Mobile Lexicography: A Survey of the Mobile User Situation

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Abstract

Users are already mobile, but the question is to which extent knowledge-based dictionary apps are designed for the mobile user situation. The objective of this article is to analyse the characteristics of the mobile user situation and to look further into the stationary user situation and the mobile user situation. The analysis is based on an empirical survey involving ten medical doctors and a monolingual app designed to support cognitive lexicographic functions, cf. (Tarp 2006:61-64). In test A the doctors looked up five medical terms while sitting down at a desk and in test B the doctors looked up the same five medical terms while walking around a hospital bed. The data collected during the two tests include external and internal recordings, think-aloud data and interview data. The data were analysed by means of the information scientific star model, cf. (Simonsen 2011:565), and it was found that the information access success of the mobile user situation is lower than that of the stationary user situation, primarily because users navigate in the physical world and in the mobile device at the same time. The data also suggest that the mobile user situation is not fully compatible with for example knowledge acquisition.
Keywords: Mobile lexicography; mobile user situation; mobile user

1 Introduction and Problem

Today, most users are always on and always connected, cf. (Google 2013:2), which reports that 84% of us use smartphones while they do other things, and users today in fact use their mobile devices in a large number of situations.
Users are already mobile, but the question is to which extent knowledge-based dictionary apps are designed for the mobile user situation. The objective of this article is to analyse and discuss the characteristics of the mobile user situation with a view to putting the user back in focus in dictionary apps.

2 Methodology and Empirical Basis

Ten medical doctors were asked to look up five medical terms by means of the dictionary app Medicin.dk, which is a knowledge-based medical resource used by most health care persons (HCPs) in the Danish health care system. As many as 15,000 users regularly update the medical app Medicin.dk, which indicates that the app is widely used by a variety of users. According to (Dolan 2012) everything in medicine is going mobile and both patients and physicians are changing behaviour in line with developments in health technology.

The test persons accessed the medical terms by means of the app Medicin.dk on an iPhone 4S, which was wirelessly connected to a PC by means of Reflector, cf. http://www.airsquirrels.com/reflector/. The medical doctors were asked to participate in two tests. In test A the test persons were asked to look up five medical terms while sitting down at a desk. In test B the ten test subjects were asked to look up the same five terms while slowly walking around a hospital bed.

The two tests were designed to imitate two typical user situations for many doctors: knowledge acquisition and knowledge checking prior to patient consultation and knowledge checking during a patient consultation.

The five tasks included looking up the five proper names Terbasmin (asthma), Tamoxifen (breast cancer), Antepsin (ulcer), Tredaptive (cholesterol) and Fludara (leukaemia) and can be summarized as follows:

- Task 1: Look up Terbasmin – to find information
- Task 2: Look up Tamoxifen – to find and extract information about side effects to be able to inform patient
- Task 3: Look up Antepsin – to find and extract information about dosage to be able to check prescription
- Task 4: Look up Tredaptive – to find and extract information about dosage to be able to inform patient
- Task 5: Look up Fludara – to find and check spelling of term to be able to write a text.

Both tests were recorded from the "inside" by means of Reflector, and at the same time the user activities were recorded from the "outside" by means of a digital camera. In addition to the recordings from the "inside" and the "outside", the empirical basis also includes think-aloud-data, as the test persons were asked to think aloud and verbalize what they did and saw etc. To deduce additional qualitative comments, the empirical basis also includes interview data as the test persons were interviewed before and after the tests.

3 Theory

Related work with direct relevance for this survey includes a number of studies of how users interact with mobile devices, such as (Pedersen & Engrob 2008), (Church et al. 2009) and (Ehrler et al. 2013). In addition to theoretical considerations on user interaction and mobile devices, this work also includes selected theoretical considerations on lexicography such as (Tarp 2006), (Verlinde et al. 2010) and (Simonsen 2011).

Pedersen & Engrob (2008) discusses a number of interesting usability tests with mobile devices. The objective of their work was to discuss which interaction technique was most suitable for mobile users. Pedersen & Engrob (2008) asked eight students to walk on a running machine while interacting with a PDA. The focus of their tests is not completely comparable with this survey, but it is highly relevant. Pedersen & Engrob (2008) found that the test persons used different interaction techniques in different user situations.

