Model of a Personalization-based Agent System for Early Product Adoption Phases

Michael J. Harnisch, Thomas Puchleitner
University of Graz / evolaris next level GmbH
Universitaetsstrasse 15/G3
A-8010 Graz, Austria
michael.harnisch | thomas.puchleitner@uni-graz.at

Manuela Reinisch, Iris Uitz
Graz University of Technology
Kopernikusgasse 24/II
A-8010 Graz, Austria
manuela.reinisch | iris.uitz@tugraz.at

Abstract

Businesses that offer Software-as-a-Service (SaaS) often allow a “tryout” phase to immediately test their system. The loss of control during this phase forces providers to offer simple ways of product learning for the demonstration of product features. We therefore develop a model of a hybrid personalization agent and logic, which is able to match predefined actions to the specific users’ needs to enhance product learning. The logic communicates the selected action to an IT-agent system that subsequently executes the action. By applying this model, businesses obtain a competitive advantage by gaining the possibility to assist and influence the user in the product adoption process. We construct our work on a product adoption process and customer lifecycle model as well as the research areas of usability and technology acceptance research to depict ways of interactive learning support. Indicators are monitored which are finally utilized to enhance the attribute “easy to learn”.

1. Introduction

Suppliers of information systems are striving for excellence in their offered software packages to enhance consumer adoption rates and boost sales. Alternative delivery concepts like “Software-as-a-Service” (SaaS) [2], a user-centric view on the usability of the software itself (“Usability Engineering” – UE) [19] or underlying factors of the Technology Acceptance Model (TAM) [6] are often consulted to increase the chance of product adoption.

As SaaS allows direct product testing, this could lead to several downturns in product learning. One of these downturns arises, when potential customers test and evaluate products in competitive software markets. By permitting non-guided tryouts before purchasing, the provider allows users to explore the product without further assistance through personal support, which limits the possibility to explain how certain features work. This stresses the product to explain itself in the adoption process of the customer. Increasing the “easy to learn” ability of the product could hence create an immense advantage in competition due to the reason that products that seem hard to understand have a lower customer acceptance rate. [31] We therefore propose the “model of a hybrid personalization agent and logic” to enhance the systems learning ability and foster product adoption. By monitoring a list of indicators, our logic chooses a personalization-based action that enhances product learning, which will be executed by an IT-agent and result in an increased probability of a positive product adoption.

The work is structured as follows: We begin by giving a short introduction into SaaS and the underlying product adoption theory and connect technology acceptance and usability research (chapter 2). Subsequently, we display that product adoption is depended on “ease-of-use” and the attribute “easy to learn” that can be found in the TAM as well as in the usability theory (chapter 3). Afterwards we provide a list of indicators that can be used to assess the users learning behavior (chapter 4) and aid in choosing an appropriate action to enhance product learning. An introduction into personalization theory (chapter 5) completes the background of our work. We then describe our proposed “model of a hybrid personalization agent and logic” in detail (chapter 6) and illustrate its application with short use cases (chapter 7). Finally we conclude our work by depicting the main findings as well as future research steps.

2. SaaS adoption process

In this chapter, we are giving a short introduction into SaaS as underlying delivery concept and depict
the product adoption theory where our work is based on and its connection to technology acceptance and usability research.

2.1. Software-as-a-Service (SaaS)

Software-as-a-Service gained popularity as a delivery concept in the mid-2000s after the emergence of several innovative Internet technologies made it possible to enhance the Application Service Provider (ASP) approach, which originated in the 1990s. SaaS is a form of software outsourcing, where companies rent software from a provider as a service. The service provider incurs all the infrastructure, maintenance and basic software costs and sells access to the software over mostly web-based and platform-independent software clients. Benefits of this approach lie in the increased flexibility and reduced costs for the customers. Disadvantages can be seen in the non-customizability of software solutions as well as in relatively high switching costs. SaaS is especially suitable for highly standardized processes. [2]

