Goal-Setting for Knowledge Documentation using Persuasive Systems Design – Selection and Implementation of Design Principles

Marieluise Merz
University of Augsburg, Germany
marieluise.merz@wiwi.uni-augsburg.de

Max Hurm
University of Augsburg, Germany
maxhurm@gmail.com

Abstract

Knowledge management and knowledge documentation are essential capabilities of organizations for innovation and competition. While documenting knowledge is often induced by extrinsic motivation, persuasive systems have the potential to change behavior by emphasizing intrinsic motivation. In this study, we explore goal-setting in persuasive systems in a design science project about knowledge documentation and derive 17 design principles from literature and theories. We apply the design principles by creating a process for guided goal-setting and implement the process in a persuasive system for knowledge documentation in form of a mobile application. We evaluated the artifacts in two iterations regarding the realization of the design principles as well as the acceptance and perceived impact of the persuasive system. The study's contribution is both the selection of the design principles, as well as the implementation in the form of a process and a mobile application.

1. Introduction

Knowledge management is a widespread discipline that evolved into an organizational necessity to realize the potential of organizations and employees [1, 2]. While the technical possibilities of knowledge management systems are widely studied [3], there are deficits in the practical application because users do not integrate knowledge management activities into their behavior [4, 5]. Often users tend to focus on receiving information but are averse to participate by documenting existing or newly acquired knowledge [4]. When goals for knowledge documentation are not apparent and clearly defined, we imply that documenting is neglected and not performed purposefully and sufficiently. This leads to loss of knowledge when experienced employees are not available anymore (e.g., retirement, job change, illness) [6] and increases the risk of outdated content in knowledge management systems, which then leads to repetition of errors, loss of competence and performance, as well as increased project costs [7]. Knowledge documentation is perceived with a high initial threshold especially when users do not have much experience in that context.

Persuasive systems are developed with the aim to impact users' attitudes or behaviors without using coercion or deception [8, 9]. They are instantiated as behavior change support systems (BCSS) [10]. Although knowledge documentation is often induced by external motivation (e.g., monetary rewards), persuasive systems have the potential to focus on an intrinsic point of view changing behavior towards a sustainable application of knowledge management without coercion or deception, reducing external efforts.

While the concept of goal-setting is often applied in persuasive systems [11–13], the descriptions of implementations lack details and miss out on supporting goal-setting in a guided form to provide a low threshold for initiating new behavior. Furthermore, we could not identify a BCSS that applies goal-setting in the context of knowledge documentation so far, nor have the design principles of persuasive systems been studied in the context of knowledge documentation. Deriving and presenting design principles transparently gained awareness in the light of emerging issues raised, among others, by Gregor et al. [14].

Following [15], this leads to the research gap to investigate an exaptation of persuasive design of goal-setting to knowledge documentation. We therefore strive to answer the following research questions: 1) What is the impact of goal-setting using persuasive systems design in the context of knowledge documentation? 2) What are the design principles for designing such persuasive systems? 3) How can those design principles be applied into a goal-setting process and implemented as a prototype?

To address those questions, we follow the Design Science Research methodology presented by Peffers et al. [16] to obtain design knowledge and tangible implementations [17] by developing a feasible and applicable artifact with generalizable utility [18]: Section 2 explains how we derived design principles based on a systematic literature review, the Goal-

URI: https://hdl.handle.net/10125/80018
978-0-9981331-5-7

setting theory [19], and the Persuasive Systems Design (PSD) model [8], which is the most used framework for developing persuasive systems. We present in section 3 how we applied those design principles in a goal-setting process that guides users to set specific and challenging goals to document their knowledge. We used a mockup to evaluate if the design principles are successfully incorporated in the process as we had intended. Subsequently, described in section 4, we implemented the process in a mobile application as instantiation of a persuasive system. To investigate the acceptance and impact of the design, and to get detailed insights of the users' thoughts, we evaluated this artifact using observation and semi-structured interviews. We conclude with a discussion (section 5) and summary (section 6) of the findings, limitations, and ensuing further research.

