ABSTRACT
In this paper we discuss the dynamic nature of mobile usage, and how this impacts on design and evaluation, particularly in an industrial setting. We argue that current industry oriented design tools need to be extended to cater more effectively to the highly dynamic and context-dependent nature of mobile usage – we suggest more focus should be put on doing instead of on being. In order to achieve this we suggest a lightweight design/insight tool developed to suit industrial practice: context cards. These cards allow designers, developers, and usability experts to perform lightweight explorations of the consequences of a range of mobile situations.

Author Keywords
Context, design, transitions, trail, mobile, usage.

ACM Classification Keywords
H.5.2 User Interfaces: theory and methods

General Terms
Design, Human Factors.

INTRODUCTION
When designing for mobile usage, the context in which the application or device is used will impact drastically on the user experience. To cover this explicitly, the concept of “situation induced disabilities” has been introduced [13] indicating the importance of involving not only real users but also real (non-lab) situations when evaluating mobile solutions. While the importance of context is well recognized, the fact that most smartphone apps are quite hard to use while actually on the move imply that more tools are needed in order to get the context properly into industrial design processes.

DESIGNING FOR A MOBILE CONTEXT
As Manuel Castells [5] has pointed out, only the technologies that the surrounding culture is open to can spread. The last 25 years or so, the field of HCI has increasingly built on an insight that artifacts always are parts of a context and need to be designed as such. Technology development and new prototypes are part of a whole, and dissociating them from that when evaluating or communicating them can seldom be done successfully. It is the effect on the whole that makes a difference, and it is in the whole that research can be conducted. The artifact’s potential is defined in and by the current situation’s horizon of possible actions.

Back in the 80’s, there was a growing criticism that the human users and their real lives were excluded instead of being an influential part of the process led to a new wave of HCI [3]. One of its obvious starting points was the groundbreaking paper, “From Human Factors to Human Actors”, by Bannon [1]. Some examples of this wave of HCI are situated action [14], participatory design [6] and increased interest in activity as described in activity theory [11].

Whenever a person wants to do something, it takes place in relation to her situated world. Situated action [14] represents a view where every chain of events depends on the current material and social circumstances. According to Suchman [14], people rely on their abilities and experiences to handle different situations in the here and now. The situated character of human action is further reflected in the statement that “the organization of situated action is an emergent property of moment-by-moment interactions between actors, and between actors and the environments of their action.”

Here, the term “moment-by-moment” is crucial, because many designers, developers and marketers tend to focus too closely on fairly stable user populations and target groups – as if user behavior is in some way more predictable if you know who the user “is”. When designing for context-dependent use, we need to focus more closely on what people “do”, and more specifically on how their actions change (or stay the same) depending on dynamic and
emerging situations. Many common design tools, such as Personas [7], are focused heavily on characteristics of the user, and although approaches like Scenario Based Design [4] involve aspects of usage context such approaches often consider either abstract representations of users or the actual use situation out-of-context. Thus we felt that current tools needed to be extended to cater more effectively to the highly dynamic and context-dependent nature of mobile usage. Much like contextual inquiry [8] focuses on how people experience tools and systems in the context of actual, ongoing work, we wanted to focus on ways to better support design decisions in an industrial setting by deepening the designers’ and developers’ understanding of mobile use situations.

BACKGROUND STUDIES
Initially we performed a series of video observations of real outdoor mobile usage (Figure 1). These videos show typical user behaviors interacting with the device while on the move (like slowing down or stopping in order to be able to interact or not being able to attend to the environment).