2.2. Product adoption process

Software products in general have a clear adoption process that can be divided into certain levels and stages. A more detailed insight into these processes is needed if the adoption of SaaS should be positively influenced. We are therefore utilizing a customer lifecycle model for web based services and information systems. It describes the continuous steps a customer undergoes when considering and purchasing a product or service. [7] The adoption and acceptance model developed by Rogers [23] and later extended by Wiedmann and Frenzel [36] defines three levels in the customer lifecycle to distinguish between phases before, during and after adoption: level of attitude, level of action and level of usage (see Figure 1). Within these three levels, the user changes his attitude regarding the product. Starting with a given opinion of the product in the level of attitude, he gains more knowledge concerning the system in the level of action. In this second phase, the user compares his expectation of performance and the actually received satisfaction. Gained impressions have a direct impact on the positive or negative decision about product adoption.

The levels of attitude and usage are not the main focus points of the conducted research, because during the level of attitude the user is not confronted with the software itself. If the level of usage is reached, the adoption of the software has already taken place. Therefore, we center our efforts on the level of action where we find the tryout stage and the adoption stage. It is obvious, that the tryout stage is influencing the adoption stage. Additionally, the tryout stage is the first contact point of the prospective customer with the software itself, where the learning abilities of the product could be utilized to enhance the adoption. Especially two research areas are describing the influence factors around these phases and are the basis of our research. On the one hand, technology acceptance research, where the Technology Acceptance Model (TAM) by Davis [6] is often utilized because of its simplicity of dependencies and adoption of additional influence factors. On the other hand, usability research is important. Both areas developed factors that influence product adoption, which we will analyze for further usage in our system.

3. “Easy to learn” as adoption attribute

We will now introduce models of usability and acceptance research and especially their interconnection, which will be subsequently used to identify indicators that picture the users’ usage and learning behavior during the adoption process. Although both research areas focus on the relation between product and user, they do differ in their approaches.

3.1. Models of usability and technology acceptance

At the level of action, the first interaction between the user and the system takes place. This interaction lies in the main focus of usability research and therefore has to be considered to find relevant indicators regarding the usage of a system and how the usability of a product can be optimized to finally enhance the product adoption. Additionally, technology acceptance models focus on the influence of single factors on the acceptance of products and
thus try to predict if and how the product will be used.

For each research area an appropriate model was selected to show interconnections between both areas and to highlight the importance of the easiness of product learning. The already mentioned Technology Acceptance Model (TAM) by Davis [6] is a commonly used model to depict the acceptance of product usage in information systems. The model (see Figure 2) is built on the idea that when users are introduced to new technologies the factors of “perceived usefulness” and “perceived ease-of-use” have a strong influence on the system usage. Thereby Davis identifies “easy to learn” as one of the attributes of the “perceived ease-to-use” factor and describes it as “how easy a system is to learn for users” [6].

![Figure 2: Technology Acceptance Model by Davis [6]](image)

Usability engineering focuses on the interaction between user and system and keeps the focus on how the system can be presented in a user-friendly way. Nielsen [19] determines attributes that have direct impact on the usability of a system and therefore have to be considered especially in early phases of use. Nielsen describes the term learnability as “The system should be easy to learn so that the user can rapidly start getting some work done with the system” [19, p.26].

![Figure 3: Ease-to-use as factor in TAM by Davis [6] and usability by Nielsen [19]](image)

Figure 3 shows the interconnection between the attributes of usability engineering by Nielsen [19] and the impact attributes of the influence factor “perceived ease-of-use” in the Technology Acceptance Model by Davis. Similarities for the definition of “easiness to learn” between the model by Davis and Nielsen’s description of Usability Engineering can be depicted. Both authors define “easy to learn” as the most important attribute within their models (Davis: “Learnability is in some sense the most fundamental usability attribute” [19, p.27] respectively highest influence factor with 0.97 on ease of use [2]) where Nielsen also describes the impact for early adoption phases: “[…] since the first experience most people have with a new system is that of learning to use it” [19, p.27f].

