

# Privacy Quiz

## Game-based learning on multiple mobile platforms

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### Abstract—

The Privacy Quiz has been developed in collaboration between the University of Applied Sciences, Darmstadt and Lufthansa AG. The goal of the project was the development of a mobile learning application for Lufthansa managers to learn about data privacy topics playfully and interactively. The application is based on a quiz concept and asks the user for answers to a series of ten questions which increase in difficulty level. While playing the game the user can use two “lifeline” helpers, the audience- and the 50-50-helper. Furthermore, the user has the ability to browse a glossary of related terms. New questions and also new games can be added with a web-based authoring tool which was uniquely developed for the application and conforms to the specific needs of its architecture.

**Keywords:** Education; e-learning; mobile learning; game-based learning; micro-learning; authoring tool; variable content; multiple mobile platforms

### I. INTRODUCTION

The Privacy Quiz app was developed in collaboration between the University of Applied Sciences, Darmstadt and Lufthansa AG, Frankfurt. We followed the goal to design an innovative system which would allow to develop a mobile learning app, present the content in a playful manner and thus meeting principles of game-based learning. As our target group included Lufthansa’s management, we carefully interviewed the target group in order to find out where they would draw the line between „playful“ and „childish“ or “silly“ and how they would like the content to be presented. As our prototype was geared towards the content of “data privacy” and “data security”, we faced the challenge of presenting a rather dry content in a motivating way. In order to be able to modify or add new content, we designed and uniquely developed a web-based authoring tool which enables users to modify the content of the app using a self-explanatory interface which converts the modifications into XML files read-in by the app dynamically.

### II. THE GAME-BASED PRINCIPLE

During the decision process, of which type of game was most suitable for our application, we had to consider various aspects:

- the motivational factor,
- the topic to be taught, and
- that its primary use meets the German slogan “Leerzeiten zu Lehrzeiten machen” (translation: turn free time into educational units).

Game Based Learning is a variant of E-Learning. E-Learning is an umbrella term for electronically supported learning. Electronically supported learning in this context means software based learning using digital media and web technologies. E-Learning can be based on very different technologies and can be realized in different scenarios, one of them being Game Based Learning.

Game Based Learning refers to games that take place in a hard- and software-based virtual environment, so-called Digital Learning Games. Digital Learning Games should be fun, but their primary goal is to acquire knowledge and skills.

When designing the app, we carefully had to find out where our target group would draw the line between “serious & playful” vs. “childish & silly”, as the latter would have led to an immediate failure.

Why did we consider the playful, game-based feature at all?

Marc Prensky, known as a developer of various educational games, is convinced that the huge success of computer games is the main argument for the introduction of Digital Learning Games [1]. The crucial factor for the success of Digital Learning Games is motivation. The reasons for more motivation are clear. There is a new commitment to learning and the process of learning itself is interactive. According to Prensky, Digital Learning Games are used for:

- Material that is dry, technical and, yes, boring
- Subject matter that is really difficult
- Audiences that are hard to reach

- Strategy development and communication.

Having confirmed that Digital Learning Games would suit our content and the listed criteria matched what our customer had in kind, we then needed to find out what type of game would be suitable for the content.

Meier & Seufert [2] categorize digital learning games (Fig.1) that focus more on qualification and games that focus more on entertainment and fun. The quiz is categorized as a game type with a strong focus on qualification. Thus the game type quiz serves as acquisition of knowledge. However, by introduction of additional gaming elements the fun factor can be increased.

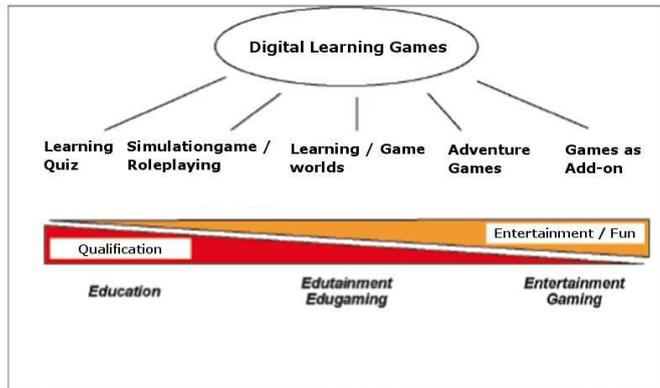


Figure 1: Categorization of Digital Learning Games

These criteria matched perfectly with the results of our interviews with the customers. Therefore, we decided to use a quiz format for the game which is widely accepted across ages. Furthermore, we decided that quiz would give us great flexibility with the content and would also be useful for short learning sessions, so-called “learning nuggets”. Our PRIVACY QUIZ is based on the idea of “Who wants to be a millionaire?” (Fig.2), the internationally known and famous TV show.