Another highly relevant contribution in this area is Church & Smyth (2009). Church & Smyth (2009) conducted a number of surveys of the mobile information needs of different users. Church & Smyth (2009) asked 20 test persons to participate in a four week long diary survey during which the test persons made notes on their mobile information needs and user situations. Church & Smyth found (2009) that user situations can be categorized in five overall categories such as Navigational, Informational, Transactional, Geographical and Personal Information Management. The informational need, cf. (Church & Smyth 2009:251) is the most important need and is focused on the goal of obtaining information about a topic.

Ehrler et al. (2013) reports on an evidence-based survey of user-interface design on handheld devices in health care. The usability test discussed by Ehrler et al. (2009) aimed at acquiring evidence about the quality of data recorded through interfaces on mobile devices and the test showed that the majority of test persons preferred the simpler models for data entry geared to the actual healthcare environment – a finding which was also clear on the basis of this survey.

Finally, a number of contributions on lexicography and information science are also relevant for this analysis. First of all the many contributions on the user and the lexicographic functions as discussed by for example (Tarp 2006) are necessary to understand the characteristics of the user. Furthermore, (Simonsen 2009), (Simonsen 2011a) and (Simonsen 2011b), who builds on (Verlinde et al. 2010), is relevant for the understanding of user research, the mobile user and mobile lexicography. Simonsen (2011a:565) makes the case for the information scientific star model as shown in figure 1 below.

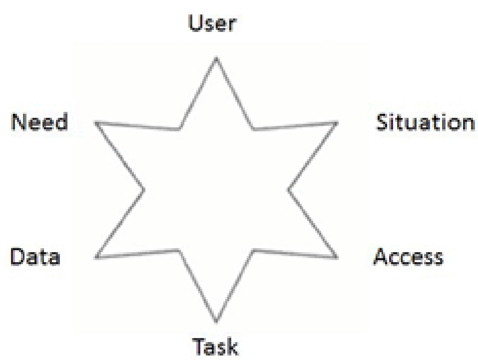

Figure 1: Information Scientific Star Model.

The information scientific star model proposed by Simonsen (2011:565) is applied on the analysis of the mobile user situations below, and it is argued that modern dictionary app development should be based on these six factors. The above model builds on (Verlinde et al. 2010:5), who argues that "relevant data should be retrieved and processed according to the external situation that motivated consultation in the first place, and the information needed to change a state of affairs in the outside world should be operationalized". Verlinde et al. (2010:5) make the case for a "lexicographic triangle" consisting of user, data and access, but it is argued that the analysis and design of information tools should be based on much more than that. Consequently, the information scientific star model was developed.

The star model includes the six dimensions: user, situation, access, task, data and need. Explicit considerations are required on the competency profile of the user, the user situation, the way the user accesses information, the type and complexity of the task, the type and complexity of data and the inherent need of the user. As the data suggest a number of these dimensions have been neglected during the design and development of the app Medicin.dk.

4 Results and Discussion

Ten medical doctors were asked to look up five medical terms by means of the dictionary app Medicin.dk and two tests were carried out. As already mentioned, the empirical data include ten recordings from the inside, ten from the outside, twenty think-aloud data recordings and interview data from all ten test persons.

An overview of some of the comparable answers offered by the test persons during the interviews is shown below in figure 2.

As will appear from figure 2 below, all ten medical doctors in fact prefer the website version of Medicin.dk when asked the question "Which platform and which user situation do you prefer"? This finding is in fact very much in line with (Ehrler et al. 2013), who argue that test persons seem to prefer the most simple data entry and data access model. The finding also seems to support the overall theoretical approach proposed by (Simonsen 2011), who makes the case for a balanced approach and focus in lexicography and information science. It may be argued that the finding is not that surprising, because medical doctors in public hospitals are not issued with a mobile device nor do their working conditions match knowledge acquisition by means of a mobile device. Furthermore, doctors often look for complex data and documents from many different sources and again the mobile device is not an obvious tool to use.

However, as will appear from figure 2 below seven out of ten doctors state that they in fact use their mobile devices professionally and nine out of ten doctors say that they use their mobile phone while moving around, so researching the mobile user situation is highly relevant.

