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The Focus Problem in Mobile Learning

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ABSTRACT

Mobile learning has a lot of potential for supporting learning in situations such as in a museum, at a tourist sight or when exploring biological phenomena at a riverside. There learners can interact with their environment and still make use of the advantages of computational power. However, we have found many of such projects hindered by placing the technology too much in the focus of the learner. Instead of interacting with the environment, we found the learners interacting with the device, heads down and ignoring the environment. We found the issue of focus to be a massive problem, one which needs a completely new metaphor for the design of an educational and technical setting. Until now, the mobile devices have been interpreted as small desktops, always in the foreground of the learners' focus. Instead, we propose a different approach, deduced from the usage of mobile phones. Mobile applications need to be designed explicitly to free the learners' focus and push the application to the background. The good news is that the actual changes to be made in existing systems are not as fundamental as one may think.

1. Introduction

Purposeful and intentional learning needs to have a focus in order to reduce complexity and give orientation. While life and reality is extremely complex, a human brain can only process a limited amount of information. Thus, a learner needs guidance what to filter out and what to aim for. For instance, walking through a museum remains undirected and mainly entertaining as long as no specific focus is defined on which to concentrate attention.

A common argument in the discussion of technology enhanced learning is the danger that the learning focus is being distracted by technology itself. Sources of distraction can be: 1) the misuse of technology (e.g., playing games during a lesson), 2) the failure of technology (e.g., a computer crash or non-functional beamers), or 3) an inauspicious domination of technology. In this paper we discuss the third type of distraction, that technology, especially new technology, undoubtedly holds high attraction for people and naturally draws attention to itself.

Domination of technology in enriched learning settings can hardly be avoided. Therefore, the purpose of bringing technology into learning is justified with the argument of training media competencies. But when technology is not the sole purpose but is meant to enhance learning, the natural attraction of it might become a problem. The learning focus, automatically drawn by the technology, must then be redirected to the actual purpose of learning.

With MobileGame we were caught in the trap of insufficient placement of focus. Several runs were performed between 2002 and 2006. MobileGame is a playful alternative for the guided tour of the campus given to incoming students (for a detailed description of the game see [1]). Instead of the traditional tour, students are equipped with handheld devices and a location aware application. The application contains maps with points of interest, location based tasks, a chat tool and a fun filled hunting functionality. Guided by MobileGames, the students explore their campus with specific tasks provided at each spot. The tasks are relevant, but the main purpose is to initiate further exploration.

We found our educational goals were not reached as expected. The mobile device, given to the players, dominates the learning experience too much. Instead of interacting with the environment, the players interact almost solely with the mobile device, even when moving in the physical space. When walking around the campus, players continually stare at the device, not noticing anything about the surroundings. In a few cases, players have even bumped into other people, glass doors or pillars. When they meet other players during the game they mostly ignore the others completely. Furthermore, players of MobileGame are much slower and less successful than players of a similar paper-based game.

A literature review (chapter 2) will highlight the phenomenon of insufficiently placed focus as not being a specific problem of MobileGame, but rather seen as a systematic mistake in the design of educational settings of mobile learning in physical contexts. In chapter 3 and 4 we will further analyze the issue of focus, and conclude with an approach for a new design metaphor (chapter 5) with requirements and guidelines (chapter 6) on how to design the issue of focus in educational settings.

2. Literature review

2.1 User attention in the HCI research area

Research in the Human Computer Interaction (HCI) area has already discussed the problem of too much focus or user attention placed on mobile devices. In an empirical study Kristoffersen and Ljungberg [2] explore the common problem of many mobile applications. The traditional direct manipulation interaction style from desktop applications is transferred to mobile applications. They argue that the direct manipulation demands too high level of visual attention for mobile usage. A driver that has to stop his car to handle his mobile application is a good example. Similarly, a mobile application designed with direct manipulation features attracts too much attention or focus and thus prevents the user from giving attention to his surroundings. Pascoe et al. [3] elaborate on this effect and show an intensification of the problem if the user is moving. Brewster [4] shows how too much attention on the device can even lead to dangerous situations, like moving in front of a driving car. All mentioned authors try to solve the problem by reducing the needed attention. But there are also other concepts in the literature. Yue et al. [5] discuss explicitly how to place the mobile device more in the focus of the users if they are too distracted by the surrounding environment.

