important it might be forgotten. User needs to remember what was in the mind earlier.	User could add a comment or some kind of remark what to remember
19	Order of tasks aka colouring little blocks	The right order of changing the colour is quite vital if one wants to reduce the number of areas that need to be coloured. For instance if the user colours with the same colour one column (aka employee) first and then wants to add, say a coffee break, for the remaining employees, the user cannot colour the entire row at once because then that mentioned employee will also have the coffee break even if it is not an intention.	This is a fundamental behavior of Excel. Maybe some hint text so that mark first the horizontal colours and only after the vertical ones.
20	Calculating summary of the certain tasks per employee	Some of the tasks are dependent on other tasks. For example, the amount of the office hours depends on how many hours of practice the doctor is doing. In order to calculate the office hours, the user needs to calculate manually the employee's practice hours.	The Äly Excel should calculate automatically how many hours of certain task has been assigned to any employee. This number is visible so that it is easy to see and there is no need to calculate the value manually. However, because those hours are not constant



			and varies in every health centers this functionality is not so easy to put into practice.
21		The user has many sources of exceptions. Meaning that the information about absences and trainings comes from many places and in many ways (via e-mail, in Effica, corridor talks, paper calendar). All this confusing data entry makes it difficult to plan the weekly schedules with the Äly Excel.	This is not the Äly Excel's fault. It is a matter of communication and the common tools that are used (or not used) in the organization. However, for future reference: a direct link to and from the Äly Excel and the Effica and calendar information could be one solution. It requires a common interface and that is not feasible in this study.
22		When the user is moving the information from the Äly Excel to the Effica, one doctor at a time is examined. The information is oriented to the columns and each doctor is side by side. There is a possibility that the user confuses and checks the plan from another column which is the other doctor's plan.	Possibility to highlight a certain row or a column would help the user to identify the correct information.
23	Re-selecting the colour	The user has chosen one colour which is going to be used for many cells. The user copies it normally but at some point the "copy" disappears and the user needs to copy it again in order to paint another areas.	I think this is the fundamental behavior of Excel, but if a <i>copy</i> function is behind one click, it might ease up a little bit.
24	Days and weekdays	When the user copies a new worksheet, the week and the day info are needed to change by hand to the form.	When the new worksheet has been copied, the form asks what week it will be and thus adds the correct days to the

			form by using a calendar feature.
25	Special days	There are special days and weeks also that differ from everyday life, such as special holidays. That is something that the user needs to consider when making the plans.	Some of the holidays are so fixed that Excel could recognize the holidays and place a note that there is something special on this week.
26	Personal holidays	The employees have distinctive holidays and leaves during the year. The user needs to consider those also in advance so that the employees have time to perform some special tasks before the leave.	If there was a calendar, the system could place a note of the upcoming holidays.
27	Green marks in cell	Excel has recognized an error in the cell and displays a little green mark in a cell. The formulas seem to work anyhow and the user is confused what is wrong. Excel hint does not clarify what is wrong. The user hopes that there would be a clear instruction what to do when this situation occurs.	Excel hints are what they are. The hints can be taken away. Also prohibiting the users for modifying the equations.
28	Inflexible blocks	Ready-made blocks are somewhat inflexible. There are blocks that need to be 20 minutes long, but the Äly Excel form does not support this kind of flexible block base.	It is not necessary feature that there are 20 minutes blocks. But in the weekly summary can be different equations for an unexperienced doctor. This, however, requires that there are some kind of indication who is a un/experienced doctor.

29	Demand and balance not used	The demand and the balance features are handy, but they are not used because the user has not any training with that.	
30	Colour copying	There are a difference when copying a colour from the base or from the side-line. The former has also borders but the latter does not. When copying from both places, the layout becomes more discontinuous	Adding the borders to the both of the colour areas.

### 3.6. User aspects

The questionnaire was conducted (Appendix 5) during the usability tests and via a Webropol survey tool [19.]. One question was a request for comments how the Äly Excel could be enhanced.

The following are the proposed enhancements:

- *Adding new employees to the table should be easy.*
- *Start and end times of the day should be changeable.*
- *Basic functions and a colour chart should remain as they are. However, adding the colours afterwards should be possible.*
- *A calendar feature is missing. The information can be in multiple places.*
- *Adding more rows and colours is difficult, one should know how to add equations.*
- *Possibility to see a column information in rows (transposed information) so that an employee's whole week is visible at one sight.*
- *Possibility to see every day of the week at once. It would be great if the days are collected side by side yet organized so that there is no need for the horizontal scrolling.*
- *One day in its entirety should be visible without scrolling up and down.*

- *A colour [in the daily planning area] should automatically change when a number is entered. Copy-paste works but is essentially slow.*
- *I have personally utilized the functionality of freezing the cells and also added the times of a day to the right side [of the planning area].*
- *Dates and the days of the week should be easy to see always when working with the Äly Excel.*
- *There is a web based version in Sweden which is worth familiarize with. A discussion has taken place precisely on this aspect.*
- *There have been problems when informing other parties. For example school nurses or home nurses cannot read Excel.*
- *It (the Äly Excel) should be integrated to the existing system to avoid unnecessary overlapping work.*
- *The term “Äly Excel” is not familiar to me. I associate it to the doctors’ work schedule planning Excel. I have seen the introduction of it but I do not have any other experience on that.*

The following benefits of the Äly Excel were reported:

- *It is easy to observe the weekly plan of every employee with a single glance.*
- *The balance is easily seen, meaning that how we respond to the demand.*
- *I can see on a weekly level what employee’s working hours consists of, and on the daily-specific summary of the employees at the health care center.*
- *The counter is calculating automatically the balance of how our supply responds to the demand.*
- *It easy to demonstrate to the others what happens in the balance and the operation if everybody are absent at the same time.*
- *With it [the Äly Excel] I can see the big picture better.*
- *I am a visual person and I think the Äly Excel suits very well for people like me.*

- *The colours help perceive the totality better.*
- *With this tool it is easy to perceive the available resource in the big picture. It acts also as a visual tool when communicating the division of work with the employees.*
- *Calculates the resources in respect of the demand. Helps to plan the appointment books and sharing the resources.*
- *It creates a necessary condition for a medical superintendent and a director of nursing service to run the daily processes.*
- *Stability to the work planning. The measurement results about the appointment resources.*
- *I can argue my appointment book plan.*

### **3.7. Strengths and weaknesses of the Äly Excel usability testing**

In the thesis writer's consideration the following are the strengths and weaknesses of the Äly Excel usability testing:

- + The test persons were actual Äly Excel users
- + Some of the testing were a real case situation
- + The observation time was long enough (~1,5 h per user)
- No recommendations how to improve or enhance the system from the users
- Only one person was observing and reporting the test sessions, and suggestions how to improve the tool is only one person's opinion. Could have been more productive if more people were involved.

### **3.8. Designing new user interface**

The goal of this task is to make the Äly Excel easier and safer to use. This means that the error prevention works so that the users cannot modify Excel by accident. An easier usage does not mean that the tool does the planning by itself. Nor it means that by one click everything is ready.

As this work progressed, it became clear that the functionalities of the Äly Excel are very much in place. There is no need to design more operations. However, there are little features that can be

improved. Some has to do with the appearance (“cleaning” the layout and some cell, row and column adjustments) and some are functions that help the users to achieve a goal that they need to do (adding a new worksheet, for example).

As the users might not be that familiar with Microsoft Excel itself, some useful features were designed to the Äly Excel. During the planning phase a lot of ideas were rising. Yet only a few of the ideas were actualized. Too many new features was not wanted because they might only confuse the users and some might not add any value at all. Simpler is better usually and some of the ideas might have been too much. Moreover, not every problem can be solved with the Äly Excel, even if that sounds good. So, a ground rule was to tidy up the interface and hide the “excelhood” to ease up the usage. The complexity is a constant (Tesler’s law [20.]) applies here so that the interface is easier to use because the complexity is hidden to the Visual Basic macrocodes.

If the Äly Excel was a web form, a UI designer should consider the fact that the web forms do not display similarly on different browsers or platforms [21.]. Since the Äly Excel is an Excel-based tool, and it is most commonly used on the computers, the most important restrictive factor is the size of a computer screen. The view of the content must be settled so that there is enough information viewable at once – thus avoiding unnecessary scrolling - even when a small screen is used. Other effective point is that the older versions of Microsoft Excel do not support all new features which might be handy when designing features to the Äly Excel.

### **3.9. UI description**

The UI aspects of the Äly Excel reflecting Nielsen’s definitions of the usability are evaluated next [7]. The definitions are studied in more detail in Section 2.1.

#### **Learnability:**

- The principle of designing the UI is that there are as unambiguous features that it is obvious how they work.
- Compared to the original version of the Äly Excel, the basic functions have remained the same.

#### **Accelerators:**

- Shortcut hotkeys (showing or hiding the employees and the tasklist, adding a new week) versus pushing a relevant button

- Filling the task table by pressing a corresponding number (the right colour will automatically appear) versus copy-paste of the colours and the numbers. This applies also to the efficiency.
- The basic functions of the Äly Excel still exists in the new version. The equations and the overall layout remains the same (expect the Weekly summary which was moved from the bottom to the top of the sheet). So, an experienced Äly Excel user should be able to use the new version fairly easily. I.e. a learning curve does not start from the bottom [7].

### **Efficiency:**

- Comparing to the original version of the Äly Excel, adding a new week is easier and faster.  
The old version: the user selected Home -> Format -> Move or Copy Sheet... -> click "(move to end)" and "Create copy". Then renames the new sheet by right-clicking the mouse over the sheets name and choosing Rename. When a new copy was created, the user manually added the dates corresponding to the week that was about to be planned.  
The new version: the user clicks the 'Uusi viikko' – button (New week), gives a week number and a year (the current year is shown by default). The Äly Excel copies automatically new worksheet to the last, renames it with the given week number (and additionally, if the week is the 1<sup>st</sup> of the year, adds the given year to the name). Furthermore, the dates are added automatically next to the days of the week, as well as the week number and the year is added to top of the sheet.
- The weekly summary is visible at all time if the user wishes so. Its position is frozen to the top of the sheet so that it will not move when scrolling up and down on different days. It is noticeable that the weekly summary can be minimized totally so that only the 'Yht.' (In all) row is visible. This gives more space to the daily views. The tasks in the weekly summary can also be hidden or unhidden individually. So the only important or deliberate tasks are visible. Hiding or un hiding a task does not affect the formulas, meaning that a hidden row values are calculated normally to the 'Yht.' (In all).

### **Memorability:**

- When hiding or showing the employees or the tasks, a list of all the employees and the tasks are shown in a pop-up form. From the list it is easily seen which of the employee or the task is hidden (the checkbox value is empty) or visible (the checkbox value is filled).

### **Errors:**

- To avoid user errors, most part of the workbook is locked. Unlocked are only those parts where the user is supposed to do changes. This includes also that the users are not allowed to add or delete rows or columns. The equations cannot be modified, which is very important. In the Visual Basic code the worksheets are occasionally unprotected when changes need to be

done in the workbook. The protection is however always put on as soon as the code has been executed.