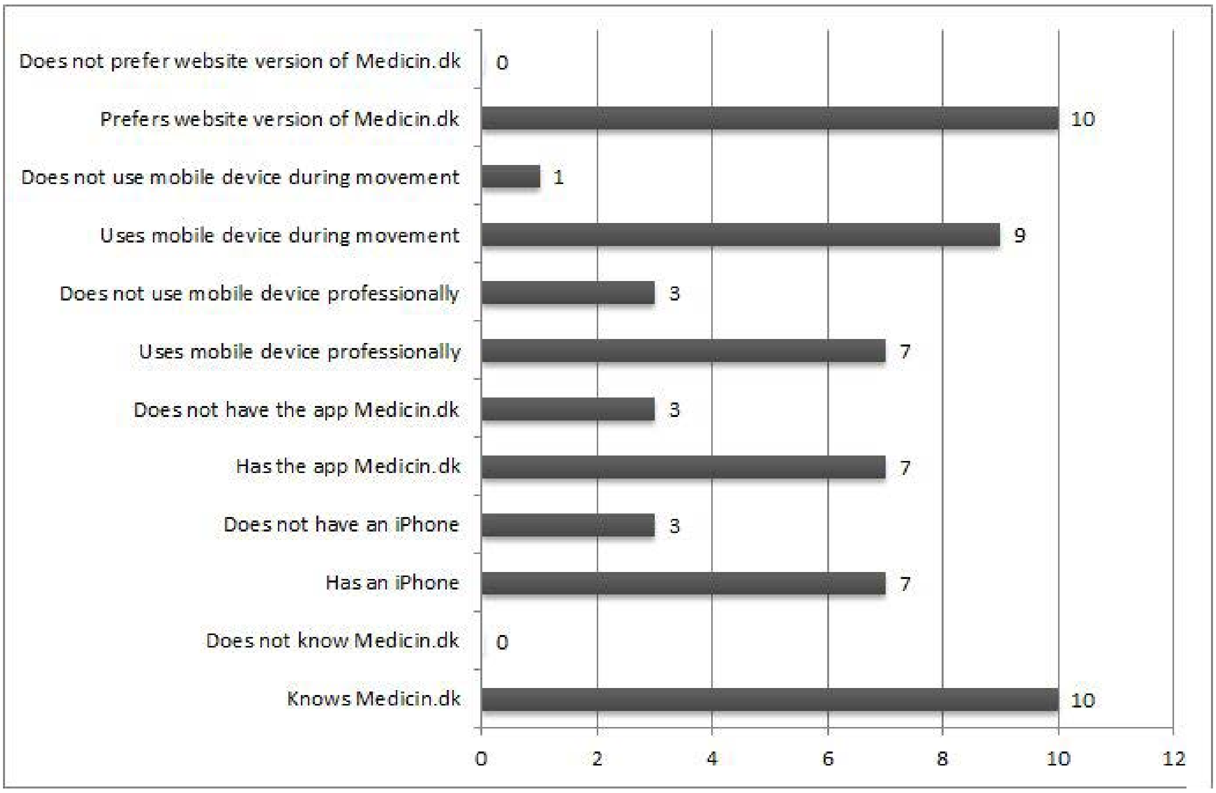

Figure 2.: Overview of Interview Data.

The six dimensions described in the information scientific star model, cf. (Simonsen 2011:565) are encapsulated by the answer given by test person 4, who is a 52-year old female medical doctor. Test person 4 states "I prefer the website version of Medicin.dk, if my problem is complex. The app and the iPhone are handy, if I suddenly have a problem that I know can be solved by the app. However, if I need more knowledge I would rather use the website".

What this statement seems to indicate is that the concrete task at hand more or less dictates the actual user situation and vice versa. Furthermore the task also dictates the amount and type of data sought by the user and in fact also the data access method needed. This correlation is in fact observable in most of the statements offered by the ten test persons, and the interview data show that the mobile user situation and cognitive lexicographic functions is not a perfect match. What is needed is an adaptable, dynamic and situational tool, which features seamless adaptation of data based on location-based services (LBS) and dynamic and situational presentation of data designed for the concrete task at hand and the competence profile of the user.

The quantitative test data from Test A and Test B also support these arguments, see figure 3 and 4 below. Figures 3 and 4 below show how the two tests were carried out and illustrate the stationary user situation and the mobile user situation.

Figure 3: Stationary Test.

Figure 4: Mobile Test.

The numbers in figure 8 below are numerical representations of a systematic evaluation of each test person's information access success in each situation. As will appear from figure 5 the five columns list the five tasks that the ten doctors were asked to do during the stationary test and the mobile test. The term information access success covers an evaluation of the search speed, search quality, focus ability, device interaction ability of each test person on a scale from 1 to 10, where 1 is low information access success and 10 is high information access success. Each number thus represents an overall evaluation of each situation based on the many internal and external recordings. The interview data and think-aloud data also substantiate the numerical evaluations made.