Figure 2. Typical screen of the "Who wants to be a millionaire?" show  
[http://mobile-suite.ru/uploads/posts/2011-02/1297656273\\_rvqawc\\_luxusehli.jpeg](http://mobile-suite.ru/uploads/posts/2011-02/1297656273_rvqawc_luxusehli.jpeg)

Besides looking at the motivational aspect of a game-based app, we needed to take into consideration the time of development as well as the amount of data that needs to be presented, stored and processed on the mobile device. Instead

of attracting and convincing our users with fancy videos, we focused on an appealing design and textual data.

When designing the gaming idea of our app, we looked at games that were not only successful in our target group but would also meet the needs of a rather fast implementation and a user-friendly end product.

### III. THE DESIGN

During the design process for different Blackberry devices common among Lufthansa’s management, we faced several challenges imposed by the smartphone itself, starting with different modes used to hold the device (Fig.3). Due to a relatively small display, all smartphones are restricted with regard to the design of the application. To ensure sufficient readability, we had to pay special attention to the font size.



Figure 3. The Privacy Quiz running on a Blackberry Bold 9700 and Torch 9800

Besides these hardware limitations, an overall user-centred design had to be reflected in all the designs. During the entire design process, we followed the iOS design principles [3], which claim “when an app fits well on the device screen and responds to the gestures that people know, it provides much of the experience people are looking for.”

### IV. THE PRIVACY QUIZ APP

Our game starts with a Welcome screen (Fig.4) that contains a "Nice-to-know fact" from the field of data security. This fact is shown in order to create awareness for the topic. It also serves to pique the user’s curiosity.

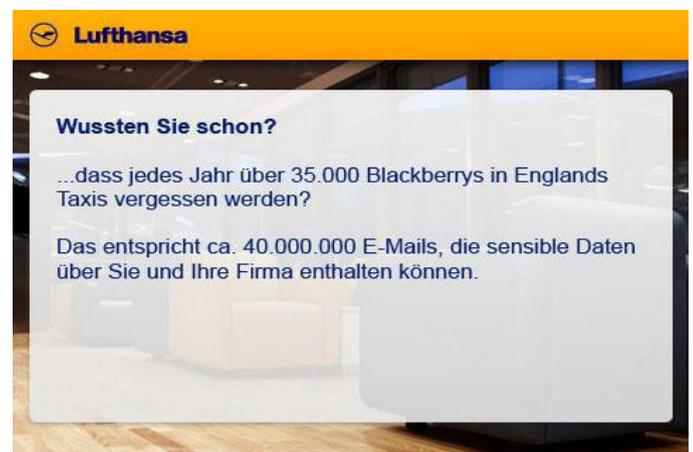


Figure 4. Welcome screen

Translation of Figure 4:

Did you know?  
 ...that more than 35.000 Blackberrys are left behind in England's taxis every year?  
 This corresponds to approximately 40.000.000 e-mails which could contain confidential data about you or your company.

the main menu (Fig.5), where he can either start a new game, continue a game, look-up a word in a glossary or exit.

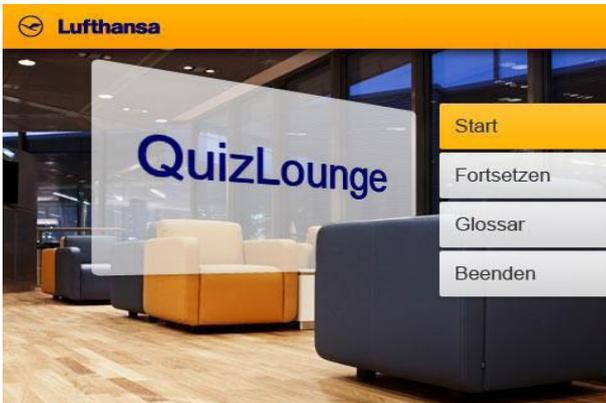


Figure 5. Main menu

When choosing to start a game and selecting a topic, a quiz starts (Fig.6). Each quiz consists of 10 questions in three different difficulty levels.