- Error prevention is also added to the Visual Basic code. When adding a new week, an empty week or year value is ignored. A week number greater than 53 is not accepted. Also only numerical values are accepted.
- The users are not allowed to add or remove any rows or columns. Adding the rows or the columns might cause unwanted behaviour on the calculations. However, a need for amount of the tasks (rows) or the employees (columns) varies per the Äly Excel user. That is why it was agreed during the project that the maximum number of the tasks is 15 and the maximum number of the employees per worksheet is 30. The extra task rows and the employee columns can be hidden by using the appropriate command buttons without a risk that the equations gets broken.
- The Äly Excel user cannot use any other numbers to the daily planning area than 0 to 15 corresponding to the tasks.
- When adding a new week, the current year is provided as the default value. It is a minor detail but might prevent sometimes a false user input.



## 4. UI IMPLEMENTATION WITH VISUAL BASIC

Visual Basic (VB) is a programming language developed by the Microsoft. It was released in 1991 [22.] The Visual Basic Application (VBA) is included in the Microsoft Office package.

### 4.1. Implementation with Visual Basic

Even though some kind of web interface was hoped by the Hyvä Potku project, the implementation of this work was done with the Visual Basic. There are few explanations.

- A web application needs a web server. There were no indications that the PPSHP is offering this kind of platform in this timeframe. Considering the schedule, it might have taken too long time to ensure that there is a web server and even a database available.
- Excel, even it is designed with the Visual Basic can be used either locally, saved on a PC or globally, or saved on a cloud. Besides, Excel is a flat file, so there is no need for an external database since all the information needed is stored in that particular Excel-file.
- As the original Äly Excel was made with Excel, the conclusion was that the Visual Basic is a good tool to enhance the Äly Excel since the Visual Basic Application is already included to Excel. So there were no need to acquire any other development software. And what comes to visualising, Excel provides some basic control forms such as the command buttons, the check boxes, the option buttons, and so on.
- As the writer of this thesis is not an experienced programmer, time for studying and learning needed web programming languages and tools in order to implement the Äly Excel in a web format was not enough.

Alternative implementations:

- Microsoft Excel ActiveX components had to be abandoned because of the unexpected and irrational behaviour on different platforms. During the development phase it was found that the ActiveX buttons moved, changed the position or stopped working precipitously. Form control buttons are more reliable but the formatting capabilities of the buttons are quite limited. The macros can be run also from all different kind of shapes. The shapes can be modified quite flexibly and the appearance can be edited for appropriated form.

The Visual Basic codes that were written are explained in section 4.2.

## 4.2. UI description and new features

Modifications of the Äly Excel layout and the descriptions of the new features are explained next.

1. **Weekly summary** is lifted to the top of the worksheet and frozen so that it will not scroll with the rest of the sheet (Figure 3). The undermost row of the weekly summary is reserved for the employee's names. Those cells are open for modifications so the Äly Excel user can edit the names as appropriate.

	A	B	C	D	E	F
4			<b>Viikko yhteensä</b>			
5	Piilota	1	LVO	0,00	0,00	0,00
6	Piilota	2	PTY, KONS	0,00	0,00	0,00
7	Piilota	3	PÄP	0,00	0,00	0,00
8	Piilota	4	SPYY	0,00	0,00	0,00
9	Piilota	5	RES	0,00	0,00	0,00
10	Piilota	6	KOUL, KOK	0,00	0,00	0,00
11	Piilota	7	RUO, KAFFE, LAES, SIIR	0,00	0,00	0,00
12	Piilota	8	NLAT, KOULU, HAL yms.	0,00	0,00	0,00
13	Piilota	9	TIIMI	0,00	0,00	0,00
14	Piilota	10	OMHO	0,00	0,00	0,00
15	Piilota	11	PUH	0,00	0,00	0,00
16	Piilota	12	vara	0,00	0,00	0,00
17	Piilota	13	vara	0,00	0,00	0,00
18	Piilota	14	vara	0,00	0,00	0,00
19	Piilota	15	EI PAIKALLA	0,00	0,00	0,00
20			Yht.	0,00	0,00	0,00
21	Piilota toimitteet		Näytä toimitteet	Nimi	Nimi	Nimi
22	Henkilöt +/-		Lisää viikko	1	2	3

	AG	AH	AI	AJ	AK
	YHT.	KYSYNTÄ	BALANSSI		
5,00	5,00		5,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
2,00	0,00		0,00		
5,00	5,00	0,00	5,00		
imi	YHT.	KYSYNTÄ	BALANSSI		
30	YHT.	KYSYNTÄ	BALANSSI		

FIGURE 3. Weekly summary view

2. **Task list** is limited to maximum of 15 different items and colours (this was agreed by the project). In the weekly summary the items can all be hidden or brought into visible individually. This feature is designed to help the users to modify an individual view. If all of the fifteen tasks are not needed, the extra items can be filtered out. Also, if the user wants to concentrate only on some of the tasks, the rest of the tasks can be hidden so that the point of interest is at sight. Hiding the rows gives also more space for the daily planning view, which might become handy if there are a lot of tasks in use and the length of the day is long. However, hiding the items in the weekly summary does not affect the daily view.

The colours are now fixed so that the user cannot change freely. This is due to *conditional formatting* rules in the daily planning area. The rules include the task colours and if the initial colours are

changed the conditional formatting rules do not apply anymore. The colours however do not follow the spectrum, even if it is highly recommended [12]. The users are on the other hand allowed to change the task names so that they can associate any of the task names to any of the colours. If the nature of the Äly Excel is considered, there is no reason to follow conventional occidental colour associations, such as red means danger or green is for 'go'. For the readability point of view, some of the numbers of the task colours are white even it is more recommendable to use black font [12]. The white font is readable when the background colour is darkish or even black.

3. For **hiding the tasks** there are individual command buttons on every task row. Hiding is done simply by clicking a button, and the row as well as the corresponding button disappears. Additionally there is one particular command button ('Piilota toiminteet' (Hide the tasks), Figure 4) that hides every task row at once. Only 'Yht.' (All in) and the name rows remains visible.

	A	B	C
4	<b>2014</b>	<b>44</b>	<b>Viikko yhteensä</b>
5	Piilota	1	LVO
6	Piilota	2	PTY, KONS
7	Piilota	3	PÄP
8	Piilota	4	SPYY
9	Piilota	5	RES
10	Piilota	6	KOUL, KOK
11	Piilota	7	RUO, KAFFE, LÄES, SIIR
12	Piilota	8	NLAT, KOULU, HAL yms.
13	Piilota	9	TIIMI
14	Piilota	10	OMHO
15	Piilota	11	PUH
16	Piilota	12	vara
17	Piilota	13	vara
18	Piilota	14	vara
19	Piilota	15	EI PAIKALLA
20			Yht.
21	Piilota toiminteet	Näytä toiminteet	
22	Henkilöt +/-	Lisää viikko	
23			

FIGURE 4. Hide the buttons

The following Visual Basic code is behind the macros attached to the 'Piilota' (Hide) buttons.

```
Sub Piilota_Click(row As Variant)
    'Unprotecting the sheet while code execution
    ActiveSheet.Unprotect
    'For preventing screen flashing
```

```

Application.ScreenUpdating = False
`Selecting the appropriate rows
`and hiding them
ActiveSheet.Rows.Range(row).EntireRow.Hidden_ = True
`Setting the activecell to "AF1"
ActiveSheet.Range("AF1").Select
Application.CutCopyMode = False
Application.ScreenUpdating = True
ActiveSheet.Protect
End Sub

```

Every 'Piilota' (Hide) command button runs a unique macro. This is an example of hiding the first task row, which is "5:5".

```

Sub Piilota1_Click()
    Piilota_Click "5:5"
End Sub

```

For bringing the **rows into sight** again there is a command button 'Näytä toiminteet' (Show tasks). When the user clicks it, a userform (Figure 5) is shown where the user can choose the rows the user wants to see (or hide). If the row is already visible, there is a selection in the corresponding checkbox. If the row is hidden, the checkbox is empty. If the user clicks 'Kaikki' (All), either all the checkboxes will be cleared or filled respectively. By hitting an "OK" button all marked rows will be visible and all unmarked rows will be hidden. A "Cancel" button offers a way to invalidate the actions. The placement of the 'Näytä toiminteet' (Show tasks) button was considered carefully. It should be in a place where there is no risk that it is hidden by the user. As the user has the opportunity to hide every row from the weekly summary, and the daily planning area and even every employee column, there really is not much space where to position the buttons that should be always visible. This was the challenge also in the 'Henkilöt +/-' (Employees +/-) and the 'Lisää viikko' (Add a week) command buttons.

When the 'Näytä toiminteet' (Show tasks) button is pressed, a window, as in Figure 5, is displayed.

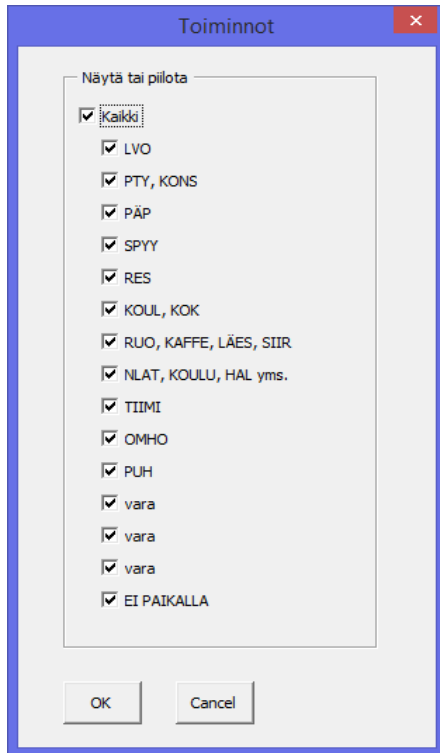


FIGURE 5. Task list (Weekly summary view)

A subroutine named ShowTasks\_Click() is called. That subroutine calls a userform named TaskRowsUserForm like this:

```
Sub ShowTasks_Click()
    TaskRowsUserForm.Show
End Sub
```

Before the 'Toiminnot' (Tasks) window opens the userform is initialized as shown in here:

```
Private Sub UserForm_Initialize()
    Dim taskcolumn As String
    taskcolumn = "C"
    CheckBoxKaikki.Caption = "Kaikki"
    CheckBox1.Caption = "1 - " & Range(taskcolumn &
5).Value
...
```

```

    CheckBox15.Caption = "15 - " & Range(taskcolumn &
19).Value
    If Range("5:17").EntireRow.Hidden = False Then
        CheckBoxKaikki.Value = True
    ElseIf Range("5:17").EntireRow.Hidden = True Then
        CheckBoxKaikki.Value = False
    End If
    If Range("5:5").EntireRow.Hidden = False Then
        CheckBox1.Value = True
    ElseIf Range("5:5").EntireRow.Hidden = True Then
        CheckBox1.Value = False
    End If
...
    If Range("19:19").EntireRow.hidden = False Then
        CheckBox15.Value = True
    ElseIf Range("19:19").EntireRow.hidden = True
    Then
        CheckBox15.Value = False
    End If
End Sub

```

The checkbox captions are taken from Excel, column C plus an appropriate row. In front of the name the task numbers (1-15) are attached. The script also finds whether the particular rows are already hidden or not and sets or unsets the checkbox value accordingly. This is done for the every task row (from 5 to 19 in this case).