Figure 5 below shows how test person 3 (TP3), who is a 62-year old medical doctor, solves the task "Look up Tamoxifen and extract information about side effects to be able to inform a patient about the most common side effects" in Test A – that is while he is sitting down at a desk.

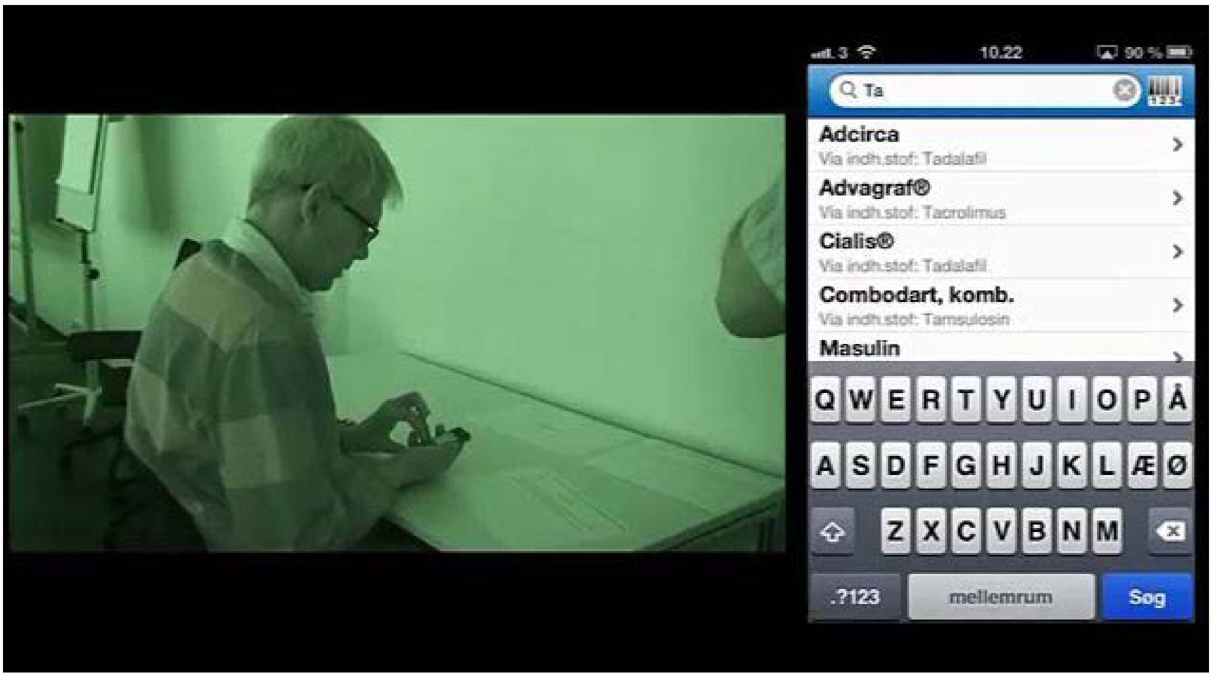

Figure 5: TP3 solving Task 2 during Test A - Outside vs. Inside.

Figure 5 is a snap shot of two video recordings, which originally were recorded at the same time, but they have been edited by means of a video editing tool so that the two recordings can be shown at the same time as a picture-in-picture video.

The entire edited recording shows how TP3 sits at the table in the left hand side of the picture interacting with the mobile device in the physical world, and in the right hand side of the picture TP3's search behaviour is shown from the inside. The left hand side video was recorded by means of a standard digital camera and the right hand side of the video was wirelessly recorded by means of Reflector, cf. http://www.airsquirrels.com/reflector/.

The edited picture-in-picture video, which is based on aligned time codes to show a time-aligned video of the user situation seen from both the inside and the outside, gives a detailed picture of how TP3 solves a concrete task and it shows how a medical doctor uses a mobile phone while sitting down at a desk to look up complex medical information.

In comparison with the stationary user situation, Figure 6 below shows the mobile user situation, that is TP3 solving the same task (Task 2) during Test A. Again the actual user situation and user behaviour are recorded from the outside and the inside and Figure 11 is also a snap shot of an edited time-aligned, picture-in-picture video.

