User Experience and User-Centered Design at DATEV eG

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Abstract

DATEV eG products are not only convincing with technical and professional perfection, but also with a design that turns simple usage into a positive experience. In order to achieve the objective of a positive *user experience*, DATEV eG has long been focused on user-oriented development and user centered design respectively.

The following article offers you an insight into user experience and user centered design at DATEV eG today and points out important milestones on the way from technology-driven development to user centered design. We describe different challenges that needed to be addressed during the change and demonstrate our practical solutions. These solutions encompass methods and tools on the one hand and organizational and personal prerequisites on the other hand. All these measures facilitate enhanced design quality and efficient development of excellent software products with a positive user experience.

1 Introducing DATEV eG

DATEV eG stands for high quality software solutions and IT services for auditors, tax consultants, and lawyers as well as entrepreneurs. The headquarters are located in Nuremberg (Germany) and further offices and associated companies are distributed across Europe. DATEV eG is a cooperative with about 40,000 members and more than 6,000 employees. About 1,000 of them work in the development department.

The DATEV eG portfolio offers about 200 business software products ranging from business accounting via tax calculation, personnel accounting and management until auditing. Software products mean classic desktop applications, cloud

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services and mobile apps. The probably best known product is from personnel accounting, because DATEV eG delivers more than 10 million payrolls in Germany every month.

2 User Experience and Design in Business Software

2.1 Challenges

In the business software area design is often misunderstood as adding colors, icons and something with a "wow-effect." Designers are expected to make products look nice at the end of the development process. However, "wow-effects" and optically overloaded user interfaces are inappropriate as revenue drivers in the business area. They do not create a positive user experience, but arbitrary product design that has no impact on your business objectives.

The big challenge for software companies today is to understand and apply user interface design as a strategic instrument. Usually, customers cannot evaluate the technical quality of a software product and its detailed professional features at first sight, but they judge what they can see. This implies that design plays a highly important role in the buying decision and customer loyalty.

In order to make excellent user experience design a solid competitive differentiator, it is not sufficient to follow the latest design trends. Primarily, the design of your products needs to fulfill your brand's promises and match customers' expectations. That means, user interface and interaction design should be based on business objectives and it should be measurable by the extent to which it reaches these objectives.

2.2 Attractiveness of Software

Whether customers find a software product attractive or not depends on several pragmatic and hedonic factors (Hassenzahl et al. 2000). In order to describe and measure the attractiveness of our software products, DATEV eG applies a model which is based on the user-experience questionnaire (Laugwitz et al. 2008) and combines both, pragmatic and hedonic factors as shown in Fig. 1. As *pragmatic factors* the model considers efficiency, perspicuity, dependability and up-to-dateness. *Hedonic factors* are aesthetic, stimulation and novelty.

The overall importance of a single factor depends on the specific product and its target group. For instance, a well-designed mp3-player primarily aims for high scores at hedonic factors, whereas business software addresses pragmatic factors first. However, also in the business software area the importance of hedonic factors is growing. From DATEV eG user studies we know that – besides pragmatic factors – especially the hedonic factor *aesthetic* contributes to customers' overall satisfaction with business software products.

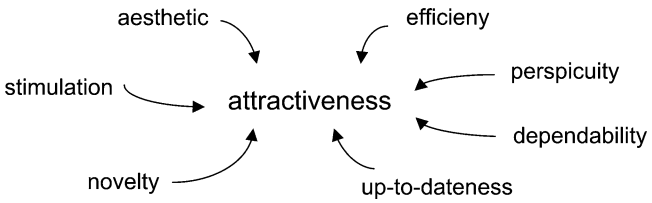

Fig. 1 Model of attractiveness of software

In order to build attractive business software that meets our customers' needs, DATEV eG has introduced and improved user centered design in its development process over the last couple of years.

