Assignment 2

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1 Interactive system description

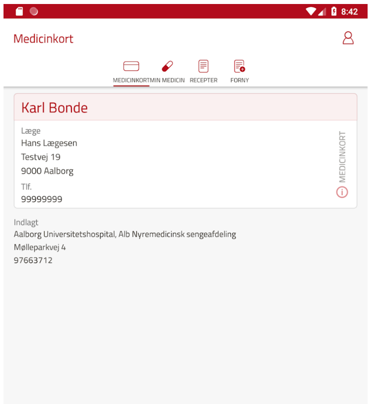

Figure 1: Medicinkort.

For this assignment, we have decided to analyse **Medicinkortet**. **Medicinkortet** is an app available on all mobile devices that lets the user see and renew prescriptions.
The first time the app is opened, the user is asked to log in with NemID and to create a 4 digit pin code. The user then has to decide whether or not to use bio-metrics to sign in. The app is then ready for use.
Depending on the device and its control system, the app has slightly different interfaces. The app has a menu bar with different menu tabs. In the iOS version of the app, the menu bar is found at the bottom of the screen, and in the android version it is found at the top.
The first menu tab is called `MEDICINKORT`, and it is this tab that the user sees when she has logged in to her app. The tab displays the name of the user, the user's doctor and the doctor's contact details. It also here, the user will be notified on new prescriptions and on status changes on requests. The second menu tab is called `MIN MEDICIN` and as the name suggests, this is where the user's medicine prescriptions are found. On iOS devices, this menu tab has two different sub-tabs displayed at the top of the screen : `AKTUEL MEDICIN` and `AFSLUTTET MEDICIN`. In `AKTUEL MEDICIN`, current prescriptions are shown, and in `AFSLUTTET MEDICIN`, medicine the user is no longer taking is shown. In the android version, instead of two sub-tabs, the information is shown in two lists : one list of inactive and one of active prescriptions. The third menu tab is `RECEPTER`. This is where the user can see all active prescriptions and how many dispensions of the medicine is left. In the iOS version there are two different sub-tabs in the top - `ÅBNE RECEPTER` and `UDLEVERINGER` - where the user can see open and dispensed prescriptions. In the android version, the information is again shown in a list form. The final menu tab is where the user can renew prescriptions. The iOS version has two tabs `FORNY` and `STATUS`. The `FORNY` tab presents a list of the medicine and beneath each medicament on the list, is a slide bar. When the user swipes the bar, a request for renewal of a prescription is sent to the user's doctor. In the status tab, the status on requests are shown. In the android version, both renewal and status are found on the same page. The page is a combination of the two iOS tabs - the renewal of the prescription is at the top of the page, and the status on requests can be found when the user scrolls to the bottom of the page.

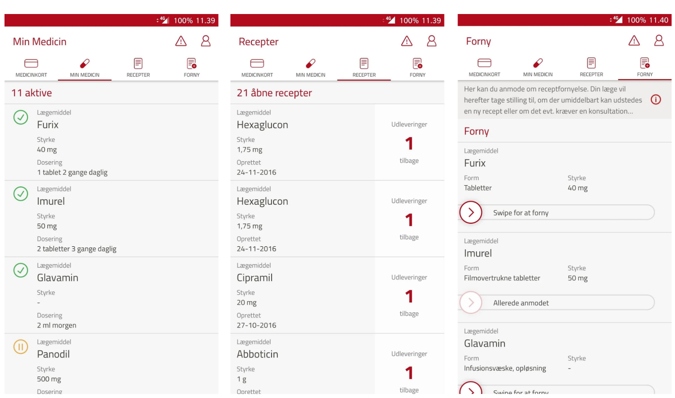

Figure 2: App interface on Android device.