Referring to the "Taxonomy of theory types in information systems research" of Gregor [20], this study contributes as a theory of design and action (type five): It provides researchers and developers with 1) 17 specifically selected design principles for goal-setting in persuasive systems, 2) realization of those design principles in form of a process, as well as 3) implementation as a persuasive system in the context of knowledge documentation. The implementation serves as a proof of concept and initial validation [21]. Furthermore, the study shows users a structured guide to initiate contribution in knowledge documentation using goal-setting.

2. Design Objectives and Principles

In this section, we outline the relevant theoretical background and highlight the research gap using a systematic literature review. The design knowledge embodied in the theoretical background and identified literature is used to derive the targeted design principles.

2.1. Theoretical Background

2.1.1. Introduction to goal-setting. Goal-setting is a popular approach to increase motivation and task performance [22]. There are many advices and how-to guidelines available in the scientific and non-academic literature. However, how to identify fitting goals highly depends on various aspects as individual personal and situational factors (e.g., abilities, endurance, task properties; additionally, this inherently influences what makes a goal "fitting") [23]. To explore this complexity, researchers and practitioners widely investigated and describe what factors influence goal-setting (e.g., [19, 23, 24]) and which general properties goals should have (e.g., specific, measurable, achievable, relevant, time-bound [25]). The Goal-setting theory of Locke and Latham synthesizes the relationship between goal attributes and task performance [19, 26]. The practical implications of the Goal-setting theory entail that goals should be 1) specific and 2) challenging; 3) users should set deadlines to increase persistence, and 4) the goal should be adapted to the abilities of the users: for example, in the case of a complex and challenging task, a learning goal (i.e., explore how to do the task) should be preferred over a performance goal (i.e., accomplish the task effectively) [26].

2.1.2. Challenges in the context of knowledge documentation. Due to the complexity and various effects of the different aspects, advices on goal-setting might provide information that is too general to users to effectively provide actionable steps or even induce information overload. This is especially problematic when the context to which the goals are to be applied is complex or unfamiliar to the users. It is more difficult to make assessments when the topic is new, which corresponds to the ability to set goals [27]. Therefore, when users newly approach knowledge documentation, they need closer guidance on what they should consider when setting goals as compared to users with experience in knowledge documentation. In this study, we focus on a guided process that provides a low threshold for initiation of behavior change towards knowledge documentation.

2.1.3. Design principles of persuasive systems. Applying goal-setting to persuasive systems has the potential to bring the process of setting goals in a form that is accessible and easily usable for users [11] without using coercion or deception [8, 10]. BCSS are instantiated research objects that address users' behavior based on design principles [10]. The most referenced framework for developing BCSS is the persuasive systems design (PSD) model by Oinas-Kukkonen and Harjumaa [8] [28], which considers 28 aspects in four categories: Primary Task Support (e.g., self-monitoring, reduction simple tasks), Dialogue Support (e.g., suggestions, praise), System Credibility Support (e.g., surface credibility, verifiability), and Social Support (e.g., normative influence, social learning) [8]. The design principles proposed by the PSD model should be selected depending on the context of implementation [8, 10, 29], however, the PSD model does not specify the selection of design principles in different application contexts [29].

In general, Fu et al. [21] define a design principle as a "fundamental rule or law, derived inductively from extensive experience and/or empirical evidence, which provides design process guidance to increase

the chance of reaching a successful solution." [21]. Gregor et al. [14] emphasize the inconsistency of how design principles are formulated and used in research, and categorize design principles into three categories: 1) about user activity, 2) about artifact, 3) both (about user activity and artifact). Design principles in persuasive systems are no exception to general design principles. In this study, we select design principles from the PSD model and supplement this selection with design principles derived from meta-requirements identified in literature and theory on goal-setting [30].