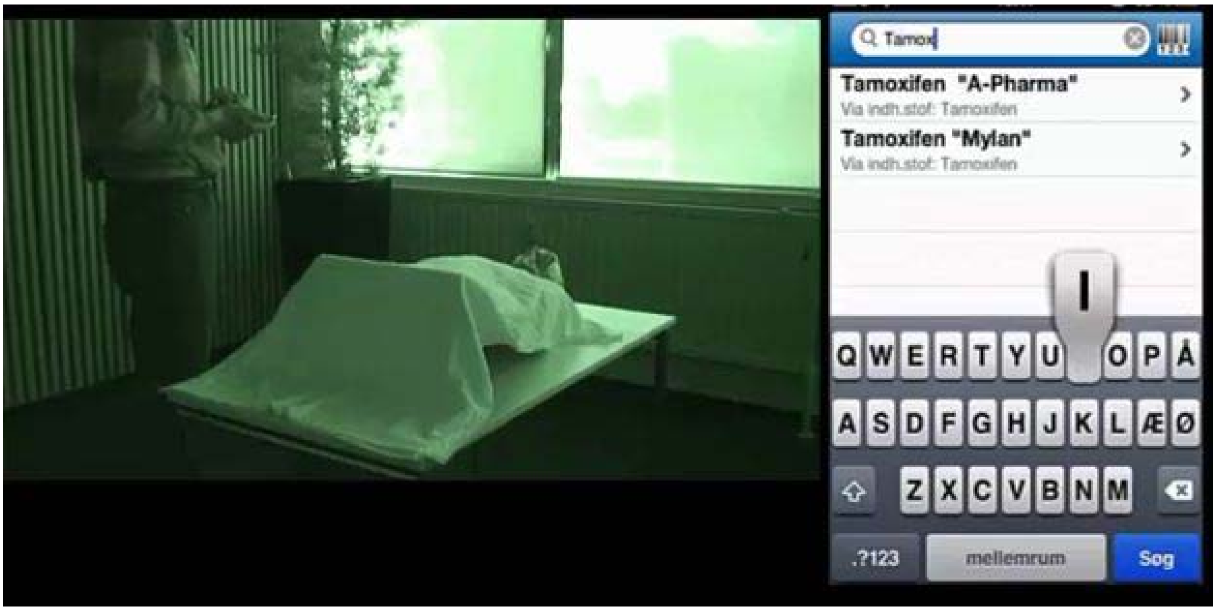

Figure 6: TP3 solving Task 2 during Test B – Outside vs. Inside.

Figure 6 above shows how TP3 walks around a "hospital bed" while solving task 2. The video gives a detailed picture of how TP3 uses a mobile phone to look up complex medical information while moving around at the same time.

A comparison of the two user situations shows that the access speed, that is from the moment the test person started the information access operation to the moment he ended the search operation, is higher during Test A than during Test B. That is in fact not surprising, because users can focus on the search operation and the mobile device while sitting down, which is in contrast to the mobile user situation where users also have to allocate cognitive effort on navigating in the physical world.

The differences between the two user situations become clearer when the two recordings from the inside are edited and contrasted. Figure 7 below shows a snap shot of the time-aligned edited picture-in-picture video of how TP7 solved Task 2 while sitting on the left hand side (Test A) and walking around (Test B) on the right hand side.

Figure 7: TP7 solving Task 2 during Tests A and B – Inside.

The video shows that TP7 is much faster at locating the section on side effects while sitting down than while moving around. The information access speed is clearly higher when sitting down than when moving around. Another interesting fact is that TP7, just as three other test persons, chose to use the mobile device horizontally allowing the screen to show more text. This result also appeared for TP8, who also chose to use the mobile device in horizontal position. On the basis of these results it may be argued that users tend to use mobile devices like small computers while sitting down (the horizontal position), which in fact the video recordings from the outside also seem to document.

The many recordings from the inside and the outside are systematized and tabulated in Figure 8 below. The many numbers in figure 8 are numerical representations of a systematic evaluation of each test person's information access success in each situation. The term information access success covers an evaluation of three factors: search speed, search quality and device interaction ability.

The search speed was relatively easy to measure and is based on the time recorder in the many recordings. The measure used here was time.