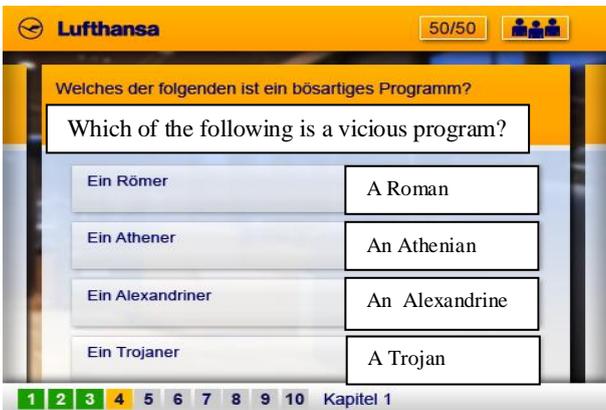


Figure 6. Typical quiz question with 4 possible answers

In case an incorrect answer was chosen, a detailed explanation is given (Fig.7).

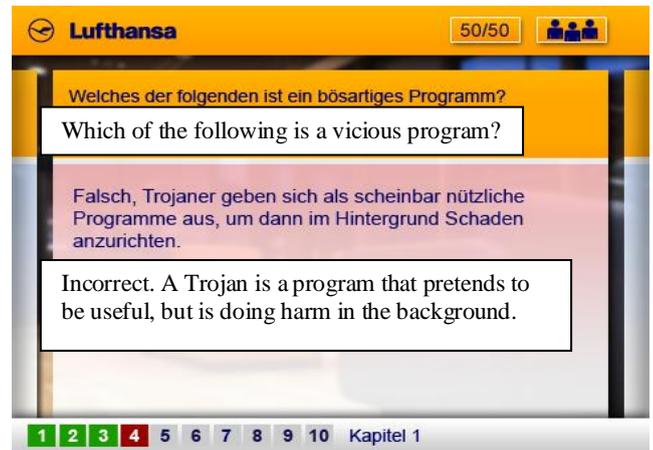


Figure 7. Feedback to an incorrect answer

## V. ARCHITECTURE AND TECHNOLOGY OF THE APP

What appears to be convenient for humans to read is usually not readable for computer programs, in this case our Blackberry App, so the content has to be prepared in such a manner that the program is able to read the text and create data objects which can be used as app-internal data representations.

Extensible Mark-up Language (XML) is a standard technology that provides the ability to structure a text document to make it readable by humans as well as by computer programs.

Because XML is considered standard, a huge number of proprietary and open source programs support it, and hence are able to interpret it easily. Moreover, many programming languages provide APIs for processing XML-documents, including Blackberry JRE.

Another advantage of using XML is its support of XML Schema Definition (XSD). XSD is recommended by the W3C for defining and structuring XML-documents. XSD enables the formal definition of XML-documents by defining the type and amount of data contained in it. By means of XSD, the structure of an XML-document can be restricted and also validated against the XSD document that describes the document's structure. The ability to validate XML documents was of considerable importance for the project, as the App can check the content for correctness and react appropriately.

The content is transmitted in XML-format from the server to the smartphone and is then parsed into Java objects which are locally stored in the database of the smartphone (Fig.8).

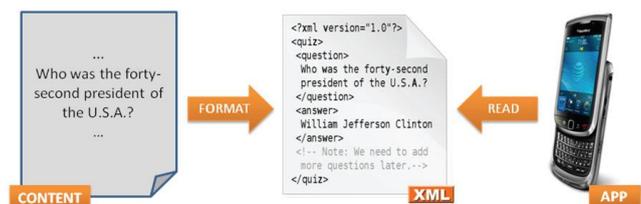


Figure 8. XML connection layer

## VI. AUTHORING TOOL

In general, downloadable apps do not come with the option for the user to modify the app. They are rigid in the sense that the user has to wait for a new version if he wants a different functionality or updated content.