2.2. Analysis of Related Literature

To systematically review prior research on goal-setting in persuasive systems, we conducted a systematic literature review based on the following review protocol [31]: We strive to identify studies that combine the aspects of goal-setting and persuasive systems to later on apply those findings to the context of knowledge documentation. To cover business and information systems research as well as more technical oriented content, we considered the databases ACM Digital Library, AIS eLibrary, IEEE Xplore, and ProQuest ABI/Inform Collection. We conducted a search without time restrictions looking for the terms "behavior change support system" OR "BCSS" OR "persuasive system*" OR "persuasive technolog*" in the Abstract AND "goal-setting" OR "goal setting" in the full text to also include studies that consider goal-setting, but do not describe them as a focus in their abstract. Our search revealed 51 results (6 ACM Digital Library, 23 AIS eLibrary, 16 IEEE Xplore, 10 ProQuest ABI/Inform Collection, minus four duplicates). We are aware that there exists a vast amount of studies on goal-setting outside of persuasive systems. However, considering the variety of results and recurrence of findings in the studies, we are confident that we could identify the most important aspects and explore goal-setting in the context of persuasive systems [32].

Regarding the context of the studies, none of the reviewed studies considers BCSS in the context of knowledge management. The considered contexts of research are mainly health (20 studies) and environmental/sustainability aspects (12 studies) which is in accordance with general findings about BCSS [29]. The most referenced theory on goal-setting is the Goal-setting theory of Locke and Latham [19, 26]; when designing BCSS, most studies refer to the PSD model of Oinas-Kukkonen and Harjumaa [8]. While the reviewed studies highlight the importance of goals in persuasive systems, none describe specific steps or a process of how the users set their goals. Some studies imply that users set goals without specific guidance, for example, defining a number of steps [33–35] or sleep hours [36] to be reached daily in the context of health. The mentioned design functions for a goal-setting process include tunneling [37], tailoring [38], reduction of information [39], and suggesting a default goal [40]. Those design principles directly refer to design principles listed in the PSD model. Additionally, multiple goals should be prioritized [41]. Many studies highlight the importance for users to define their goals themselves [36, 37, 42–44]. When users define their goals themselves, the resulting goals are more fitting to the specific needs of the users and the users are also more committed to those goals [33, 42, 43].

However, while the studies do not describe their specific implementation of the initial goal setting, they often describe following actions as monitoring of goals, reminding users, and giving feedback and rewarding [45–49]. Using self-monitoring and recommendations based on past behavior [33, 43, 50, 51], users should be able to adapt their goals [39, 40, 44]. In this study, we focus on a low threshold for initial actions to set goals in the topic of knowledge documentation as a prerequisite to following actions as the monitoring of behavior.

2.3. Summarizing the Objectives and Design Principles

This study aims to present a tangible process to guide users to set fitting goals using persuasive system design. To provide users with a low threshold, we focus on supporting the initial goal-setting in a guided form. Considering this focus, we can derive twofold design objectives from literature and theories: 1) design objectives regarding the properties of the goal the BCSS guides the user to set, and 2) design principles for the BCSS itself.

First, to derive the objectives for the goals, we summarize the identified objectives from the Goal-setting theory and related literature. The resulting goals should be: specific, challenging, time-bound, measurable, achievable, relevant, and should favor learning goals over performance goals when the user is not experienced [22, 25, 26].

Second, to derive the design principles for the BCSS, we selected applicable design principles from the PSD model [8]. We excluded the design principles that are not applicable in the scope of goal-setting (e.g., simulation) and that require interaction with other users (e.g., competition) to focus on an individual process. We further supplemented the resulting list (see Table 1) with design principles derived from the Goal-setting theory and the identified

literature (section 2.2.). We categorized the design principles to the three categories proposed by Gregor et al. [14] and summarize our derived design principles in Table1. Six of the selected design principles of the PSD model correspond with findings from literature (e.g., suggestion, expertise); two design principles are added context-specific (commitment and prioritizing). In line with the PSD model, the short descriptions are formulated in an imperative form [21].