3 Changing the Development Process

3.1 From Technology-Driven Development to User Centered Design

DATEV eG has successfully changed its development process from a primarily technology-driven approach to user centered design. The starting point for this change goes back to the 1980s when the DATEV eG product portfolio grew more and more. With no consistent design strategy at that time, user interfaces and interaction mechanisms were different across products and this situation annoyed customers. By the same time, software ergonomics and usability were emerging topics since products became more complex and interconnected with each other.

Therefore, DATEV eG decided to found a central design team. In the beginning this team consists of three experts, who introduced different measures to promote their topics throughout the software development process. Retrospectively, three of the key measures were:

- Creating and maintaining a *style guide*
- Conducting regularly *usability inspections* and
- Providing standardized *user interface patterns*

In the following, each of these three measures is explained in more detail and evaluated with regard to practical advantages and disadvantages.

3.2 DATEV Style Guide

Business software with its many complex features and functions is developed by several development teams in parallel. Creating a positive user experience under these circumstances requires consistent and high-quality user interface design from all teams. Therefore, DATEV eG employs a style guide, which is mandatory for the design of all software products and which is used by developers across the whole

development department. The wiki-based style guide fosters consistent user interface design throughout the development process by providing design principles and guidelines.

Design principles describe fundamental ideas about the practice of good user interface design. The main principles at DATEV eG are:

- Be aware of performance.
- Workflows to get tasks done have to be efficient.
- Consistent user interfaces minimize users' learning curve.
- User interfaces have to be aesthetic and visually attractive.

Design guidelines contain full documentation of the visual design and the interaction design. This includes all rules of layout, color schemes, usage of icons, etc., available templates for user interface controls and descriptions of best practices.

In order to prevent that consistency of user interfaces and interactions might be misunderstood as strict sameness, the DATEV eG style guide also explains reasons for general design decisions and points out to which extent developers have the freedom to make own design decisions which are most reasonable in the context of their special software product.

Of course, the mere availability of a style guide does not necessarily result in consistent user interfaces and continuously high ergonomic quality. Important success factors for a style guide are:

- The content of your style guide is understandable, complete, practically oriented, supported by visual examples, up-to-date and unambiguous.
- The style guide is organizationally anchored in your development process.
- The style guide is enriched with data from user centered design studies to explain design rules und user interface patterns.
- Your technical user interface developers also have a sense for appealing and consistent design.
- You have a fair amount of time for the development of your products.

At DATEV eG the acceptance of our style guide is very good and the wiki-based approach works fine. There is no misuse of the non-restrictive editing function but developers correctly use the comment area if they have any specific hint or question.

In order to keep up good adherence to a style guide, control mechanisms, e.g. usability inspections, are needed for two reasons. First, control mechanisms ensure that user interface development is consistent with current design principles and rules from the style guide. Second, control mechanisms also work the other way around and help the design team to identify missing aspects in the style guide.

3.3 Usability Inspections

The team of usability experts regularly inspects DATEV products in order to check for possible ergonomic problems and analyze inconsistencies with the style guide but also to see awesome new best practice examples. Usability inspections in this

extent require a lot of time. But it is worth it. They really help to identify most of the stumbling blocks in user interface and interaction design (Nielsen and Landauer 1993).

However, usability inspections also have some drawbacks. First, for a large software product portfolio there is a multitude of different user interfaces to inspect. Even with a lot of inspections it is nearly impossible to continuously monitor all user interfaces. Second, thorough usability inspections cost time and their findings may delay the development process. Third, if inspections are conducted with almost finished software, i.e. shortly before the product should be released, all user interfaces are fully developed but it may be too late and/or too costly to change interfaces or interaction processes.

Therefore, besides design principles and rules, developers need standardized user interface templates that can be reused and modified to a certain extent. In the following, we explain how user interface patterns enable consistent software design for the comprehensive DATEV eG product portfolio.

3.4 User Interface Patterns

There are a lot of recurring user interface and interaction problems in the development process of a comprehensive software product portfolio. Centralizing the design and developing solutions to these problems as *user interface patterns* is an important step towards consistent user interfaces (Segerståhl and Jokela 2006) and development effectiveness. We consider user interface patterns as design rules documented in the style guide and translated in software components. User interface patterns are reusable and to a certain extent modifiable building blocks which comprise controls, interactive behavior and data binding mechanisms.