When the user hits the "OK" button, another subroutine will be performed. The subroutine is the following:

```

Private Sub OKCommandButton_Click()
    ActiveSheet.Unprotect
    Application.ScreenUpdating = False
    Application.EnableEvents = False

```

```
If CheckBoxKaikki.Value = True Then
    rows.Range("5:17").Select
    ActiveSheet.Unprotect
    Selection.EntireRow.Hidden = False
```

```
End If
```

```
If CheckBoxKaikki.Value = False Then
    rows.Range("5:17").Select
    ActiveSheet.Unprotect
    Selection.EntireRow.Hidden = True
    CheckBox1.Value = False
```

```
End If
```

```
If CheckBox1.Value = True Then
    rows.Range("5:5").Select
    ActiveSheet.Unprotect
    Selection.EntireRow.Hidden = False
```

```
End If
```

```
If CheckBox1.Value = False Then
    rows.Range("5:5").Select
    ActiveSheet.Unprotect
    Selection.EntireRow.Hidden = True
```

```
End If
```

...

```
If CheckBox15.Value = True Then

    Rows.Range("19:19").Select
    Selection.EntireRow.hidden = False
```

```
End If
```

```
If CheckBox15.Value = False Then

    Rows.Range("19:19").Select
    Selection.EntireRow.hidden = True
```

```
End If
```

```

Range("AF1").Select
    Application.CutCopyMode = False
    Unload Me
    Application.ScreenUpdating = True
    Application.EnableEvents = True
    ActiveSheet.Protect
End Sub

```

It checks the values of the checkboxes and hides or unhides the rows respectively. At the end of the script an active cell is set to "AF1", the userform is unloaded and the sheet is protected again.

If the user hits the "Cancel" instead of the "OK", a cancellation subroutine is executed. The subroutine looks like:

```

Private Sub CancelCommandButton_Click()
    Unload Me
End Sub

```

It simply unloads the userform and no changes are done.

4. 'Henkilöt +/-' (Employees +/-) offers a function to narrow down the **number of (visible) employee columns**. In the Äly Excel the maximum number of the employees is set to 30. This was agreed by the project.

The employees can be hidden by hitting the 'Henkilöt +/-' (Employees +/-) button. A window, like illustrated in Figure 6, is shown. Likewise in the taskrows, visible employees are chosen by marking the corresponding checkbox.

Additionally the user can choose whether the employee is an expert or a novice on her/his area of expertise. Mainly this feature is for the medical doctors as for the novice doctors longer appointment times are allocated. If an employee is chosen to be a 'Nuori' (Young aka novice) the Äly Excel takes that into account and calculates the 'Balanssi' (Balance) according to the longer appointment times. This refers only to the first task row.





FIGURE 6. Employee's manipulation user form

When the 'Henkilöt + / -' (Employees +/-) button is clicked, the following subroutine is executed.

```
Sub Columns_Click()
    Application.ScreenUpdating = False
    ColumnsUserForm.Show
    Application.ScreenUpdating = True
End Sub
```

The ColumnsUserForm is automatically initialized by the Userform\_initialize() subroutine before the launch. Below is listed parts of the initializing subroutine.

```
Private Sub UserForm_Initialize()
    Application.ScreenUpdating = False
    Dim nameRow As Integer
    nameRow = 21
    Label1.Caption = Range("D" & nameRow).Value
    Label2.Caption = Range("E" & nameRow).Value
    ...
    Label30.Caption = Range("AG" & nameRow).Value

    If Range("D:D").EntireColumn.Hidden = False Then
        CheckBox1.Value = True
    ElseIf Range("D:D").EntireColumn.Hidden = True Then
        CheckBox1.Value = False
    End If
```

```

If Range("E:E").EntireColumn.Hidden = False Then
    CheckBox3.Value = True
ElseIf Range("E:E").EntireColumn.Hidden = True Then
    CheckBox3.Value = False
End If
...
If Range("AG:AG").EntireColumn.hidden = False Then
    CheckBox59.Value = True
ElseIf Range("AG:AG").EntireColumn.hidden = True
Then
    CheckBox59.Value = False
End If

If ActiveSheet.Range("D3").Formula =
"=(D105+D203+D301+D399+D497)/4*3" Then
    CheckBox2.Value = True
End If

    If ActiveSheet.Range("E3").Formula =
"=(E105+E203+E301+E399+E497)/4*3" Then
        CheckBox4.Value = True
    End If
...
    If ActiveSheet.Range("AG3").Formula =
"=(AG79+AG151+AG223+AG295+AG367)/4*3" Then
        CheckBox60.Value = True
    End If

Application.ScreenUpdating = True
End Sub

```

First the captions of the checkboxes are set according to the names in Excel. Then the script checks if some of the employee columns are hidden or not and sets the value of the checkbox accordingly. There is a hidden row in Excel that contains equations of the young doctors' appointment times.

That equation is set when the user set the 'Nuori' (Young) status and is taken away if the status is not set anymore. The initializing script checks if there is a young doctor's equation on row 3. If the script finds one, it sets the corresponding value to true.

The following code is executed when the user clicks the "OK" button:

```
Private Sub OKCommandButton_Click()  
    ActiveSheet.Unprotect  
    Application.ScreenUpdating = False  
    Application.EnableEvents = False  
  
    If CheckBox1.Value = True Then  
        Columns.Range("D:D").Select  
        ActiveSheet.Unprotect  
        Selection.EntireColumn.Hidden = False  
    End If  
  
    If CheckBox1.Value = False Then  
        Columns.Range("D:D").Select  
        ActiveSheet.Unprotect  
        Selection.EntireColumn.Hidden = True  
        clear "D25:D102"  
    End If  
  
    If CheckBox3.Value = True Then  
        Columns.Range("E:E").Select  
        ActiveSheet.Unprotect  
        Selection.EntireColumn.Hidden = False  
    End If  
  
    If CheckBox3.Value = False Then  
        Columns.Range("E:E").Select  
        ActiveSheet.Unprotect  
        Selection.EntireColumn.Hidden = True  
    End If
```

```

        clear "E25:E102"
    End If
...

    If CheckBox59.Value = True Then

        Columns.Range("AG:AG").Select
        ActiveSheet.Unprotect
        Selection.EntireColumn.hidden = False

    End If

    If CheckBox59.Value = False Then

        Columns.Range("AG:AG").Select
        ActiveSheet.Unprotect
        Selection.EntireColumn.hidden = True
        clear "AG25:AG76"

    End If

    If CheckBox2.Value = True Then
        ActiveSheet.Range("D3").Formula =
"=(D105+D203+D301+D399+D497)/4*3"
        ActiveSheet.Range("D5").Font.Italic = True
        ActiveSheet.Range("D5").Font.Colour = vbRed
    Else
        ActiveSheet.Range("D3").Formula =
"=D105+D203+D301+D399+D497"
        ActiveSheet.Range("D5").Font.Colour = vbBlack
    End If

    If CheckBox4.Value = True Then
        ActiveSheet.Range("E3").Formula =
"=(E105+E203+E301+E399+E497)/4*3"
        ActiveSheet.Range("E5").Font.Italic = True
        ActiveSheet.Range("E5").Font.Colour = vbRed
    End If

```

```

Else
    ActiveSheet.Range("E3").Formula =
"=E105+E203+E301+E399+E497"
    ActiveSheet.Range("E5").Font.Colour = vbBlack
End If

If CheckBox60.Value = True Then

    ActiveSheet.Range("AG3").Formula =
"=(AG79+AG151+AG223+AG295+AG367)/4*3"
    ActiveSheet.Range("AG5").Font.Italic = True
    ActiveSheet.Range("AG5").Font.Colour = vbRed
Else
    ActiveSheet.Range("AG3").Formula =
"=AG79+AG151+AG223+AG295+AG367"
    ActiveSheet.Range("AG5").Font.Colour = vbBlack
End If

Range("AF1").Select
Application.CutCopyMode = False
Unload Me
Application.ScreenUpdating = True
Application.EnableEvents = True
ActiveSheet.protect
End Sub

```

If the 'Nuori' (Young) checkbox is true the script adds an equation to the 3<sup>rd</sup> row and that value is used when calculating the balance value. Furthermore, the value of the weekly summary is coloured red and the text is non-italicized (the default font in the weekly summary area is black colour and italicized).

The script checks the name checkbox values and hides or unhides the columns accordingly. For every name columns there is an own if-clause. If the checkbox is untrue the script both hides the column but also clears the areas that are on the daily planning areas by calling a subroutine called `clear`, which is shown here:

```

Private Sub clear(d As Variant)
    Dim mo, tu, we, th, fr, week As Range
    Set mo = Range(d)
    Set tu = Range(d).Offset(98)
    Set we = Range(d).Offset(196)
    Set th = Range(d).Offset(294)
    Set fr = Range(d).Offset(392)
    Set week = Union(mo, tu, we, th, fr)
    week.ClearContents
End Sub

```

If the user clicks the “Cancel” instead of the “OK”, the userform is unloaded and no changes are done. This script is executed when the “Cancel” is pressed.

```

Private Sub CancelCommandButton_Click()
    Unload Me
    ActiveSheet.protect
End Sub

```

5. **The length of the day** can be adjusted also. There are different needs among the Äly Excel users and the lengths of the days vary. The longest day can be from 07:00 to 20:00. If that is too long and the user wants to see a shorter day, it can be done by adjusting the start and end times by clicking a command button, for example ‘MAANANTAI’ (Monday). A ‘Päivän pituus’ (Length of the day) window opens as shown in Figure 7. A start and end time interval is the same

as the blocks in that particular Äly Excel. The extra hours are simply hidden so that if the user wants to adjust the day length it is easily done without losing any data.

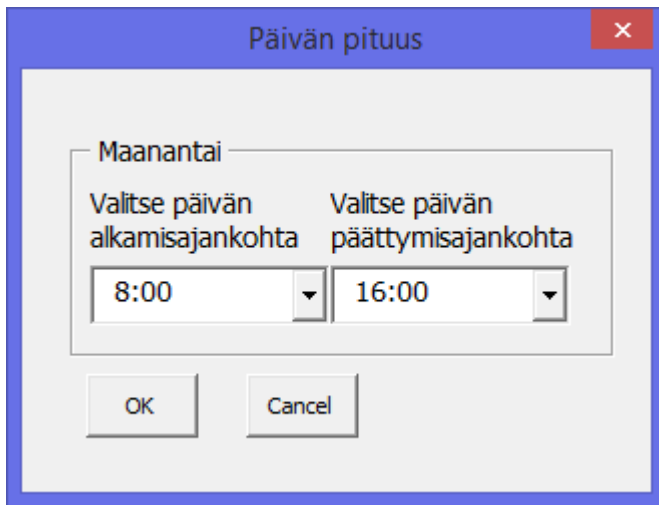


FIGURE 7. Length of the day user form

For showing the day length adjustment form a following script has been created and is attached to the corresponding command button. For every day there is an own script, for example, script for Monday looks like:

```
Sub daylengthMonday()  
    MondayUserForm.Show  
End Sub
```

The userform is initialized first as described here:

```
Private Sub UserForm_Initialize()  
    With AloitusCB  
        .RowSource = "A25:A55"  
        .ListIndex = 6  
    End With  
    With LopetusCB  
        .RowSource = "A55:A103"  
        .ListIndex = 24  
    End With  
End Sub
```

```
End With
End Sub
```

There are two combo boxes which represent the starting and ending times of a day. There is a hidden area with time values ("A25:A55") in Excel. The combo boxes are filled with those values and the default value shown is also set. In this case, the default value for the starting time is 08:00 and the default value for the ending time is 16:00.