Table 1. Design principles and their sources
(abbreviations: PSD model as PSDm, Goal-setting theory as GST)

	Principle	Short description / requirement	Derived from
about user	Commitment	Users should commit to their goals.	[33, 42, 43]
	Personalization	Goals should be set by the users themselves.	PSDm, GST, [36, 37, 42–44]
	Prioritizing	Multiple goals set should be prioritized.	[41]
about system	Authority	System should refer to people in the role of authority.	PSDm
	Expertise	System should provide knowledge and expertise.	PSDm
	Liking	System should be visually attractive to users.	PSDm
	Praise	System should offer praise as a form of feedback.	PSDm, [49]
	Real-world feel	System should provide information of the organization (…) behind its content and services.	PSDm
	Reduction	Behavior should be presented in simple tasks.	PSDm, [39]
	Similarity	System should imitate its users in some specific way.	PSDm
	Suggestion	System should offer fitting suggestions/a default goal.	PSDm, [12, 40]
	Surface credibility	Look of the system should convey competence.	PSDm
	Tailoring	Information should be tailored to the users' context.	PSDm, [38]
	Third-party endorsements	System should provide endorsements from respected sources.	PSDm
	Trustworthi-ness	Information should be truthful and unbiased.	PSDm
	Verifiability	Outside sources should be able to verify information.	PSDm
both	Tunneling	System should guide the user through the process by providing means for action.	PSDm, [37]

3. Design of Goal-setting Process

Based on the preceding identification of design objectives and principles, we developed a goal-setting process that applies the design principles and guides users to set specific and challenging goals to document their knowledge.

3.1. Development of Goal-setting Process

Considering the design objectives and principles, we first deduced eight process steps and then sequenced them in a feasible order. Figure 1 shows the resulting goal-setting process and addressed design principles.

To provide the user with background information about underlying theories and examples for each process step, we designed an information button on each screen that accompanies the process. This provides expertise, trustworthiness, authority, third-party endorsements, and verifiability, as well as non-intrusive suggestions and tailored information (i.e., tailoring).