So the HCI research area has already recognized the focus problem of mobile devices. In the ensuing debate regarding the attention problem, Pascoe et al. [3] propose a minimal attention user interface where the mobile device is used with only one hand. The user can use the fingers instead of the stylus pen to input and only needs a periphery view of the interface. Brewster [4] and Poupyrev et al. [6] enrich their interface with audio and haptic channels to give feedback from the device in order to minimize the attention time. Also, there are many attempts to make use of sensors for direct input ([7, 8]). Sensors for context awareness can even automate input for the user ([9]). An additional suggested solution is to substitute the interface through physical real world objects ([10]). All solutions try to reduce the focus to the device. But in the learning context, focus is explicitly needed.

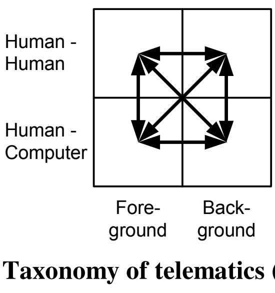

Figure 1: Taxonomy of telematics (Buxton[11])

Another way of handling the focus problem lies not in reducing the attention, but in accepting the problem and controlling the time, that is, when the focus is directed to the application and when it is not. Following the taxonomy of Buxton [11] (see Figure 1), there are applications for foreground usage and background usage. He points out the necessity of designing explicit transitions from the foreground to the background and vice versa. These transitions are visualized by arrows in Figure 1, but there is no indication from Buxton given how to design the transitions. If the transitions are designed with care, the negative effect of too much visual focus can be controlled. In this paper we show how to design this transition. To our understanding, the design of mobile learning in a physical context needs reconsideration regarding the issue of focus. We suggest concentrating on keeping the main focus in the physical environment once the technology is integrated.

2.2 Aspects of Focus

As demonstrated in the case of MobileGame, the focus issue torpedoes the learning goal of exploring the campus. Learners were found to be focusing mostly on the screen of the device and not on the environment, even when reminded to avoid this behavior. Such a phenomenon is not a specific problem of MobileGame. The following literature analysis will show that it appears systematically in educational settings, where a physical learning context is enriched by a digital/virtual dimension. Such a setting enforces frequent switches of focus from the physical context towards the digital context and back[1]. Due to the high attraction of interactive technology the attention gets stuck on the device. Thus, a switch from the device back to environment needs to be explicitly designed. Mobile learning deploys its potential strengths particularly in settings of mixed environments, i.e., the focus problem is especially relevant for mobile learning. We consider only mobile learning projects, which claim to support learning in a physical context.

2.3 Focus in other projects

Frohberg [12] suggests five types of mobile learning projects, categorized by free, formal, digital, physical and informal context. MobileGame fits the physical context category, as the university campus is the learning environment, where the players can act and move. Locations, objects, people and situations on the campus are relevant learning objects. Frohberg reports on 15 further mobile learning projects that fit into this category. We exclude the RAFT [13] project from the following discussion because the user of the mobile application is not the learning person. For the analysis of the focus aspect, we split those

[1] Nowadays ubiquitous computing is practically not yet in the stage to integrate technology smoothly in the domain of everyday life to avoid frequent switches of focus.

projects in: a) projects with dominant technology and b) projects with embedded technology. Projects in subcategory a) are projects of location and object related content delivery; those in b) are projects of environmental data collection. The first subcategory contains projects which struggle with the same kind of focus problem as the MobileGame. Analyzing the similarities, we will deduce patterns to specify the underlying aspects of focus. In the second subcategory, we bundle projects which have managed the focus problem, but at the cost of not exploiting the full potential of mobile technology. We will study there the main factors of how to embed technology in an unobtrusive way.