3.2. Determining the influencing factors on easy to learn

The learning process for product usage differs by variable factors like age, field of expertise or the usage frequency of the system. Wood [37] shows that the learning behavior is also based on the former experience with similar systems and prior knowledge in the application field. Beside active techniques to gather the required information by simply asking the user, Montgomery and Srinivasan [16] describe passive techniques for further processing in a personalized manner.

Acceptance research and usability research do both describe factors that show influence on positive or negative product experience while usage. Key indicators have to be identified to allow the continuous monitoring of usage behavior and thus support the user by the selection of appropriate techniques for product learning.

4. Deriving indicators to monitor

Based on the existing literature in acceptance and usability research, relevant criteria for the monitoring of users’ usage and learning behavior are identified. Subsequently, some given restrictions are mentioned and the indicators are classified according to the literature.

4.1. Identifying relevant indicators

Starting from the Technology Acceptance Model by Davis [6] several researchers focused on evaluating factors affecting information system satisfaction and usability. Usability and its importance in the online environment are treated in the field of human-computer interaction (HCI) and information systems (IS). Research in HCI focuses for example on usability as a positive impact on product acceptance. [20] Based on research insights,
an overview of indicators that depict the usage and learning behavior of the user is given in Table 1.

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Description</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transaction Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Visit</td>
<td>Total number of past visits</td>
<td>[5] [15]</td>
</tr>
<tr>
<td>Recency Visit</td>
<td>Number of days since last visit</td>
<td>[15] [29]</td>
</tr>
<tr>
<td>StdDecRecencyVisit</td>
<td>Standard deviation of the time between site visits</td>
<td>[29]</td>
</tr>
<tr>
<td>Mean Recency Visit</td>
<td>Average time between site visits</td>
<td>[29]</td>
</tr>
<tr>
<td>Average Visit Time</td>
<td>Total past visit time</td>
<td>[29]</td>
</tr>
<tr>
<td>Visit Time</td>
<td>Visit time of the last session</td>
<td>[29]</td>
</tr>
<tr>
<td>Total Visit Time</td>
<td>Overall visit time of past visits</td>
<td>[21] [25]</td>
</tr>
<tr>
<td>Total Clicks</td>
<td>Total number of clicks in the past</td>
<td>[29]</td>
</tr>
<tr>
<td>Number Pages</td>
<td>Total number of viewed pages</td>
<td>[5] [13]</td>
</tr>
<tr>
<td>AverageTotalClickTime</td>
<td>Average time per click</td>
<td>[29]</td>
</tr>
<tr>
<td>AverageClickTime</td>
<td>Average time per click in last session</td>
<td>[29]</td>
</tr>
<tr>
<td>AverageVisitClicks</td>
<td>Average number of clicks in a session</td>
<td>[29]</td>
</tr>
<tr>
<td>Hurry</td>
<td>Average time per click in the session is lower than the average</td>
<td>[29]</td>
</tr>
<tr>
<td><strong>User Demographics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Gender of the user</td>
<td>[13] [21]</td>
</tr>
<tr>
<td>Age</td>
<td>Age of visitor</td>
<td>[9] [17]</td>
</tr>
<tr>
<td>Language</td>
<td>Used language</td>
<td>[33]</td>
</tr>
<tr>
<td>Trust</td>
<td>Supply of phone no. or other private data</td>
<td>[29] [26]</td>
</tr>
<tr>
<td>Level of education</td>
<td>Highest education</td>
<td>[34]</td>
</tr>
<tr>
<td>Culture</td>
<td>Cultural background</td>
<td>[24]</td>
</tr>
<tr>
<td>User satisfaction</td>
<td>Satisfaction with the system</td>
<td>[34]</td>
</tr>
<tr>
<td>Experience / Learning</td>
<td>Given experience with a system</td>
<td>[3]</td>
</tr>
</tbody>
</table>

### 4.2. Restrictions

There are also statements [18] [30] that tracking users’ activities only provide figures at one particular point and time. The identification of users’ real information needs, their attitudes toward the system as well as motives for their behavior are sometimes hard to identify.