The user chooses the desired starting and ending times and clicks the "OK". After clicking the "OK" button a following script is executed:

```
Private Sub OKMondayCommandButton_Click()
    ActiveSheet.Unprotect
    Application.ScreenUpdating = False
    Application.DisplayAlerts = False
    Application.Calculation = xlCalculationManual
    daystart "25:25", "7:00", "25:54"
    daystart "25:25", "7:10", "26:54"
    daystart "25:26", "7:20", "27:54"
    ...
    dayend "55:102", "12:00", "54:54"
    dayend "56:102", "12:10", "55:55"
    dayend "57:102", "12:20", "55:56"
    ...
Unload Me
    Application.Calculation = xlCalculationAutomatic
    Application.ScreenUpdating = True
    ActiveSheet.protect
End Sub
```

The following subroutines are called by OKMondayCommandButton\_Click():

```
Private Sub daystart(hiderow As Variant, time As String,
showrow As Variant)
```



```

ActiveSheet.Unprotect
Application.ScreenUpdating = False
Application.DisplayAlerts = False
Application.Calculation = xlCalculationManual
If AloitusCB.Value = time Then
    ActiveSheet.Rows.Range(hiderow).EntireRow.Hidden =
True
    ActiveSheet.Rows.Range(hiderow).EntireRow.Locked =
True
    ActiveSheet.Rows.Range(showrow).EntireRow.Hidden =
False
    ActiveSheet.Rows.Range(showrow).EntireRow.Locked =
False
    ActiveSheet.Range("C24").Select
End If
ActiveSheet.Range("A25:C76,AH25:A076").Locked = True
Application.ScreenUpdating = True
Application.DisplayAlerts = True
ActiveSheet.Protect
End Sub

```

```

Private Sub dayend(hiderow As Variant, time As String, show-
row As Variant)
    ActiveSheet.Unprotect
    Application.ScreenUpdating = False
    Application.DisplayAlerts = False
    Application.Calculation = xlCalculationManual
    If LopetusCB.Value = time Then
        ActiveSheet.Rows.Range(hiderow).EntireRow.Hidden =
True
        ActiveSheet.Rows.Range(hiderow).EntireRow.Locked =
True
        ActiveSheet.Rows.Range(showrow).EntireRow.Hidden =
False
    End If
End Sub

```

```

        ActiveSheet.Rows.Range (showrow) .EntireRow.Locked =
False
        ActiveSheet.Range ("C24") .Select
    End If
    ActiveSheet.Range ("A25:C76,AH25:A076") .Locked = True
    Application.ScreenUpdating = True
    Application.DisplayAlerts = True
    ActiveSheet.protect
End Sub

```

The script hides or unhides the rows according to the user's choice. It also locks the hidden rows and unlocks the rows when the rows are brought to visible. As the script locks and especially unlocks the entire rows, a following command is executed so that the appropriate cells remain locked:

```

ActiveSheet.Range ("A25:C76,AH25:A076") .Locked = True

```

Adjusting the day length script is a little bit slow in the 10 minutes block Äly Excel when adjusting Wednesday and especially Thursday and Friday. This is due to a large amount of rows and an `offset` property used in the script. It is considered not being a major flaw as the day adjustments are done quite seldom thus it is not slowing down the work substantially. If the Äly Excel is under a development in the future this part of the script should be taken under investigation and enhance the efficiency of the program.

6. A time column is on the both sides of the planning area hence it is easier to see when working on either side of the planning area. The time of the day on the both sides of the planning area is highlighted corresponding where the active cell is (see Figure 12). This helps the user to focus on the relevant cells.

7. For adding a new week (aka. new worksheet) there is a command button named 'Lisää viikko' (Add a new week). When the user presses the button, two dialog boxes for the user input are displayed. In the first one (Figure 8) the system asks the number of the week the users

wishes to create and the second (Figure 9) is the year of the week. The current year is given as a default.

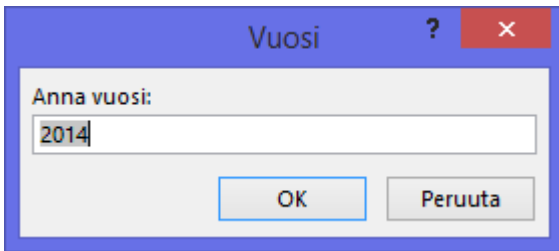


FIGURE 8. Give a week number

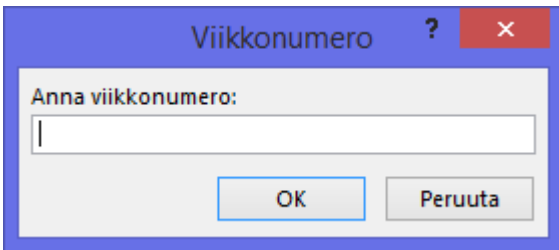


FIGURE 9. Give a year

With these information the Äly Excel renames the new sheet with the format: 'Viikko ' + the given weeknumber. If the given week is 1 the name will be in this format: the given year + '- Viikko ' + the given weeknumber. If the user stores all of the planned weeks to the same Excel, this feature might help to find the right week easier.

Additionally there is more than copying a new sheet to the last and renaming it. The script also determines the dates according to the given week and the year and adds the dates to the new sheet just besides the days of the week (see Figure 10). The week and the year is also added to the top of the sheet.

	Henkilöt +/-	Lisää viikko
22		
23		
24	27.10.2014	MAANANTAI
25		7.00-7:15
26		7.15-7.30
27		7.30-7.45
28		7.45-8.00

FIGURE 10. Dates besides the day of the week

The code below is executed when the 'Lisää viikko' (Add a new week) button is pushed.

```
Public viikkonro As Integer, viikkosolu As Range, vuosisolu
    As Range, lehti As Worksheet, vuosi As Integer
Public paivamaara As Range, paivam As Variant, i As
Integer, kvuosi As Integer

Sub uusi_valilehti_Click()
    Application.ScreenUpdating = False
    ActiveSheet.Unprotect
    Application.DisplayAlerts = False
week:
    Dim WS_laskuri As Integer, ws As Integer, RangetoShade
As Range
    'current year to kvuosi
    kvuosi = VBA.Year(VBA.Date)
    'To viikkonro-variable an asked weeknumber is saved
    viikkonro = Application.InputBox(prompt:="Anna_
viikkonumero: ", Title:="Viikkonumero", Type:=1)
    If viikkonro = False Then
        GoTo protect
    ElseIf viikkonro > 53 Then
        MsgBox "Huomaathan, että viikkoja voi olla_
vuodessa maksimissaan 53."
        GoTo protect
    End If

    vuosi = Application.InputBox(prompt:="Anna vuosi: ",_
Title:="Vuosi", Default:=kvuosi, Type:=1)
    If vuosi = False Then
        GoTo protect
    End If

    'Copy sheet to the last
```

```

ActiveSheet.Copy after:=Sheets(Sheets.Count)
Set lehti = ActiveSheet
On Error Resume Next
'Sheet naming
lehti.name = "Viikko " & viikkonro
On Error GoTo -1
If viikkonro = 1 Then
    On Error Resume Next
    lehti.name = vuosi & "- Viikko " & viikkonro
    On Error GoTo -1
End If
`WeekdaystoCells sub is called.
WeekdaystoCells
`weekYearCellSetting sub is called.
weekYearCellSetting
Application.DisplayAlerts = True
ActiveSheet.protect
ActiveWorkbook.Worksheets("PARITON").protect
Exit Sub

Protect:
    ActiveSheet.protect
    Application.ScreenUpdating = True
End Sub

`This sub set the given week and year to the top of the
`sheet (week to cell "B4" and year to cell "A4")
Private Sub weekYearCellSetting()
    Set viikkosolu = ActiveSheet.Range("B4")
    viikkosolu = viikkonro
    Set vuosisolu = ActiveSheet.Range("A4")
    vuosisolu = vuosi
End Sub

```

`This sub adds the correct dates besides to weekdays. Dates  
`are calculated by using dateSerial function.

```
Private Sub WeekdaystoCells()  
    For i = 0 To 4  
        paivam = ((7 * viikkonro + VBA.DateSerial(vuosi, _  
            1, 3)) - VBA.Weekday(VBA.DateSerial(vuosi, 1, 3))_ - 5) + i  
        Set paivamaara =  
            ActiveSheet.Range("B24").Offset(i * 98)  
        paivamaara = paivam  
    Next i  
End Sub
```

First public variables are declared. The variable named `kvuosi` is initialized with the value of current year.

```
kvuosi = VBA.Year(VBA.Date)
```

The year is got by using the VBA's year-function. The week number and the year is got by asking from the user with the two input box-functions and these values are stored into the variables `viikkonro` and `vuosi`. If the week number is not between 1 and 53, an error message is shown. Then the current, i.e. the active sheet is copied to the last and set its name with the given week number (`viikkonro`). If the given week number is "1", then the given year (`vuosi`) is also added into the name. The script also adds the corresponding dates next to the week days and the given week and the year to the top of the new sheet.

8. All the **data is locked and protected** except the daily planning areas and the notes areas on the right. The users cannot add or delete any rows or columns nor the equations cannot be interfered. This is essential for the Äly Excel functioning without problems.

9. In the daily planning area the colours and the numbers can be added either by copy-pasting or simply writing an intended number to the cell. If the second way is used, the Äly Excel adds the corresponding colour to the cell by using a **conditional formatting** feature. An example of the conditional formatting is shown in Figure 11. It is noticeable that the Äly Excel does not use the colours for any calculations, only the numbers are that matters. The colours are only for the human eyes for visualizing purposes. More than three simultaneously conditional formatting rules are possible on Microsoft Office 2007 version or newer.

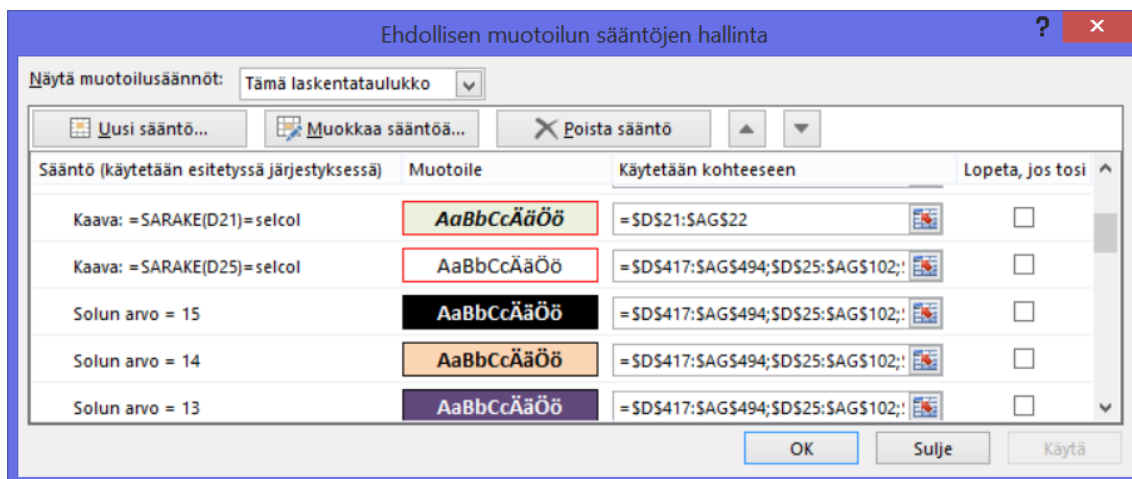


FIGURE 11. Conditional formatting rules

As well as the **time of the day is highlighted**, also the **name on the name row is highlighted** according to the active cell position. The employee which is under modification is hence more easily identified, see Figure 12.