a) Dominant technology: Location and object related content delivery: Caerus [14], Tate Modern Multimedia Tour Pilots [15], The lost worlds of Somers Town [16] and the four MIT-projects Environmental Detectives, Charles River City, Outbreak@MIT, and Mystery@TheMuseum[2] make use of a similar technical setting as MobileGame. They all have a digital map of the area on a mobile device plus a localization system in common. Those connect the physical world with the virtual world. The learners move through the environment, and their changing locations trigger events on the device. Events on the device again are thought to make learners move and act in the environment. The learning in the Bird & Butterfly Watching System [17, 18] is not triggered by a specific location, but by an object (animal).

Caerus strongly supports our hypothesis about focus being a general issue of mobile learning in a physical context. In his study visitors explore a botanical garden. They are equipped with a context aware mobile device which guides them to various locations and provides interesting information about it. Caerus is one of very few mobile learning projects which mention focus explicitly to be a problem of design. Naismith reports "*The participants felt that significant mental effort was required to use the application, which correspondingly led to a large amount of 'heads-down' interaction ([19]). The use of the handheld application was far from seamlessly integrated with the visitor experience.*" ([14]) So Naismith faced the problem of learners being occupied by using the handheld device and broadly ignoring the actual learning space - the botanical garden.

"Tate Modern Multimedia Tour Pilots" and "The lost worlds of Somers Town" are electronic location aware guides and provide mainly a navigation functionality plus consumable multimedia content, which is related to the current location of the user. As learned from MobileGame and Caerus, those elements heavily capture the learner's focus. Because of the similarities in the concept of the projects, we argue that focus must similarly be an issue in each of the tour guide systems, even if not explicitly mentioned there.

The four MIT-projects are augmented reality simulations with a frame story using the real environment as playground. Environmental Detectives, Charles River City, and Outbreak@MIT confront a team of players with a fictive disaster (water pollution, disease epidemic). Mystery@TheMuseum is a criminal case about the theft of a picture in a museum. The teams need to interview virtual people, collect pieces of information, take virtual probes, and cooperatively manage and counteract the disaster or respectively solve the theft. Most activities and events are tightly connected with specific locations, although all relevant activities (except moving through the playground) are virtual and simulated. So we conclude again, all learning activities happen with the mobile device being the main focus of the learners.

With the Bird&Butterfly Watching Systems the learners explore a natural area to find and learn about birds or butterflies. Once such animals are detected, the system supports them to identify the animals and provides further content about them. Obviously, the learners spend just a small fraction of time in observing the living animals or the environment. The rest of the time they are interacting with the device. Thus, the main objective of an expedition which is the exploration of the environment is likely to be ignored because of insufficient placement of focus.

In all these projects the technology has high dominance and steals focus from the physical environment. Now we shall look at the common aspects which lead to this result. All applications are designed to require permanent attention and interaction from the learner. There are no phases where the learner could shut down the device and put it in a pocket. The interface is explicitly designed to be most dynamic, frequently providing new multimedia content and updating location data. Thus, the interface keeps its attractiveness and remains in the foreground of the learner's focus. The applications are multi-functional and support various needs of the learner. They all are a source of almost unlimited knowledge. Additionally, they support navigation, structure the learning path, simulate human interaction, or simulate tools of investigation.

b) Embedded technology: Environmental data collection: The remaining projects in Frohberg's review are CCProbeware [19], an unnamed project at King Middle School [20], ME-Learning Experience [21], and Denali National Park Fire Succession Study[3]. The mobile device

[2] See http://education.mit.edu

[3] See http://www.concord.org/publications/newsletter/2004-fall/monday.htm

there are attached with various sensors for probe taking. They basically serve as tools for data collection and exchange during expeditions. They do not have the exclusive attention, but are one of many components in the whole setting. The focus of the learner is likely to switch permanently between device and surroundings. The learners move to a location, take a probe there, eventually note the result if not automatically done, and move on. The learners need to actively observe their surroundings in order to identify locations systematically; otherwise the data would be worthless. The benefit of using a mobile device instead of pen and paper lies mainly in convenience and not in added pedagogic value. These projects are successful in a sufficient placement of focus, but lack the exploitation of educational power of the devices.