Restrictions in the tracking of the usage behavior are given when the active usage of the system is interrupted e.g. by a coffee break. Furthermore some users might not log off when leaving the system. Consequently inactivity times will be count as if people are unfamiliar with the system and in the need of help. How is the system supposed to know whether the user is still using it? Clickstream data does not give any conclusion on the desired activity. A downloaded page can also be generated from an incidental link. These restrictions need to be considered when using the described indicators to monitor the users learning and usage behavior.

### 4.3. Categorization of the indicators

On the basis of Bucklin, et al. [4] the above listed and described factors can be categorized as user-centric and site-centric, whereby the latter are subdivided into the category of variables that relate on past records of user activities, current user records and general features of the information system. User-centric factors consist, inter alia, of demographic data, such as gender, age, level of education, as well as affiliation/experience with and attitude towards the system.

Site-centric data are tracked visitor activities of previous and current sessions. They include for example what users do when they use a system, where they click, the average time spent on the usage, their purchase behavior and similar insights. Furthermore, design elements of the system, such as the used language, loading time of the page, completeness of content or similar factors have to be considered for an improved usability.

### 4.4. Indicators as basis for personalized actions

The depicted user-centric and site-centric indicators are utilized to monitor the usage and learning behavior of the user. The use of additional indicators to enhance the systems’ ability to foster product learning is also conceivable but not evaluated at this point of time. Based on the development of the given indicators, an assessment about the learning process of the user can be made. This assessment normally differs between users, which implies, that different actions should be taken to serve the needs of the user in terms of product learning best. Based on the monitored indicators, our later proposed logic chooses which of the given actions should be performed by the agent.

---

3460
5. Personalization

We depicted, that we monitor the product usage and learning process of the user and derive the needs of the customer for better learning by interpreting the indicators. In this chapter we are giving a short introduction into personalization theory as well as a reasoning why we personalize our actions to enhance product learning.

5.1. Types of personalization

Different forms of employed personalization activities are feasible. Web personalization for example intends to adapt web content in regard to the individual needs of users’ to maximize business opportunities. [11] This type of personalization “delivers the right content to the right person at the right time” [28, p.867] by a) controlling the content, presentation format and the timing of the individualized information and b) implanting marketing messages into the users’ mind. [28] But there are other types as well, which could be relevant when the criterion of “easiness to learn” needs to be raised. Personalization research has developed various classification schemes of personalization activities. [8] [12] [27]

![Figure 4: Classification scheme of personalization [8]](image)

We would like to emphasize the model of Fan and Poole [8] (see Figure 4) that divides personalization in three dimensions, which are object (what), target (to whom) and origin (who). Fan and Poole [8] state that the object of personalization includes the content, user interface, channel or information access and functionality. The target of personalization can be divided into two groups, which are namely individuated and classified groups of persons. If individuals are the target of personalization, personalized objectives are communicated to a single person, based on its very unique user profile. If a group of persons in the categorical personalization is addressed, the objective is matched to an average need of a certain group but not to an individual user. Finally the source of personalization is described which they split into implicit or automated personalization, where the personalization is done by a specific system in the background and explicit personalization, where the basic data is provided by the user by e.g. filling in a questionnaire at the platform registration.

Beside these dimensions of personalization, Fan and Poole also provide four ideal types or perspectives on personalization. They divide the types into architectural, instrumental, relational and commercial forms of personalization. While the architectural type “creates a functional and delightful Web environment that is compatible with a sense of personal style”, the instrumental type aims to “increase efficiency and productivity of using the system”. Additionally the relational personalization type tries to “create a common, convenient platform for social interaction that is compatible with the individual’s desired privacy” and finally the commercial type intends to “increase sales and to enhance customer loyalty”. [8, p.190]

5.2. Personalization as differentiation

Information systems advanced in terms of functionality and usability in recent years. Corporations took over most of the newly provided innovative technologies and insights into their information systems and developed additional features for their users to specifically fit their needs. However, especially when it comes to Software-as-a-Service, providers of such systems are often interchangeable because basic functionalities are equal between different suppliers. Side factors which are often recognized as negligible are then able to change the outcome of the users’ decision about using a product or not. It is therefore relevant for providers of such systems to employ successful differentiation strategies to gain a competitive advantage over their competitors [22] and as a result, change the outcome of the users’ decision.