Figure 1. Outdoor mobile use

In addition we did a questionnaire survey at an open air student festival in Lund, Sweden, asking people about their mobile usage (149 out of 161 persons answered our questions, age distribution: 15-19: 7%, 20-29: 60%, 30-45: 20%, >45: 13%). The results were that 93% used their mobiles while walking, 70% used their mobiles while cycling and 79% used their mobiles while driving. 82% read text messages while walking, 44% while cycling and 46% while driving. As for writing text messages, 74% wrote messages while walking, 28% while cycling and 24% while driving. The figures for car drivers agree well with the figures gotten by a national Swedish survey made by the insurance company Trygg Hansa 2011 [9] who interviewed 1010 persons on their SMS behavior – 42% stated they read or wrote text messages while driving. Together these studies implied that mobile phones are indeed used also on the move but that current smart phone designs are not well designed to support this kind of usage.

Since we were targeting industrial practice, we interviewed persons from nine different companies (small, medium sized and large) about their work processes. We identified several potential problems concerning the design of products intended to be used in mobile situations:

- Designers and design tools are very visually oriented and there is much focus on the screen, while many mobile situations require the user to focus on the environment and not on the device (as seen in the video observations).
- Even though parts of the design and development team is well aware of the requirements posed by users and situations, other parts of the team may not be – and decisions influencing the user experience are also made by members of the team less focused on the user experience. There is a need to communicate user and usage information within cross-functional/transdisciplinary teams.
- Design and development usually take place in office environments, not in mobile use contexts.
- There is much focus on some sort of abstract user – target user groups are often mentioned.
- Timelines are short – there is often no time for extensive user studies, or other work practices that require much time and effort. Projects have a tendency to be “over budget and after schedule” from day one. Development methods such as SCRUM use very short iteration cycles.

With these issues in mind we decided to focus on developing a lightweight - quick and efficient - tool aimed at bringing the mobile usage context closer to industrial designers and developers.

DYNAMIC USER EXPERIENCES
Our initial studies led to the realization that many design methods originate from the design of desktop systems – good lighting conditions, quiet environment, few disturbing elements etc. Most development also takes place in this type of environment, and during development the technology is in addition the (sole) focus of the activity. Mobile use situations are often different – people or things in the environment are the focus of the activity and require attention, bright sunlight might make the screen hard to see, a noisy environment may make the audio hard to hear, the device might be kept in a bag etc.

By focusing on persons and abilities (using Personas or Target User Groups) the influence of the mobile context may easily be obscured. Looking at abilities, one may state that a typical user has good eyesight, good hearing and good motor and cognitive ability. Re-writing this list in terms of a context specification it becomes: the user can easily look at and attend to the screen, quiet environment without sound disturbances, the user holds the device in the hands (no gloves or similar) and no external vibrations or shaking that makes it hard to feel touch feedback, the user has nothing else in the hands and can use both two-handed and one-handed grips, no shaking or vibrations that interfere with the ability to interact.

Looking at this list it is clear that mobile devices are used in a range of situation where the above is not true. Instead we may have:
• Context that requires attention (e.g. other people, traffic, sights, scenery etc). Non-optimal lighting (e.g. bright sunlight), or when the user has or wants to look elsewhere (while crossing a street, negotiating rough terrain, etc).

• Noisy environment (e.g. in a crowd, by a busy street, at train station, at festival or fair, etc) or an environment where sounds are not suitable (e.g. meeting, concert, theater, bird-spotting – not to frighten the birds etc)

• Situations that limit your ability to touch the device, e.g. cold hands, using gloves (cold weather or keeping the device in a pocket or a bag) or when external vibrations/shaking makes it hard to sense the feedback.

• Situations that limit your ability to manipulate the device, e.g. having to hold something else in one or both hands (e.g. umbrella, bag, take away coffee, ice cream, pram, child etc) or when shaking/vibrations that make it difficult to interact.

In addition, we argue that the mobile situation is inherently dynamic, but that we often fail to recognize how quickly the users switch between different situations and contexts. We suggest that early testing methods, such as a cognitive/heuristic walkthrough [12], need to pay closer attention to the dynamics of mobile usage. This shift of perspectives could be facilitated through imagination or through more situated, physically oriented exercises. It is important that the above situations are used to both stimulate ideation and to guide evaluation of ideas and concepts. The question “how well does this design work in context x, y or z” should always be on top of the designer’s agenda.