Analysing these projects, we draw the following conclusions. The learners use the device quite differently from the learners in category a). Because the used functionalities of the devices are limited to collecting and sharing data, there are enough remaining activities to be done without the device. This causes a discontinuous usage instead of a continuous usage. The focus is naturally on the environment and switches only to the device when used. A natural foreground / background switching, triggered by the activity, can be observed here.

In contrast to category a) where the dynamic interfaces for the positioning information are constantly changing, the interfaces of the projects in category b) are not described in detail. But from the usage scenario we reason that they are static and simplistic. They avoid challenging the learner's play instinct by dynamically changing frequently. They support only one single activity and thus do not distract the learner when there is no purpose. No content delivery and no navigation functionalities are implemented. Instead, the devices trigger activities rather than being the activity.

In this section we have described the two main categories of mobile learning applications which are designed to be integrated in a physical context. In a) applications dominate the learning, they exhaust all potential of mobile technology for learning, causing a focus problem and preventing the learners from sufficient interaction with the physical environment. In category b) we have described applications which deal well with the issue of switching the focus, but do not exhaust the full potential of the technology. We argue that there must be a more optimal trade-off designing an application between these extreme positions.

In section 3 and 4 we will describe and analyse the MobileGame intensely. As owners, we naturally have access to all details of the design, details that were missing from the other projects. Based on the literature review and the analysis, we will in section 5 introduce the small desktop metaphor and the mobile phone metaphor. Section 6 closes with a set of concrete recommendations and requirements when designing mobile learning applications in a physical context.

3. Field tests

At the beginning of the winter term, 2004, all 149 students of an introductory course to informatics played the MobileGame at the University of Zurich (for detailed description of the test and results see [22]). In this trial we compared different groups. One of the results was the huge difference in the activity level of the ‘teams of two’ and individual players. Teams of two solved 63% more tasks than individual players. In interviews, we found the device drew too much focus and required mental effort. The individual player was overstrained in concentrating on the environment, the orientation in a new area and solving the tasks. In teams of two the participants could share their cognitive load to some extent. The social interaction resulted in more confidence, in feeling less lost. After this result we performed another trial to see what would happen if no device, attracting so much focus, was used in the game.

Thus, in October 2005 we tested the MobileGame in Zurich again. All students of the introductory lecture to informatics were offered to play the game as an introduction to the Irchel Campus of the University of Zurich. 57 students joined the experiment: 25% were females; 75% were male. 53% were studying computer science; the other 47% took informatics only as a minor field of study. The average age of the students was 23 years.

The experiment was designed to compare the digital MobileGame with an analog alternative. 41 players played the game in teams of two (except one individual player). The teams in each run acted as one game entity, but competed with each other in getting points for solving tasks. After an introduction of 15 minutes to the technology and the rules of the game, they had 90 minutes to complete the seven location depending tasks. Additionally, they had the opportunity to get extra points if they could digitally "catch" other teams. After the game the participants answered a short questionnaire. One week later the participants came back to answer a second questionnaire with detailed questions.

The remaining 16 students which had not played the digital game received a paper based version of the game. The seven location specific tasks were marked on a map of the campus and the campus buildings. The students had to fulfill these tasks just like the players of the digital game. But they did not get extra points by catching other teams. The students played the analog game in teams of two. After the game the same questionnaire (except the technology dependent questions) were given to them. One week later the participants came back for a short interview and they also filled out the second questionnaire without the technical questions. Unfortunately, only 37 of 56 students returned the second questionnaire.