2 Interactive system analysis

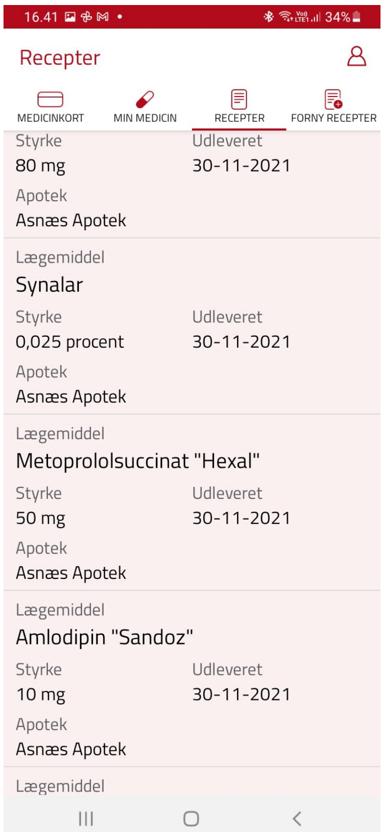

Figure 3: The main window

In the following, we are going to to analyse the mobile application **Medicinkortet** by drawing on Johnson (2021)'s design rules and on his descriptions of human psychology, perception and cognition. We will start by accounting for the two design choices that concur with Johnson (2021)'s recommendations:

1. Overview and structure : As can be seen in Figure 3, the app provides a full overview of the prescribed medicine which makes it easy for the user see all the medicine that she has been prescribed in the past ten years. That is exactly what the Gestalt principles of *Proximity*, *Symmetry* and *Continuity* are about. According to Johnson (2021), human vision is optimized to see structure, simply because a visual hierarchy allows people, when scanning information, to quickly find what is relevant to their goals.

2. Prescription renewal : With a single swipe (cf. Figure 4), the user can easily renew her prescription, which is very handy and time-saving. Alternatively, medicine renewal requires that the user calls the medical center, presumably having to wait while staying on the line, or even visit the practitioner in person. And it is highly doubtful that those two scenarios would give the user an easy and enjoyable experience.

Johnson (2021) points out that humans have time requirements too. That means that all the necessary information should either be ready, in front of the decision maker or it should be obtainable with only minimal browsing or searching. In this respect, swiping with a finger is nearly equivalent to the eye movement to the place where crucial information or the goal is displayed.

Concerning the aspects of **Medicinkortet** that do not harmonize with Johnson (2021)'s recommendations, we will focus on the two following :

1. Menu tabs : As can be seen in Figure 3, there are four menu tabs at the top of the main window: `MEDICINKORT`, `MIN MEDICIN`, `RECEPTER`, `FORNY RECEPTER`. Even though four is a manageable number of tabs, it seems unnecessary to have three individual sections with basically the same information. According to Johnson (2021), hierarchies with multiple levels or multiple-directory-structures would exceed the user's short-term memory capacity and make her forget where she came from and what her goal was. From the user's point of view, therefore, only one directory in **Medicinkortet** would be required, especially because additional clicks might be time-consuming and because navigating between sections might be confusing.

Figure 4: Forny recept

2. Order of information : As can be seen in Figure 3, in the current state of the application, the first piece of information about the product `Synalar` is a Latin name of the drug. For most people this is neither easy to remember nor important to know. Conversely, it is critical for the user to see (1) **the application and the effect** of the medicine, (2) **the active component** of the medicine and (3) **the name** of the product handed out at the pharmacy. For instance, instead of *Synalar* it should say *Mod hudlidelse i ansigtet*. This would be a much more relevant description,

since it is the medicine's effect, and not its name, which is important to the user. Moreover, the the active component *Fluocinolonacetonid* is the same in all the similar products produced by different manufacturers, and the varying names that manufacturers give their medical products have only little value for the user.

Finally, the prescription window should provide the name of the last product (i.e. the specific drug manufacturer) that was handed out at the pharmacy.
This user feedback perfectly supports the theory and is in accord with the principle of *"recognition is easy, while recall is hard"* (Johnson, 2021), which is why Latin terminology should be reserved for experts alone, while non-expert users should be provided with recognisable product names or pictures/images that are easy to recognise.