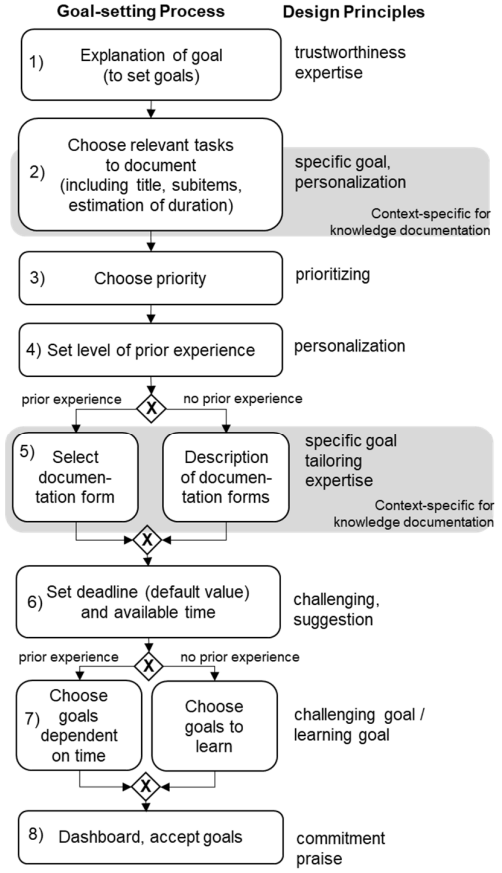

Figure 1. Goal-setting process and addressed design principles

1) The artifact starts with an introduction to build trust and explain further actions. 2) Next, the user is asked to specify tasks or documents to consider in their documentation. To specify the goal, the artifact requires additional information on subitems and an estimation of duration. 3) After this loose collection, the user can prioritize their list. 4) As knowledge documentation is depending on the form of documentation (structured, semi-structured, or unstructured documentation), the artifact distinguishes between users with experience with those documentation forms and users without. 5) The process follows with a selection if the forms are known, and more information if the forms are unknown. This process step is context-specific to knowledge documentation and should be replaced with necessary content regarding the application domain (e.g., forms of execution, tools). 6) To specify a time-bound goal, the user defines a deadline and assesses, how much time they can invest for knowledge documentation until that deadline. A deadline of one week is suggested as a default value by the system. 7) Depending on the prior experience, the artifact guides the user to a performance goal or a learning goal. A learning goal provides the user with the possibility to explore their strategy to conduct the task effectively. The performance goal compares the estimated time to complete the documentation with the available time of the user and suggests selecting or deselecting goals accordingly. 8) The goal-setting concludes with a dashboard of the specified goals. The user can accept and is congratulated on setting their goals.

The other design principles (e.g., surface credibility, tunneling, liking) are implemented overarchingly without direct reference to a specific process step.

3.2. Evaluation of Goal-Setting Process

3.2.1. Design of Evaluation. Following, we choose an early evaluation using a mockup to assess if the developed process follows a sequence that is perceived as reasonable and fitting to users and if we fulfilled the implementation of the identified objectives for the goals and design principles (section 2.3.). This evaluation ensures that the designed the goal-setting process is in accordance with the selected design principles and builds a base for an in-depth evaluation of the impact of the design principles in section 4.2.

We build an interactive mockup in PowerPoint that allows users to trace the process and assess the early design of the artifact. Each step of the goal-setting process was implemented as one screen. We gave the mockup to five users with different levels of experience of knowledge documentation to assess the feedback of users with different levels of familiarity with knowledge documentation (section 2.1.2): One user stated to have experience, two with some experience, and two without experience. Using a questionnaire for feedback, the users did have no time constraints or surveillance when familiarizing themselves with the mockup.

The questionnaire asked for feedback regarding the order of the process steps, as well as if the objectives and design principles (Table 1) are perceived as fulfilled (three-point Likert scale: fulfilled, partly fulfilled, or not fulfilled). Free text fields allowed for comments and suggestions for improvement regarding each aspect.

3.2.2. Results of Evaluation. All responses affirmed that the process was perceived as reasonable. 70% of responses rated the objectives and design principles as "fulfilled", 30% "partly fulfilled", and only one design principle was rated "not fulfilled" by one user (**<** 1%, in the aspect of reduction). Tunneling, surface-credibility, and real-world feel were rated especially well and as fulfilled by all users. The results on praise and suggestion are more ambiguous (1x fulfilled, 3x partly fulfilled). The users requested more recommendations on which options should be used in which situation. The aspect of reduction was the design principle rated lowest (2x fulfilled, 2x partly, 1x not fulfilled) as a result of the close guidance. Regarding the objectives for the goals, two users requested more aid and examples regarding the formulation and deadline for a time-bound goal.

The results did not reveal different perceptions of users with experience, with some, and users without experience of knowledge documentation. One user with no prior experience stood out with their detailed feedback and agreed to a follow-up interview further discussing the results and further development.

Following the evaluation, we subsequently added more examples and details, where possible as hints directly on the screens, or using the information button as non-intrusive support. In the mockup, the selection of the deadline was set to one week. In the next iteration, we made sure that the deadline can be personalized while still offering the default suggestion as guidance.

While we only surveyed a small number of users, we obtained detailed feedback for the subsequent development iteration based on users with different levels of experience in the application context. The results confirm that the proposed mockup incorporates the targeted design principles as base for subsequent implementation and assessment.

4. Design of Persuasive System

In this section, we describe the implementation of the design principles and goal-setting process into a persuasive system in form of a mobile application. We evaluated the system in semi-structured interviews of 20 users with different levels of experience in knowledge documentation to assess the acceptance and impact of the system.