There are many possibilities to differentiate the own product or service, ranging from price differentiation to an altered provision of software features or system design. [10] Especially online marketers have adopted several of those differentiation strategies to attract and retain their customers. [28] Personalization activities are one example for popular differentiation strategies in a web and software context. Those activities could be established on various factors and are able to yield additional customer attraction and loyalty. But it could also be supposed that they have the ability to yield a significant influence on “easy to learn”. The
personalization activity could then be the crucial point that decides the outcome of the users’ choice. This is the reason why we suggest the deployment of a special personalization agent and logic to the information system, which takes the specific needs of the user in terms of “easiness to learn” into account and afterwards applies an individually chosen and predefined personalization action on the information system which influences the users’ perception of the system and affects his decision.

5.3. Personalization agent

Agents, which are software modules used to generate an individual corporate communication to the customer, are usually perceived as the IT enabler of personalization. [28] Traditionally these intelligent personalization agents are employed to collect and analyze the users’ activities and transactions, create unique customer profiles and finally provide individualized information to the user. [14] Especially this individualized respectively personalized communication is then qualified to attract customer attention, strengthen customer loyalty [1] and support the attribute “easy to learn” of the information system and hence raise the customer acceptance. For our area of application a split of the general valid model of an IT-agent into the agent itself and a separate logic seems appropriate because the agent needs to be adaptive in regard to the information system whereas the logic is universally applicable. We will describe our model in more detail in the following chapter.

6. Hybrid personalization agent and logic

We are now proposing our model “Prototype of a Hybrid Personalization Agent and Logic” which is depicted in Figure 5. Our system improves the users learning process on how to use a certain information system. Although the model is applicable over all phases within the customer lifecycle process, the need for product learning support is especially given in early phases of product adoption. A reasonable supporting system will therefore allow different actions for users with less product experience like additional support in system navigation, and users who have already knowledge and so want to perform tasks more rapidly. Due to personalization methods the supported actions are individually usable and adoptable by the users’ learning progress.

Figure 5: Model prototype of a hybrid personalization agent and logic

6.1. Hybrid personalization agent and logic

If we take the model of an IT-agent into account, which should enhance the “easy to learn” criterion, a mixture of different personalization strategies and types could be employed to fit into our theoretical structuring.

First of all, the information system and its interconnected database monitor certain indicators implicitly and in a way that the user does not recognize the automated tracking. But also a short questionnaire during the registration process is imaginable to build a general basis of the specific individual user profile. The collected data is stored in the database of the information system and is assigned to certain user profiles.

Our logic afterwards is able to decide which of the predefined personalization actions should be executed by the agent. This decision is based on the specified and monitored indicators. The logic consists of a processing order to aggregate all generated information to an association of significant data, and a predefined instruction set to allow decision-making. It mainly uses categorical personalization in this part of the process, because for different people the same predefined action could be suitable although they are assessed individually by analyzing their personal user profile.

Depending on the collected data of the observed criteria, the underlying content, user interface and functionality could be altered according to the users’ expectations and needs of the information system. We call these alternations predefined actions, which the agent is able to execute. The agent interacts as a direct interface back to the information system and applies the selected actions. If the user provides his interest implicitly or directly, defined and sorted content could be displayed. Depending on factors like
age or gender, the user interface could be altered by e.g. changing the arrangement of areas of the information system. Finally also the functionalities could be enhanced or reduced if the system observes that a simplification for early stage users would be beneficial.