		Yht.	6,25	6,25	6,25	6,25	6,25	6,25	0,00	0,
toiminteen	Näytä toimin	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi
enkilöt +/-	Lisää viikko	1	2	3	4	5	6	7	8	
27.10.2014	MAANANTAI									
	7.00-7.15	1	2	3	4	5	9			
	7.15-7.30	1	2	3	4	5	9			
	7.30-7.45	1	2	3	4	5	9			
	7.45-8.00	1	2	3	4	5	9			
	8.00-8.15	1	2	3	4	5	9			
	8.15-8.30	1	2	3	4	5	9			
	8.30-8.45	1	2	3	4	5	9			
	8.45-9.00	1	2	3	4	5	9			
	9.00-9.15	1	2	3	4	5	9			
	9.15-9.30	1	2	3	4	5	9			
	9.30-9.45	1	2	3	4	5	9			
	9.45-10.00	1	2	3	4	5	9			
	10.00-10.15	6	6	6	6	6	6			
	10.15-10.30	6	6	6	6	6	6			
	10.30-10.45	6	6	6	6	6	6			
	10.45-11.00	6	6	6	6	6	6			
	11.00-11.15	7	7	7	7	7	7			
	11.15-11.30	7	7	7	7	7	7			
	11.30-11.45	10	11	11	2	4	1			
	11.45-12.00	10	11	11	2	4	1			
	12.00-12.15	10	11	11	2	4	1			
	12.15-12.30	10	11	11	2	4	1			
	12.30-12.45	10	11	11	2	4	1			
	12.45-13.00	10	11	11	2	4	1			
	13.00-13.15	10	11	11	2	4	1			

FIGURE 12. Daily planning area

10. Microsoft Excel copies also data to the hidden cells if no extra action is taken. If there is an employee hidden somewhere in the middle, it is not preventable that the values are pasted also to the hidden employee's column. That is, however, an unwanted feature. This is solved so that every time when a value in the cell "AH20" (that is the total sum value of the daily summary) changes, the script will find the hidden columns and **clears the content in the daily planning areas**.

This part was the most difficult to implement. It was discovered that there are certain VBA Events tools that were introduced in Excel97 [23.]. A `deleteHidden()` subroutine was first implemented into a `worksheet_selectionChange()` event, but it turned out that it disabled the paste function. For some reason that feature either empties the clipboard or does something else so that paste after copy is not allowed. The copy-paste functionality was, however, widely used among the Äly Excel users. That is why some other solution than the `worksheet_selectionChange()` event had to be considered.



The `Worksheet_Calculate()` event occurs when the worksheet is recalculated [24.]. This feature is utilized to detect the changes in the total summary cell (the cell "AH20" in this case), which is in fact automatically recalculated when the values are passed to the cells.

The following script is executed every time when a worksheet is recalculated:

```
Private Sub Worksheet_Calculate()  
    Application.EnableEvents = False  
    Dim target As Range  
    `Target is set to the cell where is the total sum of  
    `weekly summary  
    Set target = Range("AH20")  
    Call deleteHidden  
    Application.EnableEvents = True  
End Sub
```

`DeleteHidden()` subroutine goes through the cells and clears the appropriate cell contents as described here.

```
Private Sub deleteHidden()  
    ActiveSheet.Unprotect  
    Application.ScreenUpdating = False  
    Application.EnableEvents = False  
    Application.Calculation = xlCalculationManual  
    Dim x As Integer, col As Integer, hidCol As Integer,  
clearRange As Variant, test As Variant  
    Dim colHigh, colLow As Variant  
    For col = 4 To 34  
        If Columns(col).hidden Then  
            hidCol = col  
            Set colHigh = ActiveSheet.Cells(25, col)  
            Set colLow = ActiveSheet.Cells(76, col)  
            For x = 0 To 4  
                Range(colHigh, colLow).Offset(72 *  
x).ClearContents
```

```
        Next x
    End If
Next col
Application.Calculation = xlCalculationAutomatic
Application.ScreenUpdating = True
Application.EnableEvents = True
ActiveSheet.Protect
End Sub
```

Because there are five separate areas (Monday, Tuesday, Wednesday, Thursday and Friday) a loop was created that takes care of the cells of every day.

11. For the users convenience there a **notes area**, which is shown in Figure 13. It is located on the right side of every day. The user can add any notes as intended. As the majority of the Äly Excel is protected by the locked cells, the notes area provides an area where the user can make remarks.



*FIGURE 13. Notes area*

### 4.3. System Testing of the New Äly Excel

During the development work the Äly Excel was tested with Microsoft Office 2013 version, which was used as a development platform and with Microsoft Office 2010 version, which is currently widely used in the health care environment. As the new version of the Äly Excel was ready it was sent to the couple of the project members for checking and possible testing as well as to the previous Äly Excel usability test persons. A short user guide (Appendix 6) was written where the new features are described.

The first testing session was really productive as couple of major errors were found which had not appeared on the earlier test sessions. A test case scenario was written of how to test the new functionalities (Appendix 7). A test person was engaged who executed the tests. During the tests no major problems raised anymore but some future development suggestions raised. Those ideas are discussed in more detail in Chapter 6.

### 4.4. Error handling

A well-designed software or a system is as error proof as possible. The code is reliable thus preventing internal errors to occur. Also preventing of users making mistakes is as important as well [7].

The following features in the Äly Excel prevent user errors:

1. Most part of the sheet is protected so that the users cannot make any changes on the sheet. The right formulas are essential and if the user changes the formulas by accident, the Äly Excel malfunctions. Also the new features relies on that the rows and the columns do not change.
2. The userforms behind the command buttons offer a cancel option, so that the user have a way to back out of the action without any changes.
3. When adding a new week, a blank answer is shown in the inputbox as long as a valid input is given (should be a number from 1 to 53). If the user tries any other values, a message is shown where the acceptable values are told (see Figure 14). After that the procedure ends without any changes. The current year is given by the default so it both eases the use (no need for a manual input most of the cases) and also automatically provides the year in a

correct format. The cancel option cancels the entire function, so no new worksheet is created if the cancel button is pressed.

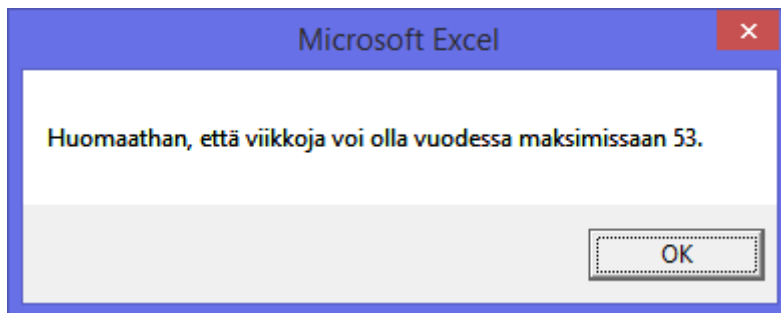


FIGURE 14. Response if an invalid week number is entered

4. In the daily planning area the user cannot enter other values than 0 to 15 (corresponding to the number of the tasks). No other values are accepted. This feature is enabled by the Microsoft Excel data validation. It offers also an error message function so that an error message is displayed if the users tries to enter invalid data (Figure 15). However, zero (0) is not used in the tasks numbering yet it still is an acceptable value. It can be used as a dummy number and it is not calculated into any equations.

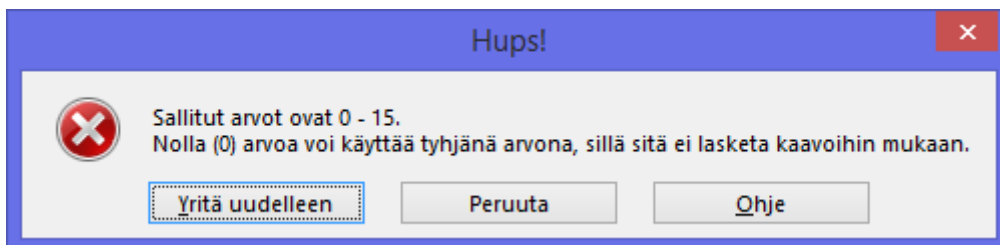


FIGURE 15. The error message when an invalid data to the planning area is entered

However, it does not prevent pasting an invalid data into a cell. This is the Microsoft Excel feature and it cannot be changed.

5. There is an option in the employee manipulation form that an employee can be marked as 'Nuori' (Young). If that option is chosen the balance in the weekly summary is calculated a bit differently. Where an experienced doctor uses a 15 minutes block for a regular appointment, for a young doctor a little bit longer slot is allocated. This difference is taken into account in

the balance which shows the actual, produced appointment quantum. If there is one or more young statuses Excel shows a notice that the balance is now a deviant. Also the corresponding employee summary is coloured red (see Figure 16).

	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO
			YHT.	KYSYNTÄ	BALANSSI					
0	0,00	5,00	9,75		8,50	<-- HUOM! Balanssissa otettu huomioon yhden tai useamman nuoren lääkärin pidemmät blokkiajat				
1	0,00	0,00	4,75		4,75					
2	0,00	0,00	3,00		3,00					
3	0,00	0,00	4,75		4,75					
4	0,00	0,00	3,00		3,00					

FIGURE 16. Status 'Nuori' (Young) and the notice of it

## 5. PROBLEMS FACED

Both in the preliminary usability testing period and the testing of the new version of the Äly Excel finding suitable and available test persons was a big challenge. This was, however, quite expected as the target users of the Äly Excel are health care professionals and are somewhat busy in the daily work. It could not be expected that any of the volunteers would participate in the tests during free time and the working hours of the health care professionals are highly controlled otherwise. Luckily, permissions to follow the use of the Äly Excel during the regular day when the Äly Excel was used anyway was granted. As the Äly Excel is not in use every day, a suitable day for a meeting was a bit challenging thus causing delays in the scheduled plan.

While implementing the new features to the Äly Excel was in the thesis writer's point of view quite interesting, yet lonely. The writer was the only resource and could not iterate the new features with anyone. It could have been more productive if there was another person with whom to design the new features. Lacking of another person and the suitable testing persons also affected on the testing of the new Äly Excel. The tests during and after the implementation work was not enough as some major flaws were found when the first actual Äly Excel user was trying to use it. This, however, did not cause major drawbacks as the erroneous functionalities were found and fixed from the code that caused the malfunctioning.

Technically the most difficult part was how to prevent copying to the hidden cells. This raised a question due to the implementation approach that no rows or columns are deleted or inserted, but are only hidden or brought to visible. As the columns can be hidden the problem raised that when copy-pasting the data to the planning area it is also copied to the hidden cells even though that is not wanted. Microsoft Excel does not provide an option to paste only to the visible cells so another solution was to find out. As described in Section 4.4., the solution that was created does not actually prevent the paste to the hidden cells but it clears the contents of the hidden cells in the planning areas whenever the data is entered to the planning area (i.e. the summary value changes in the weekly summary).

## 6. FUTURE DEVELOPMENT POSSIBILITIES

The biggest change what can be done to the Äly Excel is to make it a web based application. There are many benefits: the same version is available for everyone, it is available from any computer that has an internet access (and the appropriate user rights), the layout could be more practical and above all, there is a slight possibility that it could have an interface to the electronic health record systems.