At DATEV eG user interface patterns are composed of simple default controls and complex controls. Simple default controls are, e.g. buttons or text boxes. These controls already have a DATEV eG-specific design and features like validation and formatting. Complex controls are a collection of simple controls enriched with data binding mechanisms or complex user interface components like a table view. User interface patterns can comprise simple controls and complex controls. All user interface patterns are deployed as part of the DATEV eG development framework which is the technical platform of all DATEV eG products. Technical developers choose from the available set of user interface patterns when implementing user interfaces for their software products and combine patterns with product specific user interface development. The information which pattern to apply for a certain interaction problem is documented and explained in the style guide.

The application of user interface patterns in the development process has advantages for all stakeholders.

Advantages from users' perspective:

- Consistent user interfaces within a software product and across multiple products

- Reduced efforts for education and training since acquired knowledge can easily be transferred to further products

Advantages from technical developers' perspective:

- Reduction of workload since there is no need to deal with recurring interaction and design questions
- Central requirements engineering for user interface patterns instead of multiple, distributed efforts
- Central maintainability and correction in case of technical or ergonomic problems instead of multiple, distributed efforts
- Central enhancement and further development of user interface patterns instead of multiple, distributed efforts
- Central testing and quality control instead of multiple, distributed efforts

Advantages from management perspective:

- Higher development efficiency due to reusability of user interface patterns
- Better and faster acceptance of user interface enhancements and further development among users

However, there are also a few challenges when applying user interface patterns, which should not be underestimated. Apparently, user interface patterns require efforts for requirements engineering, maintainability, further development and testing at a central pattern development team. The more complex user interface patterns become with regard to design and technical realization, the more central development effort is needed. In addition, intensive coordination and feedback between the central pattern development team on the one hand and technical product developers on the other hand is an essential success factor. User interface patterns should not lead to general decreased efforts for conception of the user interface and their workflows. If technical developers would take user interface patterns as an easy available solution for the wrong kind of interaction problems, that would be a misuse of the whole concept and finally even lead to lower design quality of your software products.

In order to decide whether a specific user interface solution should become a general user interface pattern, DATEV eG uses the following decision criteria.

Frequency of use:

- How often will the user interface pattern be used in different products?
- How generic has the solution to be to meet the requirements of all products?

Complexity:

- Is it necessary for the user interface pattern to make changes of functionality immediately available to all products?
- Do we expect new functionalities or changes in the functionality triggered by legislation amendment?
- Does a user interface pattern help to reduce the probability of implementation errors caused by high interaction and design complexity?

Figure 2 shows the decision matrix and the expected benefit of a user interface pattern. For example, if the complexity of a solution is high but the frequency of use low, it is much cheaper to develop individual user interfaces instead of trying to implement a generic and reusable pattern.

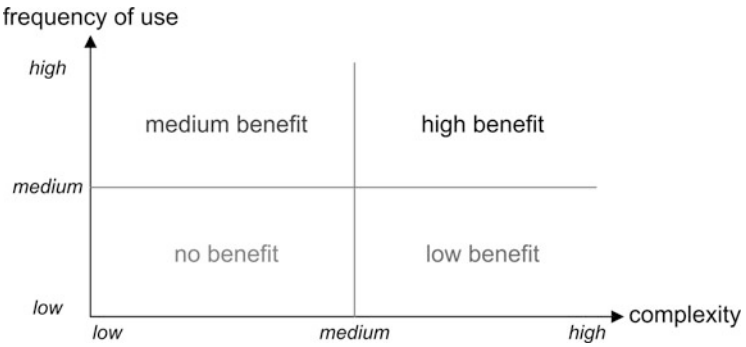

Fig. 2 Decision matrix for user interface patterns

User interface patterns are not a panacea that automatically leads to excellent user interface design. Good decision criteria, a well-established cooperation process between the pattern development team and product developers and an always up-to-date style guide are important factors for successfully working with user interface patterns in the development process.