What we expected was a better and quicker orientation with the digital version of the game. The players of the digital game had the same maps as the players of the analog game, but in a digital representation on the PDA. Additionally, they could see where they were on the map, where they came from (visualized as a red line on the digital map) and had auto-scroll to see the proper part of the map as they were moving on.

However, we found the opposite. Only 48 % of the players of the digital game fulfilled all tasks in the given 90 minutes (10 of 21 teams fulfilled all tasks). We observed several teams which had great problems mapping the digital representation of their own position with the surroundings. Many players just moved across the campus, their heads down to the PDA, without noticing anything except what was happening on the PDA. Some players crashed into other people or pillars.

In contrast, the players of the analog game were much more efficient. All analog players fulfilled all tasks. And the average time to fulfill all tasks was 40 minutes (min = 32 minutes, max = 59 minutes).

The reason for this unexpected result lies in the usage metaphor of the provided resources (PDA versus paper). The PDA had the permanent focus, which hindered the players from efficient performance. The paper map switched only to the foreground when it was needed, and then disappeared again from the players' view. They just looked at the map to plan the route to the next task, and afterwards only if they lost their way. They used the map simply as an unspectacular tool of support, putting it away when it was not needed anymore. The potential value of the PDA was compensated by shifting it permanently to the foreground.

One may argue that the focus problem was actually only an issue of the screen size. With a sufficient screen size, the current version of the MobileGame was equal or superior to a paper-based version of the game. But we argue that the screen size is only one (probably not the dominant) part of the problem. An expert survey was done to analyze this issue to a further extent.

4. Expert survey

In February 2006 we tested the game with an expert group. In the context of a workshop for pedagogues and teachers, we played the same game as described above. There were 12 participants at this workshop and all took part in the survey. Again, they played in teams of two and had to fulfill several tasks. There was also the opportunity to hunt each other. After the game we used the electronic meeting system (for a detailed description see [23]), Group Systems, to discuss the game, the scenario and the technology.

In the first stage we started an electronic brainstorming with just the simple question, "General feedback: What was good? What was bad?" We did not direct the experts in any kind as to the focus issue. Altogether we had 59 feedback items to the game, 14 items relating to the focus issue. So 23% of all feedback entries in this open feedback brainstorming addressed only the focus problem. The PDA was generally blamed for such a high focus that they could not focus on anything else in the surroundings. Here some quotes of these items:

"The view was more centered on the Palm than on the premises and the buildings."

"Generally the view was centered on the Palm. As the game was over I had for a short moment problems with the orientation."

"Should I paint now offhand a map of the building, I would be totally unoriented. I have always looked to the Palm and I haven't recognized the surrounding.

The second step in the process of reflection was to make each participant select the three most important points of the feedback. The item "The view was more centered on the Palm than on the premises and the buildings" received the most votes. In the discussion after the voting, the pedagogues and teachers confirmed that the PDA hindered them most in exploring the new environment.

5. Changing the design metaphor from "small desktop" to "mobile phone"

The design of applications can benefit from an appropriate design metaphor guiding the developers' work and assuring a coherent design approach [24, 25]. It is obvious that a desktop application cannot directly be transferred onto mobile devices because the screen is too small, processing power is comparably low, and mouse and keyboard input are more tedious. But instead of constructing a complete new design metaphor, many mobile applications still have a metaphor in mind which we call "small desktop". This metaphor is characterized by the reduction of the old, well known desktop to a smaller size: changing the menu navigation to button based navigation, simplifying the input, displaying all information in one space to reduce scrolling and reducing the functionality. But it is still a desktop metaphor because the usage scenario is still the same. The mobile applications still claim the exclusive focus of the user. This might be efficient for cognitive work with documents. There are undoubtedly as well learning applications where the small desktop metaphor is the better choice, e.g., all content delivery systems like AvantGo [20]. But as discussed earlier, for explorative and situated learning in physical contexts, focus should not be limited to the device.