Based on these definitions our agent is related to three different personalization types. First of all the agent aims to increase the efficiency of the usage of the information system, which could be related to an instrumental type of personalization. Due to the reason that the customer respectively user loyalty should also be increased the commercial personalization type is comprised too. But also the architectural type of personalization is represented, because the agent is able to adapt the environment of a user in a way that is compatible with its very own individual needs and preferences.

Based on this structuring, we find that various personalization strategies need to be defined as predefined actions. They cover content, user interface and functionality personalization and are attributable to the architectural, commercial and instrumental type of personalization. Also suitable indicators need to be defined for each action the logic has to take over. Due to the reason that our agent is part of different research fields and personalization types and forms, we call our model “prototype of a hybrid personalization agent and logic”.

### 6.2. Exemplary use cases

For demonstrating the personalization-based model some exemplary use cases and a possible criteria flow model, shown in Figure 6 and 7, are created. Figure 7 is an illustration of an exemplary decision making process where the logic chooses appropriate personalization actions, based on user centric and site centric criteria.

**Case 1:** A male person, aged 23, highly educated, with web experience and unknown culture shows a slow clickstream behavior during his first use of the information system. The monitoring logic recognizes that the indicating level for clickstream behavior is lower than the predefined limit. The logics processing order then selects the most appropriate predefined action. Finally the logic assigns the execution of the specific action to the agent to assist the users early stage usage behavior. In our case the agent enhances the information system by adding an additional help function in the bottom right corner. This feature should assist the user in system learning by showing a help screen when activated (see Figure 6). Thus the attribute “easy to learn” will be positively affected in regard of production adoption.

**Figure 6: Case 1 – Personal guide to enhance product learning**

Case 2: A female person, aged 45, highly educated, with web experience and known culture is already using the information system within a thirty day SaaS-testing period. Although the system
provides a wide range of features her usage behavior shows only the execution of very limited functionalities. In our case the tested product is differentiated to other products by this range of features which is therefore one of the products competitive advantages. The more features a customer is using the more likely a positive adoption decision will be made as by only using very specific features other products might provide low-cost alternatives. To show the user other relevant features the logic selects a pop-up as suitable predefined personalization action. This pop-up, which will be executed by the agent, should guide her to other functionalities and therefore allow a deeper understanding on what additional features could be interesting for her and how they work. In this case an indicator would be the amount of used features. Again if this amount falls below a predefined limit the logic recognizes a shortcoming of knowledge in terms of product capabilities. The logic selects instruction manual popups as an appropriate predefined action and therefore assists the user during product learning.

7. Conclusion and further research

Product lifecycles of Software-as-a-Service packages often allow potential customers to immediately test the product within a “tryout” phase. Especially in this early product adoption phase the users require additional support to learn about the systems features and functionalities. Personalized actions to enhance product learning allow appropriate possibilities to increase the attribute “easy to use” and therefore enhance positive product adoption. Theory from usability as well as technology acceptance research was taken into consideration to identify relevant indicators for the prediction of the users need for interactive support.

We subsequently developed the conceptual model of a hybrid personalization agent and logic for the assistance of learning processes when using information systems. By executing specific predefined personalization actions while a user works with an information system, an integrated IT-agent enhances the learning ability of the system. We proposed a logic that is able to match the right predefined personalization action to the specific needs of the user. The logic communicates to the agent which predefined action should be executed to enhance the users product learning and therefore influence the users decisions about a positive adoption. This could lead to a significant advantage for companies over their competitors.

Figure 7: Case 1 criteria flow model

Further research will continuously determine applicable personalization strategies for product learning based on the selected and monitored criteria. Also the decision making process within the logic will gain precision to allow more appropriate selection of predefined actions. Further evaluation will depict which criteria and personalization strategies will be most efficient in various application areas for product learning and positive product adoption.

8. References


[28] K.Y. Tam, and S.Y. Ho, “Understanding the Impact of Web Personalization on User Information Processing and