4 Rethinking Prerequisites

4.1 Methods and Tools

The previous section pointed out how measures such as a style guide, usability inspections and user interface patterns support good user interface design. For a highly efficient and qualitative user centered design process, further methods and tools are needed. Involving users in the software development process from the beginning reduces risks of undesirable development and costly changes at later stages in the process.

Table 1 shows an overview of user centered methods for different stages of the development process. In the following, we explain two of these methods and how they are applied at DATEV eG.

The *user experience questionnaire* is a tool for qualitative evaluation of user experience objectives (Laugwitz et al. 2008). The standardized questionnaire contains 26 semantic differentials, e.g. whether users find a product attractive or boring, fast or slow, etc. For users the questionnaire is relatively easy and fast to answer and for your company it is a budget-friendly way to monitor the quality of your software.

DATEV eG regularly sends out user experience questionnaires via online survey. The results allow two kinds of analyses: First, we can compare the user experience of different versions of the same software product and conclude which one is better received. Second, we can compare the user experience of different products in order to ensure continuously high quality across the whole product

Table 1 User centered design in the development process

Stages of the development process			
1 Requirements engineering	2 System design	3 Implementation	4 Release and maintenance
Methods			
User experience questionnaire (UEQ)	Storyboards	Usability testing	User experience questionnaire
Interviews	Wireframes	Rapid prototyping	Field studies
Focus groups	User scenarios	High fidelity prototyping	Online surveys
Personas	User stories		
Field studies			
Online surveys			
Goal			
Who are our users? How do they work?	How will users interact with the system?	Do processes work and fulfill the requirements?	Has user satisfaction improved?
Which added value do our products provide?		Does user interfaces match with guidelines?	Are all errors fixed?

portfolio. Note that presenting absolute values from a user experience questionnaire without anything to compare these values with is not very meaningful. Questions from the user experience questionnaire fit to the model for software attractiveness (see Sect. 2.2). For DATEV eG products we learned from statistical analysis that especially the factors dependability, perspicuity and aesthetics increase users' overall satisfaction.

Another awesome method to gain user feedback directly is *usability testing*. Usability testing enables you to test the whole range from a first clickable prototype to a fully developed product. Usually usability testing determines all positive and negative experiences of subjects with an interface through observation and questioning. At DATEV eG it is mandatory that the whole team of developers observe test sessions in order to get a realistic impression of how their product is used by users, which user interfaces work fine and which ones still need improvement.

DATEV eG often combines both of the previously described methods. We invite selected users to test prototypes in a usability lab and ask them to fill in a user experience questionnaire afterwards. This combination allows enrichment of the qualitative results from the lab with quantitative results from the questionnaire.

4.2 Technicians Are not Designers

How difficult it is to introduce user centered design depends on your company and your established development process. At DATEV eG it was relatively easy to start with user centered design in general since there always have been feedback

mechanisms between DATEV eG as a cooperative and its users who are members of DATEV eG at the same time.

The main challenge was enabling technical developers to create excellent user interfaces and interaction design. Establishing a central design team was a first important step in this direction.

Today, there are basically three roles in the DATEV eG development process:

- *Domain developers* who have very good specific knowledge in the business domain of the software and mainly develop concepts.
- *Technical developers* with excellent technical and programming skills for the implementation of concepts.
- *User experience designers* who are highly familiar with user centered design methods and support their implementation throughout the development process. As part of a development team, user experience designers are also responsible for user interface and interaction design.

Historically, DATEV eG had a lot of domain developers and technical developers but not enough designers. Therefore, the first approach was to further qualify technical developers and teach them design lessons. In the process it became clear that you cannot expect excellent technicians to become excellent designers. As a consequence, additional designers have been hired. Nowadays, the responsibility for user experience design at DATEV eG is shared between the central design team and further decentralized user experience designers who are an integral part of a product development team together with domain developers and technical developers. The decentralized designers accompany the development of a software product from requirements engineering to product release.