In this version of the Äly Excel some code adjustment can be done to make it run more smoothly. For instance, clearing the hidden areas is a very heavy procedure. It causes a lot of delays and slows down the usage of the Äly Excel. Also determination of when Excel does the calculations could speed the macros. Putting all the formulas into the VBA codes is worth considering as it speeds up the code dramatically and lessens the need of recalculation of the sheet.

The improvement of the layout and adding more user friendly functionalities such as a calendar where the employees can mark the absence and holidays. The Äly Excel takes the information into account automatically, like for instance marks the absent employees unavailable so that no planned actions can be done. A minor enhancement is that when the user is creating a new week, instead of two separate windows, the week and the year could be asked on a single window.

One handy and a user-friendly feature could be a chance to reset the daily planning area easily. Resetting the view returns all the formatting conditions, the day lengths and empties the whole day view. If the user makes an irreversible mistake starting from the beginning the whole week is not needed, just resetting the concerned day area would be enough.

Another enhancement proposal is to add an option that suggests the next week when adding a new week. At the moment only the current year is given as default, but because of the nature of the Äly Excel and its usage, when the weeks are planned in a contiguous manner, the Äly Excel could suggest the next week that has not been planned yet. I.e. if the week 42 exists the Äly Excel suggests that the next week is 43 (or simply "Next week").

## 7. CONCLUSION AND DISCUSSION

Doing this master's thesis has been very interesting and motivating. In the beginning I had a little uncertainty about my skills as I have never developed any software other than C++ assignments in the University of Applied Sciences in Kajaani almost 20 years ago and Python assignments in the Oulu UAS one year ago. Despite of my inexperience in the field of programming I was still determined that I can handle this development work. Of course, if I had more experience the outcome of this project could have looked different. Maybe I had had developed a www-version of the Äly Excel where the software is running on its (virtual) server and the users use a web browser instead of Microsoft Excel. This scenario is worth considering if the development of the Äly Excel still comes in question.

During this work I have learned to program with the VBA, as well I have learned from Microsoft Excel and its features, a lot. I found out that there are a lot of readymade VBA code examples on the internet as many others have struggled with the same kinds of problems. The case is that the right solution is found and modified so that the example codes fit to the program.

The usability and the UI psychology have been a very interesting field to study. I am grateful that I had an opportunity to study this field in the Oulu UAS and had a possibility to put my learnings into the practice. At the beginning of my thesis work I had a chance to run the user tests among the real Äly Excel users. It was a very interesting part of my study as I have not run that kind of testing before. I had read the theory about the user testing which helped me to focus on the right matters. Also I used the Webropol tool to run the questionnaire to many other Äly Excel users all over Finland. A response rate was about 15% which is not very good, but I have a feeling that more answers would not make any difference as I think that the most of the usability questions were already in the air.

Technically the hardest part was to find a solution for how to prevent copying into the hidden cells. Microsoft Excel does not provide a readymade solution for that, meaning that it allows copying into the hidden cells and there is no way how to prevent it. The nature of my version of the Äly Excel is that there can be hidden cells (rows or columns) by the users' choice. However, no data should be allowed to those hidden, unnecessary cells. Locking was not a solution because then the copy-pasting to that area could have been very difficult and awkward as the user does not properly see



the allowed pasting areas. During the implementation process this problem haunted me and took the most time to be resolved. However, when the right solution finally was implemented, the solution appears to be quite simple.

Optimizing the macrocode was also quite challenging. The more code was added the more optimization had to be done. Otherwise the performance of the Äly Excel would have been very slow. Also running the use case tests relieved slowness in the implementation, which also demanded some code enhancement.

Testing in the final phase was also quite demanding. I suffered a little bit of blindness towards my work in the end as I was not able to find obvious error states that the test users faced. Luckily there were some volunteer test persons who made testing for me.

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## **APPENDICES**

**APPENDIX 1: PROJECT PLAN**

**APPENDIX 2. PERMISSION FOR TESTING AND VIDEORECORDING**

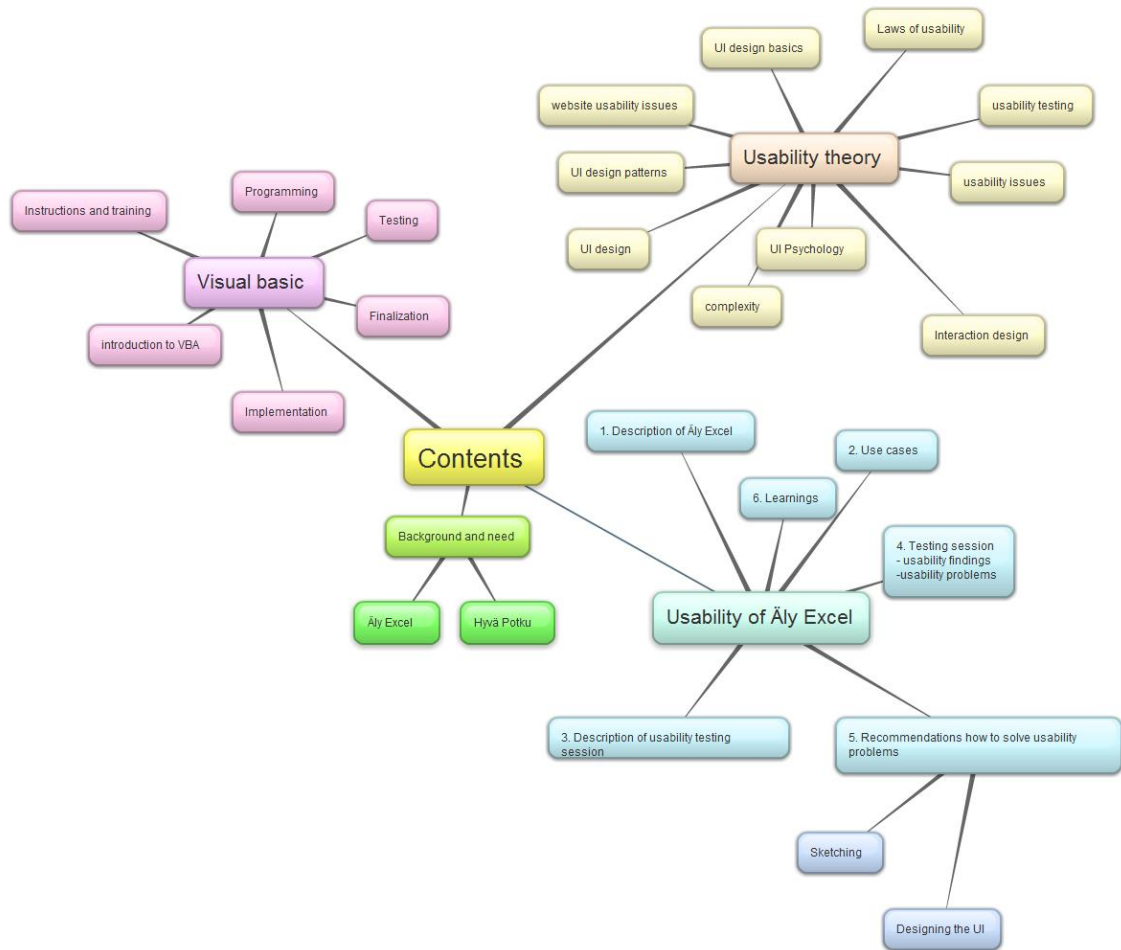
**APPENDIX 3. STARTING QUESTIONS**

**APPENDIX 4. WELCOME TO TEST ÄLY EXCEL!**

**APPENDIX 5: QUESTION FORM**

**APPENDIX 6: NEW ÄLY EXCEL GUIDE**

**APPENDIX 7: TEST CASE SCENARIOS**



I \_\_\_\_\_ will participate as a test user for a usability testing of the Äly Excel. The test is arranged by a student from the Oulu University of Applied Sciences. This usability testing is a part of her final thesis project and its subscriber is the Hyvä Potku project. The Hyvä Potku project is managed by the Northern Ostrobothnia Hospital District.

The testing session will be recorded by a camcorder. All material will be handled with confident and anonymously.

Test results will be only available for the final thesis student and the results will not be handed out to any third party.

I will give my permission for the testing and the camcorder recording.

---

Place	Date	Signature
-------	------	-----------

I, Heli Tolonen, assure that all the results and materials will be handled with confident and anonymously. I guarantee that all the materials will be used only for the final thesis purposes and I will not hand out them to any external party.

---

Place	Date	Signature
-------	------	-----------

Two (2) similar agreements have been made. One for the test person and one for the final thesis student.

**Pilot user x.**

1. Age:
2. Occupation:
3. How long time you have used computers?
4. Do you use computers at your work daily?
5. Have you used the Äly Excel before?
6. How much and how long time?
7. In your opinion, how well you can use Microsoft Excel?

Purpose of this testing is to find the usability questions and problems of the Äly Excel. Results will give a valuable information how to improve and enhance the Äly Excel. The test results will be used for the final thesis work purposes only, they are confidential and they are not handed out to any external party. Please notice that this test will focus only for the Äly Excel and its usage, not for the test person oneself.

You have a computer in front of you where is available the Äly Excel. There is also a videocamera in the room which is recording both sound and video during the test. As a test instructor I will also be present. I will observe your actions with the Äly Excel and I will make notes. I am not allowed to help you with your tasks so you have to cope with them by yourself. If you get stuck at any point, that is ok, too and I will write the observations of that situation. If you have any questions about the test situation, please ask before you start to procedure your tasks.

You have been given a use case. I am asking you to execute it with your own tempo. You can stop this session at any point if you will.

It would be very desirable if you could think aloud at all the time you are executing your tasks. I hope that you will tell how you feel and think, question the behaviour of the Äly Excel and comment everything you see, feel and sense.

When you are ready, please let me know. I will ask some questions about the test session afterwards.

After this, the testing has ended.

Have a nice testing!



#	Question	Choose an option	Free Comment
1	How regularly do you use Äly Excel?	1. Daily 2. Weekly 3. Monthly 4. Not so often	
2	If you answered "Not so often", please specify why?		
3	How long time have you used the Äly Excel?		
4	Did you get any training for using this tool?	Yes / No	
5	Usability is in my opinion: (please, circle)	1 2 3 4 5	
6	Has the planning of time schedules been:	1. Easy 2. I have had some problems 3. Difficult	
7	Do you think the Äly Excel is useful at your work?	1. A lot 2. Just right 3. A bit 4. I don't see any benefit	
8	Äly Excel is bringing me these benefits:		
9	<b>Please, tell freely your opinion how the Äly Excel could be enhanced and what additional features you would like to have.</b>		
10	Please, give a grade to the Äly Excel	4...10	

## New features

- There are two versions of the Äly Excel: 10 minutes and 15 minutes blocks. All the features are the same in the both versions.
- The weekly summary has been lifted uppermost of the sheet
- Amount of the tasks is constant 15 (fifteen). The task rows can be hidden whenever needed
- The amount of employee columns is constant 30 (thirty). The employee columns can be hidden whenever needed.
  - For every employee there is an option to mark the employee as “young” – or not so experienced doctor. In the weekly summary balance this is taken into account.
- The new week can be easily created with the couple of clicks. When the new week sheet is created also the corresponded dates are added automatically to the sheet.
- The lengths of the days can be adjusted individually. The time range is 7 am to 8 pm.
- The cells are protected and locked so that the changes are allowed only on the daily planning area.