Apart from desktops, there is the mobile phone which is very successful in non-permanent usage. This application works quite well in nearly all situations with focus switches. The focus is raised by the phone if it is necessary (e.g., by a ring tone) and then switches back automatically. For that reason, we will analyze the metaphor of a mobile phone in depth to learn how to design PDA applications which support focus switches. Table 1 summarizes the major differences between the two metaphors.

Small desktop	Mobile phone
- used permanently	- used discontinuous (only if needed)
- focus always in the foreground	- focus switches from the foreground to the background and backward (triggered)
- dynamic interface design (many changes)	- reduced interface design (reduced to essentials)
- multi-functional usage	- specific usage
- content delivery	- triggers activities

Table 1: Different between the design metaphors

There are two major differences between both metaphors. First, desktops are designed for permanent usage. Interruptions are exceptional or at least undesirable. Generally, mobile phones are only used for shorter episodes of activities like talking or writing an SMS. This causes the second major difference, the focus. The desktop application always needs the focus of the user; it is always in the foreground. The mobile phone is explicitly designed for focus switches. The phone triggers the focus switch with a ring tone so that the focus moves from the background to the foreground. After the usage there is no longer an attraction and the user puts the phone away.

The user interface of the small desktop application itself is typically very dynamic. All information changes are displayed directly; there are many options, buttons and ways to navigate. On the other hand, the interface of a phone is reduced to the essentials. All functions can be addressed directly. Only necessary functions are integrated[4].

[4] Undoubtedly there is a trend of producing smart phones with a small desktop metaphor.

In the desktop metaphor, the main learning objective of a mobile device is to deliver information and multimedia content to the learner. Such content is supposed to be consumed by the learner, drawing all focus and attention for a long time. In a mobile phone metaphor, the device is rather a means to trigger and initiate non-digital activities. SMS are typical in such a metaphor, as those messages are very short. If not used for pure social interaction, they often contain instructions and suggestions like when to go where to meet other people, what to buy for a spontaneous party, or a reminder to finish a paper as promised. For triggering such activities, the device requires attention for a rather short period of time. During the time that the initiated activity is performed, the device would be in the background again.

Thus, a mobile device should no longer be considered as the only interface of interaction, but the whole physical environment, too. This rather new understanding of human-computer interaction is naturally not established for desktop computer applications. If a PDA is not realized to be something different than being just a smaller and less powerful desktop computer, mobile learning will not exploit its full potential.

6. Requirements for the "mobile phone" metaphor

Below we describe some requirements which are deduced from the "mobile phone" metaphor. Additionally, we illustrate the requirements exemplified on the MobileGame application and its scenario. All requirements are aimed to bring the focus back from the mobile device to the physical artifact; the artifact is the object of learning and not the device.

Plan discontinuous usage

As we stepped from the MobileGame scenario phase to the implementation phase we did not consider any kind of discontinuous use. Quite on the contrary, we implemented caching algorithms for the MobileGame client to bypass connection losses. Thus, the players would be allowed to use the mobile application permanently, any time and anywhere. We provided the client with frequently and quickly updated information on the screen. Thus, the players could always see something new on their device. We were assuming that the players would put the device away if it was not needed. But this did not happen. Instead, the players were obviously more attracted by the quickly changing information than by the surrounding environment. They feared missing something if they did not monitor the screen at all times. Without intention, the learning effect of the game changed from a familiarization with the environment to a familiarization with the mobile technology.

To implement discontinuous usage into the MobileGame, we plan to switch from information push to information pull. If the player needs information, he can use the mobile device to get it. But without any interaction with the device, no information change will be displayed. Important information which needs the players' attention will be triggered by a sound or haptic notification. As a result, the player still benefits from the availability of information when needed, without being permanently distracted from the environment.