All in all, it is our impression that the designers of **Medicinkortet** had pharmacists in mind — rather than ordinary users — and that they created the medicine overview and structure with a one-to-one correspondence between the standard medical requirements and the interface of the app.

Now, speaking about the consequences of the two user "un"-friendly design choices described above, we will employ the experience of interacting with **Medicinkortet** of one of our elderly family members, Lars. According to him, the design choice `Menu tabs` is neither *easy to remember*, nor is it *efficient to use*. To be more specific, Lars complained about having to jump between the three different menu tabs `MIN MEDICIN`, `RECEPTER`, `FORNY RECEPTER` every time he had to check up on the pills he ran out of: 1) having to find the active prescription in the `MIN MEDICIN` menu tab; then 2) switching over to the next tab `RECEPTER` in order to see the contents of the prescription in question (while still having to remember the Latin name of the drug from the first menu); and finally reaching the goal 3) renewing the medicine in the third tab `FORNY RECEPTER`. Lars finds this long journey superfluous and stupid. And if he were asked to submit his user review of this design choice, it would hardly be positive.

We can conclude that, in terms of **usability**, the functionality of the app is not satisfactory, simply because the app is less efficient (Nielsen, 1993) than the designers desired it to be. We could also say that from the **user experience** perspective, every time Lars had to renew his prescription, his experience of interacting with **Medicinkortet** was frustrating — let alone such elements of user experience as "visual aesthetics", "beauty", "joy of use" or "surprise" (Bargas-Avila & Hornbæk, 2011).

As far as the second design choice is concerned, `Order of information`, Lars finds Latin names confusing and hard to remember. When he needs to buy his medicine, pharmacy personnel usually asks him whether he wants to buy the cheapest product on the market instead of the one in the prescription, which he obviously says yes to. That is, of course, a nice service that allows a customer to save the money. However, when Lars has to renew the medicine he ran out of, he compares the name of the medicine handed out at the pharmacy with the one in **Medicinkortet** — and they never match! In other words, Lars often ends up frustrated at having to figure out whether this or that prescription is still active and whether he can renew it or not.

If we were to apply the principles of **usability** (Nielsen, 1993) in this particular case, it would be a stretch to claim that **Medicinkortet** is "efficient" to use or "easy to remember". Neither is the **user experience** of interacting with this application accompanied with "subjective pleasure" or "joy" (Bargas-Avila & Hornbæk, 2011).

In conclusion, irrespective of its drawbacks, the swipe-feature to renew your prescriptions on **Medicinkortet** is a simple and practical solution to an otherwise bothersome task.

3 Keystroke-level model of the system

The Keystroke-level model (KLM), is a widely useful predictive model of the HCI literature, designed by Card, Moran and Newell (1980; 1983, ch. 8). This model was designed specifically for analyzing the time requirements of various tasks in interactive computing systems. A KLM analysis attempts to predict the amount of time required for a given task by separating it into a series of predefined primitive operations. Each of these primitive operation has an average time requirement which often depends on the user's level of experience in using the app or device. These time requirements can then finally be added together to predict the total time requirement of the whole task. The model separates the necessary motor-control operations, that are required to operate a compute, into keystroking(K), pointing(P), homing(H), and drawing(D). In addition to this, the model includes a system response operator(R) as well as a mental operator(M), to factor in things like human response time.

To test the efficiency of the **Medicinkortet** application, a KLM analysis is prudent. Specifically, KLM is well fit to analyse the specific task of renewing a prescription, as this is one of the main functions of the application. The process of renewing a prescription is as follows:
(1) The user navigates to the application on their phone, and opens it.
(2) Here, they are met with a login screen, where they type in their 4-digit pin code. Alternatively, this part can be skipped with the use of bio-metrics. Upon typing in the last digit of the pin code, the user is immediately brought to the front page of the application.
(3) From here, the user must press the `RENEW PRESCRIPTIONS` button on a ribbon pane.
(4) The application now shows a page with all the prescriptions that the user can potentially renew. The application only displays one prescription at a time, so if the prescription to be renewed is not at the top, it will be necessary to scroll down and find it. When the prescription has been found, there is a large button that says `SWIPE TO RENEW`.
(5) From here, the user can specify the number of medicine packages, as well as the volume of these. On the same page, there is a button called `REQUEST` which concludes the task when pressed.