It was far more difficult to precisely measure the search quality and device interaction ability. The evaluation of the search quality was partly based on an assessment of the quality of the search result found by the test person. The evaluation was based on an analysis of the think-aloud data where the test person described what he did and found and an analysis of the video recordings. The most important measure in this analysis was the test person's ability to quickly find the right information and verbalize it as think-aloud data. The measure used here was the ability to find the right information.

The device interaction ability was equally difficult to accurately measure. The evaluation of the test person's ability to use the device effectively was partly based on an analysis of the video recordings and the think-aloud data, which together made it possible to describe each test person's ability to use the device effectively. The measure used here was the ability to use the device effectively.

The data show that the information access success of the ten medical doctors was higher when they sat down at a desk than when they walked around a hospital bed. The data also seem to suggest that the task itself and the cognitive complexity of the information dictate the degree of information access success. In other words, simple and easy-to-find information correlates with high information access success while on the other hand complex and hard-to-find information yields lower information access success. This is clear when the two tasks "Find information" and "Find and extract information about dosage to be able to check prescription amount" are compared.

	Terbasmin		Tamoxifen		Antepsin		Tredaptive		Fludara	
Task	Find information		Find and extract information about side effects to be able to inform patient about them		Find and extract information about dosage to be able to check prescription amount		Find and extract information about dosage to be able to inform patient about dispensation		Find and check spelling to be able to write text	
Test person/ Situation	Moving	Sitting	Moving	Sitting	Moving	Sitting	Moving	Sitting	Moving	Sitting
T1	7	8	4	7	4	7	4	7	4	7
T2	3	4	2	5	2	5	2	5	2	5
T3	6	7	3	6	3	6	3	6	3	6
T4	7	8	4	7	4	7	4	7	4	7
T5	6	7	3	6	3	6	3	6	3	6
T6	2	3	2	3	2	3	2	3	2	3
T7	7	8	4	7	4	7	4	7	4	7
T8	7	7	4	7	4	7	4	7	2	7
T9	3	8	2	7	3	5	3	6	4	7
T10	4	6	3	7	2	7	4	7	2	6
Total	**52**	**66**	**31**	**62**	**31**	**60**	**33**	**61**	**30**	**61**

Figure 8: Overview of Test Data.

When asked the question "Do you use your mobile device while moving?" test person 3 states "Yes – when I suddenly think of a medical question that I would like to look up, but I also use my mobile phone in other situations". This answer is somewhat in contrast to the answer provided by test per-

son 5, who states "No – not really. I mostly use my mobile phone when I am sitting down because I think the screen is too small and my fingers are too big for the key pad screen".
Interestingly, test person 5 is a 61-year old male medical doctor, and is the oldest test person, which seems to indicate that age plays a role in mobile information access behaviour as does age in the discussion of digital natives, who are tech-savvy young people to whom digital technology is an integrated part of their lives, cf. (Prensky 2001) for a detailed discussion of digital natives.
It was also found that the information access speed and quality of the mobile, punctual user situation is somewhat lower than the stationary, punctual user situation. The many recordings from both the inside and the outside clearly show that the test persons need to navigate both in the physical world and in the mobile device user interface. They stop walking during the interaction with the mobile device, because they also need to look up and navigate in the room.
When asked the question "What do you think of the mobile user situation?" test person 1 states"I do not think that there is a big difference between moving around and sitting. Okay – maybe you spend more time on the search operations when you walk around, because you have to look up and see where you are" and test person 1 states "As long as I stop up and stand still I actually think it works fine".
To substantiate the argument about information access speed, test person 7 is much faster at locating the section on side effects while sitting down than while moving around. The information access speed is clearly higher when sitting down than when moving around. Another interesting fact is that test person 7, just as three other test persons, chose to use the mobile device horizontally allowing the screen to show more text. This result also appeared for test person 8, who also chose to use the mobile device in horizontal position. On the basis of these results it may be argued that users tend to use mobile devices like small computers while sitting down (the horizontal position), which in fact the video recordings from the outside also seem to document.
The 5-inch screen size of a standard smartphone such as the iPhone is simply not enough. Size does matter when it comes to successful information access and the layout and design of dictionaries has always been relevant for lexicography, cf. for example (Almind 2005) and (Almind & Bergenholtz 2007). This is very much still the case as the data presented above suggest. The problem is that the human-mobile interaction is not optimal. The input device (the finger) and the small letters shown on the 5-inch screen are not a perfect match as one of the test persons surveyed actually also verbalize. Obviously, it would be logical just to call for bigger screens, but that would be naïve because smartphones are in fact supposed to be small. However, HUD technology may at some point allow us to display dictionary data in HUD format (Head-up Display) where information is visually size enhanced and relayed to the user surroundings, but it will be some years before that technology becomes commoditized. A number of theoretical contributions discuss mobile design and mobile usability, for example (Budiu & Nielsen 2013), who make a very strong case for more usability research in mobile design, (Cerejo 2012), who discuss the many elements of the mobile user experience, including the more social and personal elements of mobile user personas

and of course also (Nielsen 2011), who offers a myriad of practical and easy-to-use instructions on mobile design.