4.1. Development of Persuasive System

Oinas-Kukkonen and Harjumaa [8] describe the development of persuasive systems in the PSD model with the three steps: 1) analysis of persuasion context, 2) selection of persuasive design principles and requirement definition for software qualities, and 3) software implementation.

Ad 1) The persuasion context is defined by intent (persuader change type), event (use, user, technology), and persuasion strategy (message, route) [8]: Our persuasive system intends to initiate contribution in knowledge documentation using goal-setting. To overcome the initial threshold, the system addresses to form a change of complying to a new behavior which helps to achieve a behavior change [10]. We consider users with different experiences in knowledge documentation and aim to provide guidance while considering the complexity and variety in applying goal-setting. Accordingly, we chose a flexible and independent mobile application. The system's strategy aims to persuade by creating goals that enable and stimulate action and contribution [26].

Ad 2) The selection of design principles and following implementation is according to sections 2 and 3 (objectives for goals, design principles, and process definition).

Ad 3) Based on the goal-setting process and the results of the evaluation of the mockup, we developed a functional application for Android, IOS, and web using the cross-platform development kit Flutter. Analogously to the mockup, each step of the goal-setting process is implemented as one screen. While our artifact was originally in German language, we translated the texts into English for the demonstrating screenshots of the Android version in Figure 2.

4.2. Evaluation of Persuasive System

4.2.1. Design of Evaluation. Since we are addressing a lack of adopting knowledge management systems in the first place, it is essential to also evaluate the acceptance of the persuasive system. Further, we evaluate the impact of the selected and implemented

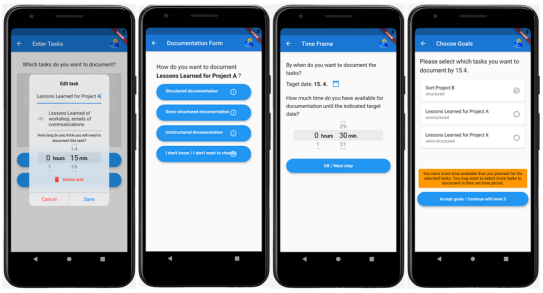

Figure 2. Screenshots from application: process steps 2), 5), 6), and 7)

design principles to gain design knowledge and potential for further development.

To obtain detailed insights into the users' utilization and thoughts, we observed the users during familiarization and application of the prototype to their current work and daily tasks. Further, we conducted semi-structured interviews, which allow to investigate specific aspects but also to include more feedback using open questions [52]. We based the interview questions that assess the acceptance of the persuasive system on the constructs of the Technology Acceptance Model of Davis [53] (i.e., perceived ease of use, perceived usefulness, intention to use), we further asked about positively and negatively perceived aspects to obtain unbiased feedback on the design. This allows us to assess which design aspects have the most negative and positive impact to the users.

We interviewed 20 users with different levels of experience (twelve male, eight female): two users stated that they had experience in knowledge documentation, seven that they had some experience, and eleven with no experience. The observations and interviews were conducted virtually using the web application, recorded, and the responses were transcribed for the analysis.

4.2.2. Results of Evaluation. The recordings took 24 minutes on average (min. 12 minutes, max. 40 minutes). Users with no prior experience took more time to familiarize and describe the system (recordings on average 27 minutes) than users with some experience (recordings on average 19 minutes). During familiarization, the users set on average 2.1 goals (min. 1 goal, max. 4 goals).

We analyzed the transcripts and feedback and clustered the responses to measure system acceptance (perceived ease of use, perceived usability, and intention to use [53]) and which design aspects and objectives of the goal were addressed by the users. We coded the responses regarding the system acceptance to three levels as presented in Table 2.