Plan focus switches

To embed mobile application in other activities, focus switching has to be designed explicitly. In MobileGame the application is integrated in the orientation rally. The technology should only support and not dominate the rally. In the current version of MobileGame the focus of the players is permanently on the device. The only exception (where the device is in the background and the focus switches to the environment) is when tasks are solved. Immediately after solving the task the device is in the foreground again to get their new information about the next task. Once captured by the mobile device, the focus does not switch back to the environment until the location of the next task is reached.

In a revised version of MobileGame with information pull, the device will be in the background by default. According to the mobile phone metaphor, important information which needs the players' attention will be triggered by a ring tone or vibration notification; they are alarming, but not permanently obtrusive. For example, a highlighted or blinking text on the display would not be useful because the player always needs to check the display whether something new has happened or not.

Use technologies only if it brings added value

A danger in mobile learning is the technical infatuation of designers and maybe even of learners. Technology does end in itself and the actual benefit remains vague or in the worst case it is not existent. To some extent we must admit, we were trapped as well by this phenomenon. MobileGame forces the players to use the PDA for spatial orientation, although a simple paper based map turned out to be more efficient.

In a revised version we will provide players with paper based maps and thus extract the orientation functionality. The PDA will mainly be a casual tool to collect data (e.g. pictures), annotate locations, provide the current location on demand, or contact other players for cooperation or social communication. But we will not erase the navigation features from the game; there are necessary features which can only be provided digitally. One is the display of the current location. Additionally, information about dynamic tasks, hunters and preys are to be provided, but only on request. We will no longer design for using the mobile device for everything; instead, we will consider more selectively where mobile support will provide the most value.

Do not use animations if the application is in the background focus

Moving objects are, in general, an eye catcher and draw attention [26]. This commonplace is probably one major reason for the attraction of the screen in the current version. The display is very dynamic as the current location of oneself and of the other players is automatically updated every few seconds on the map; it scrolls automatically; the red line, symbolizing the path history, updates while moving; a symbol of a sheep to be caught or a wolf to hide from might appear; text messages that are coming in are shown, and so on.

These animations draw the player's focus even if the device is in the periphery of the player's attention. Animations result in the device always coming to the fore and forcing the environment to the background.

To avoid this effect, we are considering mechanisms that stop the animation if the device switches to the background of the user's attention. First, there is the possibility of the notification mechanisms (as described above) which disburden the player from always checking the screen to get all relevant information. Further, we plan to animate the information only if the player requests animation by pressing a button on the device. This animation will be stopped if the user releases the button.

Reduce features as much as possible

A misleading element is to implement too many features in the application. Players will always test all available functions, wanting to see what they are and then just following their play instinct. In this way, the player is focussed on the device. We believe it should always be clear for what purpose a functionality is designed and how it can be used. If there is no specific need for a functionality, because it is more a gimmick, it should rather not be implemented. So the application should be specifically designed under the motto "less is more".

7. Conclusion

In mobile learning, in contrast to e-learning, the role of a computer device changes dramatically. In e-learning the computer is a medium with an active role. It delivers learning material, moderates the learning proces and designs the context of learning. In mobile learning small computer devices are often thought to fulfill a similarly active role. But mobile learning is a completely different type of learning. It is explorative, situative, cooperative and contextual. The goal is to free the learner from a passively consuming status. Instead the learner is supposed to be activated in doing and thinking, as he interacts with the physical environment and its objects. A dominance of the computer is counterproductive here, as it distracts the learner's attention from the context of interest. Instead the role of the computer is to enrich the environment on demand and allow additional activities. Thus a computer device has generally a passive role with designated active episodes. Therefore it needs to be designed with a different metaphor in mind. Small computer devices in mobile learning must not longer be designed as weak replacements of desktop computers. Instead we suggest to be geared to the usage model of mobile phones. They are only temporary in the foreground of the user's attention, but switch into its background if not needed any more.

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