CONTEXT CARDS
Since users move quickly and effortlessly from situation to situation and from context to context, mobile products and services must be designed to deliver user experiences that are equally dynamic. In order to bring the context closer to the developers we decided to use the above list of conditions as inspiration, and design a set of cards where each card would have an image of a specific mobile use context on one side, and on the other a short text describing key features and things to note (Figure 2). With these cards it would be possible to explore the dynamics of mobile user experiences, and to understand how products and services might be perceived in dynamic situations and contexts, also at very early stages of the design process. We have developed a set of 30 cards in order to cover a wide variety of different contexts. All 30 cards can be found at http://www.english.certec.lth.se/haptics/ContextCards.pdf. The situations and contexts described in the context card deck are examples that can be used either to enhance heuristic tests – “how does this application work under these conditions?” – or as a starting point for generating device or application specific scenarios. We do not suggest that all parts of any application need to work under all possible conditions, but we do argue that any designer or developer needs to think about various realistic conditions.

How to use the context cards

• Choose a product or service to evaluate or develop new ideas for.

• If you are evaluating an existing product or service: pick a context card from the deck and ask yourself: “What would the user think about the experience (or how would he or she behave) if this situation or context should occur during use?”

• If you are developing ideas for new products or services: pick a context card from the deck and ask yourself: “How could we create something which delivers great user experiences in this particular situation or context?”

• Mix and match context cards in different sequences to explore how your products and services might impact user value as users switch between contexts and situations.

The context cards can also be used to trigger the development of scenarios or the design of user trials. In addition they can be used at business meetings with customers for discussing what an application or a service should offer. The context cards are complemented by a context card poster showing all 30 cards at once. This poster should be placed on the wall in rooms where development takes place. We had previous experience of how attractive posters had a good chance of surviving in industrial environments also long after the end of a project.

PRELIMINARY EVALUATION
Given our target users are industry practitioners, we have initially had to rely on informal testing. The cards have been distributed at industrial fairs such as Mobile World Congress and have been very well received, although it has been pointed out that they reflect a European context and
would need to be adapted/extended for other regions. We are currently getting follow up requests also from large companies (names withheld for confidentiality reasons). In addition our cards have been used by a design/innovation company in Denmark, DELTA. They provided the following feedback (translated):

- We find that they work really well as generative inspiration. Either as inspiration during idea development, or as inspiration for how to test the ideas and concepts being sketched.
- We often arrange co-creation workshops where participants have varying backgrounds. In this situation it has been useful to select a couple of cards to get the process going and for idea generation.
- I have (myself) used the cards a couple of times to reflect on a design, and have found that they rather gave me new ideas than a reflection over existing ones.

CONCLUSION
In this paper we introduce a novel lightweight design tool intended to make it easier for industrial design and development teams to take the demands of the variable mobile context into account. Our deck of context cards can be used as a cognitive tool for both design and development (similar to [12], [2]). Comments from informal evaluations show that these cards work well for idea generation – although it remains to be seen how using context cards throughout development will affect results. Compared to the activity walkthrough [2], we introduce a tool which adds to existing practice both by putting more focus on a variety of mobile contexts and by being explicitly designed for an industrial environment. In contrast to the IDEO method cards [10] which represent methods design teams can use to understand the people they are designing for, our card deck is designed to bring the mobile context as such into the development process. We recognize that our 30 cards do not cover all possible contexts – they may need to be extended for specific regions or activities. We have made print pdf:s available on the web, something which both guarantees easy access and allows extension (easy to add and remove cards). Although the context cards are designed for the industrial environment we suggest their usefulness is not limited to industrial settings - we hope they can serve as inspiration for further work concerning how dynamic context and usage can be mediated during design and development processes.

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