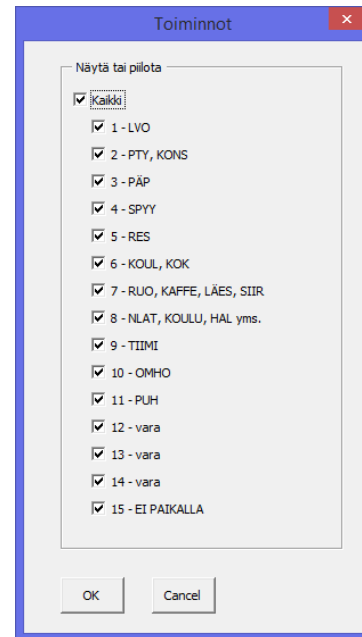
## Weekly summary – task rows

- The weekly summary with the employee name row is fixed to uppermost of the worksheet.
- Any of the task rows can be hidden with a command button **Piilota**
- Every task row has its own hiding button.
- If a row is hidden, it does not effect on the equations on that row or on the weekly summary. It means that if the row is hidden and there is data in it, that data is still summed to the grand total.
- The task rows can be hidden at once by **Piilota toiminteet** button.

	A	B	C	D
4	<b>Viikko yhteensä</b>			
5	Piilota	<b>1</b>	LVO	0,00
6	Piilota	<b>2</b>	PTY, KONS	0,00
7	Piilota	<b>3</b>	PÄP	0,00
8	Piilota	<b>4</b>	SPYY	0,00
9	Piilota	<b>5</b>	RES	0,00
10	Piilota	<b>6</b>	KOUL, KOK	0,00
11	Piilota	<b>7</b>	RUO, KAFFE, LÄES, SIIR	0,00
12	Piilota	<b>8</b>	NLAT, KOULU, HAL yms.	0,00
13	Piilota	<b>9</b>	TIIMI	0,00
14	Piilota	<b>10</b>	OMHO	0,00
15	Piilota	<b>11</b>	PUH	0,00
16	Piilota	<b>12</b>	vara	0,00
17	Piilota	<b>13</b>	vara	0,00
18	Piilota	<b>14</b>	vara	0,00
19	Piilota	<b>15</b>	EI PAIKALLA	0,00
20	Yht.			<b>0,00</b>
21	Piilota toiminteet		Näytä toiminteet	<b>Nimi</b>
22	Henkilöt +/-		Lisää viikko	<b>1</b>
23				

- more space to the daily planning area

- The task rows can get to visible by **Näytä toiminnot** button, either all at once or individually. When **Näytä toiminnot** button is clicked enclosed window pops up.
- If a checkbox is selected then the corresponding task row is visible. Unchecking the checkbox row is hidden after the “OK” button is pressed.
- The ‘Kaikki’ (All) checkbox corresponds to every row. By checking or unchecking it every task row can be brought to visible or hide at once respectively.
- If the task name is changed also the names in this window changes.



## Employees

- There can be up to 30 employees in the one Äly Excel work sheet.
- The employee columns can be hidden if needed. **Henkilöt +/-**
- When the employee column is hidden all employee data will be erased.
- Recommendation is that the employee columns are subtracted from either of the edges, albeit the Äly Excel works if the employee columns are hidden in the middle of the working area.

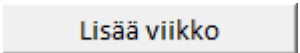
15	Piilota	11	PUH	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
16	Piilota	12	vara	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
17	Piilota	13	vara	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
18	Piilota	14	vara	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
19	Piilota	15	EI PAIKALLA	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
20			Yht.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	
21	Piilota kaikki		Näytä	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	Nimi	
22	Henkilöt +/-		Lisää viikko	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
23																			
24			MAANANTAI																
25			7.00-7.15																
26			7.15-7.30																
27			7.30-7.45																
28			7.45-8.00																
29			8.00-8.15																



- A starting time and an ending time can be chosen from the form. The interval of choosing the starting and the ending time is the block length of the Äly Excel i.e. 10 or 15 minutes.
- Note that the data is not lost outside the specified time range. This means that also the hidden data is summed to the grand total. Hidden cells are, however, locked so that accidental paste to the hidden areas is not possible.
- The length of the day adjustment does not effect on the another days, not in the current sheet nor in any of the worksheets of the workbook.

## New week

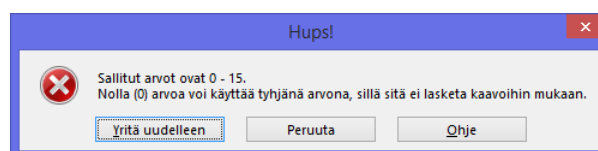
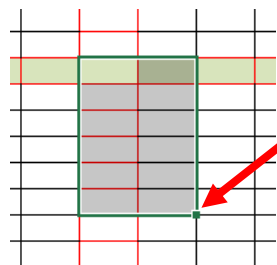


- A new week (i.e. new worksheet) can easily be added with .
- The new week can be added (copied) from any of the worksheets that has been created before.
- Creating the new week, two windows are shown. In the first (1.) window a week number is asked.
- Second window (2.) asks the year. The current year is given as a default.
  - The allowed week numbers are from 1 to 53. If any other value is entered an error message (3.) is shown and the week creation procedure will be cancelled.
- The new week procedure creates a new worksheet by copying the active worksheet and renames it with the given week number, for example: "Viikko 33". The given week and the year as well as the dates of the given week are automatically entered to the new sheet in the appropriate cells.

- If the given week number is one (1), the naming of the worksheet is a bit different → “2015 – Viikko 1”

## Miscellaneous new features

- On the daily planning area conditional formatting rules are applied. The background colour of the cell is automatically changed when an allowed value is entered to the cell. The allowed values are from 0 to 15 as they represents the task numbers (excluding zero (0), which can be used as a dummy or an empty value if needed). Values can be entered to the cells by writing the value, by copy-pasting or using Excel fill handle. If an invalid value is entered an error alert is shown.



- Time of the day and the name of an employee are highlighted when the active cell is on the daily planning area. This feature helps to see which row (time) and which employee is in the making.

- Notice that if the daily planning area is empty, the whole row and column are highlighted. When you add the tasks to the area, only the time column and the employee row are shown as highlighted.

		Yht.	3,25	3,25	3,25
Näytä		Nimi	Nimi	Nimi	Nimi
Lisää viikko		1	2	3	
014	<b>MAANANTAI</b>				
	7.00-7.15	1	2	3	
	7.15-7.30	1	2	3	
	7.30-7.45	1	2	3	
	7.45-8.00	1	2	3	
	8.00-8.15	1	2	3	
	8.15-8.30	1	2	3	
	8.30-8.45	1	2	3	

- In addition to previous version of the Äly Excel a timecolumn is added also on the right side of the daily planning area.
- Because Excel worksheet is locked and protected so that changes can be made only on the daily planning area a specific notes area is introduced. There is a notes area for every day for remarks.



<b>Test Case ID:</b>		1		<b>Test De- signed by:</b>	Heli Tolonen	
<b>Test Priority:</b> (Low/Me- dium/High)		Medium		<b>Test De- signed Date:</b>	19.11.2014	
<b>Module Name:</b>		Weekly Summary		<b>Test Execu- ted By:</b>		
<b>Test Title:</b>		Task name editing		<b>Test Execu- tion Date:</b>		
<b>Description:</b>						
<b>Pre-conditions:</b>		The Äly Excel has been opened with Microsoft Excel, version 2010 or newer.				
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Click any of the task name		Name of the task is changeable and also the names on the daily views are also changed			
2	Erase the existing name					
3	Write a new name					
<b>Post-conditions:</b>						

<b>Test Case ID:</b>		2		<b>Test De- signed by:</b>	Heli Tolonen	
<b>Test Priority:</b> (Low/Me- dium/High)		Medium		<b>Test De- signed Date:</b>	19.11.2014	
<b>Module Name:</b>		Weekly Summary		<b>Test Execu- ted By:</b>		
<b>Test Title:</b>		Hiding the taskrows in the weekly summary		<b>Test Execu- tion Date:</b>		
<b>Description:</b>						
<b>Pre-conditions:</b>		The Äly Excel has been opened with Microsoft Excel, version 2010 or newer.				
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Click any of the "Piilota" command buttons		A corresponded row is hidden.			
2	Click other "Piilota" buttons so that every row of the summary are hidden.		All summary rows except the total sum- mary row are hidden			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>		3		<b>Test De- signed by:</b>	Heli Tolonen	
<b>Test Priority:</b> (Low/Me- dium/High)		Medium		<b>Test De- signed Date:</b>	19.11.2014	
<b>Module Name:</b>		Weekly summary		<b>Test Execu- ted By:</b>		
<b>Test Title:</b>		Show all the summary rows		<b>Test Execu- tion Date:</b>		
<b>Description:</b>						

<b>Pre-conditions:</b>		All Summary rows are hidden (see for example Weekly Summary #2 test case)				
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Click 'Näytä toiminteet' button		'Toiminnot' window should open			
2	Check 'Kaikki' box		All the boxes are checked.			
3	Click "OK"		Toiminnot windows closes and every summary row will be visible			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	4	<b>Test De- signed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Me- dium/High)	Medium	<b>Test De- signed Date:</b>	19.11.2014			
<b>Module Name:</b>	Weekly summary	<b>Test Execu- ted By:</b>				
<b>Test Title:</b>	Hide the summary rows via 'Näytä toimineet'	<b>Test Execu- tion Date:</b>				
<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Click the 'Näytä toiminteet' button		'Toiminnot' window should open			
2	Uncheck any of the task checkboxes		Checkboxes can be checked or un- checked individually			
3	Click "OK"		Corresponded taskrows will be hidden as the checkbox was unchecked			
4	Click the 'Näytä toiminteet' button		A 'Toiminnot' window should open			
5	See if the checkboxes of the corresponded hid- den rows are un- checked		If a taskrow is hidden its checkbox is empty.			
6	Change all unchecked checkboxes to checked and click "OK"		All of the taskrows should be visible again.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	5	<b>Test De- signed by:</b>	Heli Tolonen
<b>Test Priority:</b> (Low/Me- dium/High)	Medium	<b>Test De- signed Date:</b>	19.11.2014
<b>Module Name:</b>	Weekly summary	<b>Test Execu- ted By:</b>	
<b>Test Title:</b>	Cancel button test	<b>Test Execu- tion Date:</b>	
<b>Description:</b>			
<b>Pre-conditions:</b>			
<b>Dependencies</b>			



Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Click the 'Näytä toiminnot' button		A 'Toiminnot' window should open			
2	Check or uncheck any of the boxes.		Boxes change their status			
3	Click "Cancel"		The 'Toiminnot' window closes but no changes are done.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	2.1.	<b>Test Designed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Medium/High)	Medium	<b>Test Designed Date:</b>	19.11.2014			
<b>Module Name:</b>	Employees	<b>Test Executed By:</b>				
<b>Test Title:</b>	Hiding the employees	<b>Test Execution Date:</b>				
<b>Description:</b>	Employee column hiding					
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Click 'Henkilöt +/-'		A 'Työntekijät' window opens			
2	Uncheck any of the boxes from 'Poista / lisää'.		Chosen boxes are unchecked			
3	Click "OK"		The 'Työntekijät' window closes and the unchecked employees are hidden.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	2.2.	<b>Test Designed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Medium/High)	Medium	<b>Test Designed Date:</b>	19.11.2014			
<b>Module Name:</b>	Employees	<b>Test Executed By:</b>				
<b>Test Title:</b>	Showing the employees	<b>Test Execution Date:</b>				
<b>Description:</b>	Employee column visible					
<b>Pre-conditions:</b>						
Test case 2.1. is performed						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Click 'Henkilöt +/-'		A 'Työntekijät' window opens			
2	Check any or all of the unchecked employees		The checkbox values change as you will			
3	Click "OK"		The 'Työntekijät' window closes and the checked employees are visible again.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>		2.3.		<b>Test De- signed by:</b>	Heli Tolonen	
<b>Test Priority:</b> (Low/Me- dium/High)		Medium		<b>Test De- signed Date:</b>	19.11.2014	
<b>Module Name:</b>		Employees		<b>Test Execu- ted By:</b>		
<b>Test Title:</b>		Novice employee		<b>Test Execu- tion Date:</b>		
<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Add the task numbers including number 1 into some of the employees daily planning area. Add data to the every day or day of your will.		On the weekly summary a corresponded values are updated as well as 'YHT.' and 'BALANSSI' values. 'YHT.' and 'BALANSSI' values are the same.			
2	Click 'Henkilöt +/-'		A 'Työntekijät' window opens			
3	Check the employee's 'Nuori' box and click "OK"		The 'Työntekijät' window closes. The colour of the first row of the summary of the employee is turned red. 'BALANSSI' value is different than 'YHT.' on the first row and there is a note text on the right.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>		2.4.		<b>Test De- signed by:</b>	Heli Tolonen	
<b>Test Priority:</b> (Low/Me- dium/High)		Medium		<b>Test De- signed Date:</b>	19.11.2014	
<b>Module Name:</b>		Employees		<b>Test Execu- ted By:</b>		
<b>Test Title:</b>		Novice to expert		<b>Test Execu- tion Date:</b>		
<b>Description:</b>						
<b>Pre-conditions:</b>						
Test case 2.3. is performed						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Click 'Henkilöt +/-'		'Työntekijät' window opens			
2	Uncheck the employee's "Nuori" box and click "OK"		'Työntekijät' window closes. Colour of the first row of the summary is turned black and the 'YHT.' and 'BALANSSI' values are the same. The note from the right disappears.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>		2.5.		<b>Test De- signed by:</b>	Heli Tolonen	
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<b>Test Priority:</b> (Low/Medium/High)		High	<b>Test Designed Date:</b>		19.11.2014	
<b>Module Name:</b>		Employee	<b>Test Executed By:</b>			
<b>Test Title:</b>		Empty the data when hiding an employee	<b>Test Execution Date:</b>			
<b>Description:</b>						
<b>Pre-conditions:</b> Test case 2.3. is performed						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Notice the weekly summary values					
2	Click 'Henkilöt +/-'		A 'Työntekijät' window opens			
3	Uncheck the employee that has data on the daily planning areas. Click "OK".		The 'Työntekijät' window closes. The values in the summaries are recalculated so that there is no data from the hidden employee.			
4	Click 'Henkilöt +/-'		'Työntekijät' window opens			
5	Check the hidden employee and click "OK"		The hidden employee column is visible and all the data has been erased.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>		3.1.	<b>Test Designed by:</b>		Heli Tolonen	
<b>Test Priority:</b> (Low/Medium/High)		Medium	<b>Test Designed Date:</b>		19.11.2014	
<b>Module Name:</b>		Day length adjustment	<b>Test Executed By:</b>			
<b>Test Title:</b>		Individual day adjustment	<b>Test Execution Date:</b>			
<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Choose a day and click the button named like weekday, i.e. "MAANANTAI".		A 'Päivän pituus' window opens. A default starting time is 08:00 and ending time is 16:00.			
2	Choose any other starting and ending times from the list.		The times are selectable in ten or fifteen minutes intervals, depending which Äly Excel is under work. The starting time is not dependent on the ending time, however the starting time is limited from 07:00 to 12:00 and the ending time is limited to 12:00 - 20:00.			
3	Click "OK"		The 'Päivän pituus' window closes and the length of the day at hand is set according to the choice.			
<b>Post-conditions:</b> Other days remain the same they were.						

<b>Test Case ID:</b>		4.1.		<b>Test De- signed by:</b>	Heli Tolonen	
<b>Test Priority:</b> (Low/Me- dium/High)		High		<b>Test De- signed Date:</b>	19.11.2014	
<b>Module Name:</b>		New week		<b>Test Execu- ted By:</b>		
<b>Test Title:</b>		Adding a new week from the base		<b>Test Execu- tion Date:</b>		
<b>Description:</b>						
<b>Pre-conditions:</b>		A form can have any planning data and any settings				
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Click 'Lisää viikko'		A window that asks 'Viikkonumero' (a week number) is shown.			
2	Enter a week and click "OK"		If the entered week number is between 1 and 53, a 'vuosi' (year) window is shown. If the week number is other than 1 to 53, an error message is shown and the procedure ends after the "OK" is clicked. If that is the case, please start from #1. If the entered value is not a digit please enter a value in numerical form.			
3	Enter a year and click "OK"		The current year is given as a default. You can change it if you will.			
4	Check the new sheet		There is a new sheet named with the given week (and the year if the week was 1). There are also the week number and the year on the top of the sheet as well as the corresponding dates are added besides to the weekdays. Otherwise the sheet is an exact copy of the original sheet.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>		4.2.		<b>Test De- signed by:</b>	Heli Tolonen	
<b>Test Priority:</b> (Low/Me- dium/High)		High		<b>Test De- signed Date:</b>	19.11.2014	
<b>Module Name:</b>		New week		<b>Test Execu- ted By:</b>		
<b>Test Title:</b>		Adding a new week from any sheet		<b>Test Execu- tion Date:</b>		
<b>Description:</b>						
<b>Pre-conditions:</b>		Test case 4.1. is performed				
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Take the sheet created in the test case 4.1. and make some changes (for example change the planned data or the day lengths).		Only that particular sheet is changed.			
2	Perform the steps 1 to 4 from the test case 4.1.		See 4.1. Expected results.			

<b>Post-conditions:</b>	
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<b>Test Case ID:</b>	5.1.	<b>Test De- signed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Me- dium/High)	High	<b>Test De- signed Date:</b>	19.11.2014			
<b>Module Name:</b>	Daily planning area	<b>Test Execu- ted By:</b>				
<b>Test Title:</b>	Conditional formatting and data validation	<b>Test Execu- tion Date:</b>				
<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Enter numbers from your keyboard to the daily planning area. Test it under every day.		The sells change their background colour automatically equivalent to the task colours on the summary views. The summary values are automatically updated.			
2	Overwrite the previously written values with the new values. Test it under every day.		The background colours are automatically updated.			
3	Enter the values other than from 0 to 15. Test it under every day.		An error message is shown that the allowed values are from 0 to 15.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	5.2.	<b>Test De- signed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Me- dium/High)	High	<b>Test De- signed Date:</b>	19.11.2014			
<b>Module Name:</b>	Daily planning area	<b>Test Execu- ted By:</b>				
<b>Test Title:</b>	Entering data using copy-paste	<b>Test Execu- tion Date:</b>				
<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Copy a colour code anywhere from the sheet (if empty sheet, then use the weekly summary or the daily summary colour codes) and paste it to the daily planning area. Repeat this with multiple colours.		The paste function is available and the data is copied and the summaries are recalculated as expected			
2	Overwrite the copied data by entering a numerical value from the keyboard		The conditional formatting rule applies so that the colour is changed and the summaries are updated as expected.			

3	Copy the data from the daily planning area and paste it to the area.	The paste function is available and the data is copied and the summaries are recalculated as expected			
<b>Post-conditions:</b>					

<b>Test Case ID:</b>	5.3.	<b>Test De- signed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Me- dium/High)	High	<b>Test De- signed Date:</b>	19.11.2014			
<b>Module Name:</b>	Daily Planning Area	<b>Test Execu- ted By:</b>				
<b>Test Title:</b>	Adding data to the adjusted planning area.	<b>Test Execu- tion Date:</b>				
<b>Description:</b>						
<b>Pre-conditions:</b> Test case 2.1. (Hiding employees), 3.1. (Day length adjustment) are performed.						
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Copy-paste data ove ther hidden employee column		The data is not copied to the hidden col- umns. This can be verified by following the summary values (the summary value contains data only from the visible cells).			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	5.4.	<b>Test De- signed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Me- dium/High)	High	<b>Test De- signed Date:</b>	19.11.2014			
<b>Module Name:</b>	Daily Planning Area	<b>Test Execu- ted By:</b>				
<b>Test Title:</b>	Copy the whole day	<b>Test Execu- tion Date:</b>				
<b>Description:</b>						
<b>Pre-conditions:</b> Two days have the same length						
<b>Dependencies</b>						
<b>Step</b>	<b>Test Steps</b>	<b>Test Data</b>	<b>Expected Result</b>	<b>Actual Result</b>	<b>Status (Pass/Fail)</b>	<b>Notes</b>
1	Copy the data from the other day to other		The data is copied as is and the summar- ies are updated accordingly.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	5.5.	<b>Test De- signed by:</b>	Heli Tolonen
<b>Test Priority:</b> (Low/Me- dium/High)	High	<b>Test De- signed Date:</b>	19.11.2014
<b>Module Name:</b>	Daily Planning Area	<b>Test Execu- ted By:</b>	
<b>Test Title:</b>	Data outside the planning area	<b>Test Execu- tion Date:</b>	

<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Enter values from your keyboard to any other area than the daily planning areas or the task names on the weekly summary		An error message pops up that indicates that the worksheet is protected and the cells are locked. Entering the data is not allowed.			
2	Copy and paste data to any other area than the daily planning areas or the task names on the weekly summary		An error message pops up that indicates that the worksheet is protected and the cells are locked. Entering the data is not allowed.			
3	Copy a range of cells and paste it to the edge of the daily planning area (so that at least a part of it is going outside the planning area.		An error message pops up that indicates that the worksheet is protected and the cells are locked. Entering the data is not allowed, not even to the allowed area.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	5.6.	<b>Test De- signed by:</b>	Heli Tolonen			
<b>Test Priority:</b> (Low/Me- dium/High)	High	<b>Test De- signed Date:</b>	19.11.2014			
<b>Module Name:</b>	Daily Planning Area	<b>Test Execu- ted By:</b>				
<b>Test Title:</b>	Paste data over day end	<b>Test Execu- tion Date:</b>				
<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Adjust any of the days to end at any time		The day length is adjusted as expected.			
2	Create a range of data, copy and paste it to the bottom of the daily planning area. Make sure that the copied area is larger than the allowed area below.		An error message pops up that indicates that the worksheet is protected and the cell are locked. Entering the data is not allowed, not even to the allowed area.			
3	Adjust the day length so that you can see the whole day.		No data has been copied to the area that was hidden.			
<b>Post-conditions:</b>						

<b>Test Case ID:</b>	5.7.	<b>Test De- signed by:</b>	Heli Tolonen
<b>Test Priority:</b> (Low/Me- dium/High)	Low	<b>Test De- signed Date:</b>	19.11.2014

<b>Module Name:</b>		Daily Planning Area		<b>Test Executed By:</b>		
<b>Test Title:</b>		Highlight time and name		<b>Test Execution Date:</b>		
<b>Description:</b>						
<b>Pre-conditions:</b>						
<b>Dependencies</b>						
Step	Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)	Notes
1	Click anywhere in the daily planning area		The corresponding time of the day and the name of an employee are highlighted.			
<b>Post-conditions:</b>						