In order to be able to modify the content of the app and also to be able to create new mobile quiz apps, we designed and uniquely developed a web-based authoring tool which enables users to modify the content of the app using an easy-to-use, self-explanatory interface which enables the author to create new quizzes and new questions for existing quizzes, as well as change existing content (Fig.9).

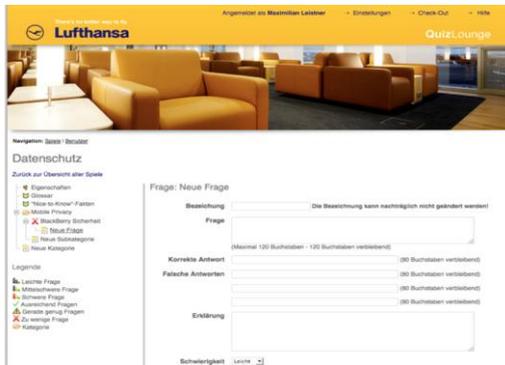


Figure 9. The GUI of the authoring tool

## VII. ARCHITECTURE AND TECHNOLOGY OF THE AUTHORING TOOL

The authoring tool is designed and implemented in PHP as a web application, thus demanding minimal computer affinity of the author. Several authors can work in parallel on either the same quiz or different quizzes.

After modifications have been made, the authoring tool converts these modifications into XML files, which are then transmitted via the server to the smartphone, where the Eclipse-based Blackberry App locally stores them as Java objects in an SQLite database (Fig.10). An update mechanism reacts dynamically to changes in the content by communicating with an Apache-Server. That way, the content on the smartphone is always held current.

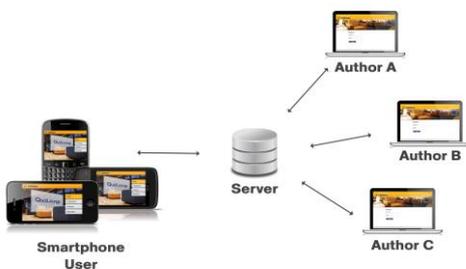


Figure 10. Communication between the author(s) and the app

## VIII. DIVERSITY OF MOBILE DEVICES & PORTABILITY ISSUES

In order to meet the demands of the highly diverse smartphone market (Fig.11), we explored the question of porting the app to other mobile devices.



Figure 11. Diversity of the mobile device market

After exploring the smartphone market and its current sales figures, four main platforms could be identified: Research in Motion with their Blackberrys, Apple's iOS and their iPhones, Android devices, and Microsoft's Windows Phone. [4]

In general there are two alternatives to successfully run the app on other devices:

Either an app is natively re-coded for another operating system or a Cross-Platform Development (CPD) Tool is used to convert the app directly. We followed and compared both approaches but didn't come to a clear conclusion as to which of the alternatives is to be preferred. The native approach involves the detailed understanding of different operating systems as well as different programming languages for those operating systems, but leads to a direct transfer of all functionalities of the app, including its navigation on the GUI. The CPD approach, which initially appeared to be faster, resulted in a fast transfer of most of the functionalities, but demanded thorough programming in detail, e.g. when certain details didn't get translated and had to be manually debugged and re-coded. Both approaches led to successful results and the Privacy Quiz is now successfully running on four different platforms.

## IX. SUMMARY

The goal of the Privacy Quiz was the development of a mobile e-Learning application by the use of which Lufthansa's managers should be able to learn about data privacy topics playfully and interactively.

The application is based on a quiz concept and asks the user for answers to a series of ten questions which increase in difficulty level. While playing the game the user can use two "lifeline" helpers, the audience- and the 50-50-helper. Furthermore, the user has the ability to browse a glossary of related terms if he or she has the need of more detailed knowledge. New questions and also new games can be added with a web-based Authoring Tool. The Authoring Tool was uniquely developed for the Privacy Quiz application and conforms to the specific needs of its architecture.

Although the app was initially developed for Blackberry devices, we have ported it to other mobile platforms in order to not be limited to just one environment.

## REFERENCES

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