However, what we can do at this point is to design the actual dictionary app in such a way that intelligent search engines and easy-to-use interfaces facilitate easy information access. As the data of the survey suggest, simple search engines with a simple search field and a simple TOC-like display of the dictionary data are preferred by most users. Scrolling through large text blocks reduces the information access success of the ten medical doctors surveyed.

It was also found that the information access success of the ten medical doctors was drastically reduced in cognitive user situations, that is when they were asked to solve cognitively-based problems like task 2, task 3 and task 4, which were all about locating complex information with a view to making decisions as to side effects, dosage and how to take the medicine etc.

This finding is also expressed by test person 7 who states "If I have to look a little bit deeper into a question then I clearly prefer the computer. I would definitely use the computer if I were to prescribe medicine that I have never used before". In other words, it was found that the mobile user situation and cognitive lexicographic functions is not a perfect match.

All this in fact seems to suggest that mobile lexicography needs to reinvent itself and take into account the six dimensions proposed above by (Simonsen 2009). This contention seems to be supported by (Church & Smyth 2009:255-256), who state that: "...mobile users are on-the-move and as such are interested in locating different types of content. We found context to be a very influential factor in many mobile information scenarios and as such argued for the need for new types of context-sensitive mobile interfaces that take full advantage of temporal, location, and preference-based contexts".

A similar argument was made by (Leroyer & Kruse 2011: 411-415), who describe a pragmatic data presentation and user interface in a French/Danish Real Estate e-Dictionary. Leroyer & Kruse (2011) make the case for a situational user interface, which definitely is the way forward in mobile lexicography.

However, mobile lexicography should not only be based on temporal and situational dimensions. Mobile lexicography is different from Internet lexicography and very much different from paper lexicography. Mobile lexicography is unique, because the user very often is mobile and on the move when using his device.

That very fact calls for new theoretical considerations and on the basis of the empirical data and the discussion above the following mobile lexicography principles can be identified.

Mobile user principle

The mobile user is on the move and needs and accesses information while on the go. This makes the mobile user punctual, impatient, imprecise and preoccupied with other things.

Mobile situation principle

The mobile user situation is characterized by being volatile, punctual and by often taking place while the user does other things. The mobile user typically checks knowledge and performs simple searches. The mobile user situation primarily supports simple, punctual, communicative lexicographic functions, and is not suited to support complex, cognitive lexicographic functions.

Mobile data access principle
The mobile user navigates in both the physical world and in the user interface of the mobile device at the same time. This calls for a very simple and easy-to-use data access method for example a very intelligent semasiological search engine or even better a voice-activated search engine like Siri in an iPhone.

Mobile data principle
The mobile user situation also dictates the type and complexity of the mobile data. The size of the user interface and the punctuality of the user situation mean that complex data and long text segments are not optimum mobile data.

5 Conclusion

This article discussed the mobile user situation, and it was demonstrated that medical doctors prefer the website version instead of the app version. It was also found that the information access success of the mobile user situation is lower than that of the stationary user situation, primarily because users are required to navigate in both the physical room and in the mobile device. It was also found that the mobile user situation is not at all suitable for solving cognitive lexicographic problems such as for example knowledge acquisition etc.
On the basis of the survey it is argued that classic lexicographic virtues such as attention to the characteristics of the user situation, the task, the type of user and the presentation of data seem to be in demand in app development. The data provided in a dictionary app must be adapted to the mobile user situation and the data access structure of the app should take into account the limitations of the mobile user situation and should be task-dependent. The empirical data and the discussion led to the formulation of four principles on mobile lexicography.
Users are already mobile, but lexicography does not seem to be up to speed with the users. A dictionary app should satisfy concrete and potential lexicographic needs. Consequently, further research in mobile lexicography is needed – to put the user back in focus.

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