Applying KLM to our chosen task, requires defining exactly which operations each of the sub-tasks entails.
(1) This task is user-dependant : it depends on where the application is located on the user's phone, and it depends on the user's ability to remember where the app is located. Therefore, it will not be included in the analysis.
(2) The act of moving your finger to press on a touch screen is most accurately represented by a draw operator. As these four draw operators are part of a cognitive unit (a pin code), only 1 initial mental operator is required. As there is some loading time, as the application opens, a system response time operator is added. Therefore, this sub-task totals at: MDDDDR. Alternatively, with the use of bio-metrics, it is: MDR.
(3) The `RENEW PRESCRIPTIONS` button is located in the far left corner, and requires a long draw operator. The time required for each individual draw operator will be calculated afterwards, however. The total is: MD
(4) As mentioned above, the number of required draw actions may vary, depending on the order and amount of prescriptions. A realistic estimate could be two draw operators - each preceded by one mental operator to check if the prescription in question has been found. A final draw operator is required to swipe the `SWIPE TO RENEW` button. The total is: MDMDMD
(5) In the majority of cases, only one package of the prescribed medicine will be necessary. Therefore, this sub-task entails only a single draw action, and its associated mental operator. The total

is: MD.
When totalling the overall task time, the standpoint of an expert user is used. For this reason, it is assumed that bio-metrics will be enabled:

$$t_{execute} = 6M + R + D_2 + D_3 + 3D_4 + D_5$$

In Mackenzie 2013, the mental operator is defined to 1.35 seconds, and the system response operator varies depending on the system. In this case, it took about 0.3 seconds. The draw operation is calculated using Fitts' law. The calculation is $0.9 * n_D + 0.16 * l_D$, wherein n_D represents the amount of straight lines necessary to reach the goal, and l_D represents the total length of these in inches. These values are inserted in the formula:

$$\begin{aligned} t_{execute} = 6 * 1.35s + 0.3s + (0.9s * 1 + 0.16s * 1.1) + \\ (0.9s * 2 + 0.16s * 4.5) + 3 * (0.9s * 1 + 0.16s * 2) + (0.9s * 2 + 0.16s * 2.2) = 17.808s \end{aligned}$$

The final, total time it takes to renew a prescription - according to the KLM analysis - is just around 18 seconds. This is very fast, and in most real-life examples, it will not be as fast. The reason that the KLM analysis results are this good, is that the application is very well optimized. It is clear that the HCI regiment has been considered and utilized in the development of this application. A reason for this could be that a large portion of the userbase for the application is of the older generations, and therefore extra care has been made making the system simple and approachable. Additions such as bio-metrics, that help improve KLM times, has already been implemented.

Because the application is already incredibly well-optimized, it is difficult to see how one could improve it. However, there are a few areas that might be improved. After the pin code is entered, the user is brought to a screen called `MEDICINE CARD`, that states the name of the user's doctor, and the doctor's contact information. From here, the user has to find and press the `RENEW PRESCRIPTIONS` button (sub-task (3) of the KLM analysis). If the application went straight to the `RENEW PRESCRIPTIONS` page, this step could be skipped. This however, assumes that renewing prescriptions is the primary objective of the applications userbase.
Another change could potentially improve upon sub-task (4) of the KLM analysis. In the `RENEW PRESCRIPTIONS` page, the amount of information, or the text size could be reduced. This would allow for more prescriptions to be shown at a time, and thus reduce the number of draw operators necessary to reach the desired prescription. This however, could reduce both readability and understanding, which are particularly important factors considering the app's elderly userbase.

Conclusively, **Medicinkortet** is well optimized and has a low KLM time necessary to achieve one of its major purposes. The interface could potentially be improved in a few minor ways, but these changes must be weighed accordingly with the primary userbase in mind. (MacKenzie, 2013)

References

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