4.3 The Role of User Experience Designers

In the past, user interface and interaction design was characterized by a lot of transformation work by the central design team and developers. Ideas were via use cases and wireframes that finally lead to a design concept. This concept was given as bitmap image to the technical developers, who implemented the user interface design in real code. As a result, the final user interface design and the design concept were only approximately the same.

Today, the user takes the central role in the development process. User experience designers start their work by understanding users and their tasks. Based on this understanding, designers create use cases, further usable wireframes and design resources (e.g. color schemes, icons, etc.). Wireframes and user interfaces are designed by the user experience team with a technology that can be reused by technical developers. This means, designing user interfaces is not only showing graphics, but already creating code that describes key aspects of the design. Thereby, user experience designers are an integrated part of the software development process. At MIX ‘11 Jeff Croft explained the challenge for designers as follows (Croft 2011; Schubert 2011):

Designers: Your material is code. Code is the building block of all digital products.

Both, designers and technicians need a general understanding of design and technics in order to cooperate effectively and use modern development technologies to their full advantage. If this is working, the triad of domain-specific, technical and design-related know-how will create the best possible product.

5 Best Practices

In the course of the development of the current DATEV eG product line, more than 3,500 users were involved trough user centered design methods. As a conclusion we present best practices that we learned during the years.

5.1 The Key to Good Design is the Management

User centered design is best enforceable top down. It is essential that the management understands design as a strategic instrument that helps to reach the corporate objective and fosters innovation. Good design is not for free, but it costs time and money. These resources need to be allocated by the management.

5.2 Numbers Convince the Management

The best way to convince the management is presenting numbers. Therefore quantify the quality of the user experience your products deliver. Reasonable instruments to evaluate and benchmark the user experience of your products are, e.g., the user experience questionnaire (see Sect. 0) or the AttrakDiff questionnaire (Hassenzahl et al. 2003).

5.3 The Change from Technology-Driven Development to User Centered Design Needs a Trigger

Nobody wants to change a running system. The decision for user centered design needs a trigger. Does your company have a lack of revenue? Is the satisfaction of your users decreasing and criticism growing? Is there a new, very powerful competitive product on the market or will be released soon? Use this situation to start a change and introduce or improve the user centered design in your company.

5.4 Start Small and Promote Your Success

If you plan to introduce user centered design in general or fundamental new methods, start with a small, promising project and promote the success broadly. This will be the best motivation for other projects to follow and cooperate with your design team.

5.5 Communicate Your Design Guidelines Clearly and Effectively

To successfully establish continuously excellent design, communicating the rules and guidelines is absolutely important. Explaining the background of design decisions helps to enhance the acceptance also among technical developers. Whether you should dictate strict design rules or rather provide general principles depends on the question, how much design background and knowledge the target group has. In general, the more design know-how is already available, the less strict guidelines need to be, e.g. in a style guide (see Sect. 0).

5.6 Define Clear Responsibilities and Dependability

User centered design is not a democratic process within your company, so define and communicate responsibilities and dependability. However, access boundaries to user centered design methods should be as low as possible. Cooperate with product managers and invite not only designers but also technicians, e.g., as observers to a usability test. This will broaden the understanding and acceptance of user centered design across your company, while the final decisions are still made by the design team.

5.7 Do a Lot of User Centered Design in Early Stages of the Development Process

The earlier you collect user feedback, the cheaper it is to fix identified problems. Asking your users, e.g. via questionnaire or focus groups, does not cost much and provides you and your company's management a solid basis for further decisions.

6 Summary

This article provides insight into the change from technology-driven development to user centred design at DATEV eG. It describes our pattern-based approach, the design methods and tools we employ, and how responsibility for user centred design at DATEV eG is shared between the central design team and further decentralised user experience designers who are an integral part of a product

development team. We condense our overall experiences from the change process and describe the seven best practices for successfully establishing user centred design in software manufacturing companies. The application of these measures facilitates design quality and efficient development of excellent software products with a positive user experience.

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