Table 2. Results regarding system acceptance

Aspects	yes	partly	no
Ease of use	19	0	1
Usefulness	17	2	1
Intention to use	11	4	5

Regarding the ease of use, users highlighted the clear structure, understandable explanations, and simple design of the app. Following the linear process, the concept is easily comprehensible. The information button to provide background information about underlying theories and examples was mentioned positively but should be displayed more conspicuously. Inhibitors to ease of use are that users had difficulties prioritizing and estimating the duration of the tasks. Regarding the perceived usefulness, users stated that the app would help them to set goals and especially highlighted their awareness for knowledge documentation and the explanatory texts. As inhibitors of usefulness, the users mentioned the long process and stated that they would need more specific guidance.

The majority stated that they would intend to use the system: Factors are the high relevance of knowledge management and fostered self-management capabilities. However, of the 20 users, four users expressed that they were not sure about using the system or would possibly use the system (assigned in Table 2 to "partly"), five users stated that they do not think they would use the system (assigned to "no"). As inhibitors, six of these users specified a missing integration into a more comprehensive system with more functions than just goal-setting and three users would require direct integration into their team or job, for example, as work instructions.

Regarding the properties of the resulting goal, the users overall perceived that the resulting goals would be specific and challenging (see Table 3, we do not have responses by all users about that aspects).

Table 3. Results about objectives for goals

Aspects	yes	partly	no
Specific goal	11	5	1
Challenging goal	13	3	0

While the users mostly stated that the system guides them to define specific and challenging goals, users suggested a more detailed structuring of the goals, for example, in form of categories and subgoals that cover parts of the overall goal as well as intermediate goals. While setting deadlines leads to specific and challenging goals, estimating the duration of tasks was perceived as difficult.

Regarding the assessment of responses from users with different levels of experience in knowledge documentation, all three users that did not perceive the system as useful are of the group of users without prior experience in knowledge documentation. Beyond that, however, we did not identify notable differences in the responses of users with and without prior experience.

5. Discussion

Investigating how a persuasive system should be designed to guide users to set specific and challenging goals, we followed design science methodology and firstly derived objectives and design principles based on theories and a systematic literature review. We identified 17 design principles that, referring to the categorization of Gregor [14], mostly (13) describe system features, three of the design principles are about users and one (tunneling) is about both (system and user). During the development of the goal-setting process, we found that we could not assign all design principles to a specific process step, but that some design principles address basic requirements (e.g., surface credibility, expertise, tunneling). We therefore want to bring such general design principles and their implementation to the attention of researchers and developers. The responses to the goal-setting process indicate that we were able to apply the targeted design principles. Although we expected that users without experience might evaluate the artifact differently, the evaluation did not reveal different perceptions. To provide users with a low threshold and clear guidance, examples of goal formulation and wording in the chosen application context are essential. We therefore want to highlight the importance of the design principles suggestion and tailoring of information.

Subsequently, we implemented the goal-setting process into a functional persuasive system. The results of the evaluation indicate users' acceptance of the system regarding perceived usefulness and perceived ease of use. Regarding the intention to use, the results are mixed because of missing integration into other systems and their organizational structures. This indicates that the concept of the artifact is accepted but does not reach its potential as a singular and standalone implementation. Overall, the evaluation confirms the selected design principles and goal-setting process. Further, we observed that design principles are not mentioned directly in the interviews, which emphasizes that design principles are inherent to artifacts. We suggest a distinction between design principles that address basic user requirements (e.g., *surface credibility*) and those that address user interaction that users are actively conscious of.

Regarding our implementation in the context of knowledge documentation, the results affirm that the developed process and persuasive system guide users to create specific and challenging goals. Besides the identification of positive aspects and issues that should be addressed further, we noted that the depth of detail requires further discussion: While a detailed guidance does not inherently lead to a reduction of steps and time, it can reduce cognitive effort and is especially suitable for initial actions of users with low knowledge in the referring context. The users even stated to require more guidance. In future improvement, different pathways with, for example, shortcuts could provide personalization with different process steps regarding the necessary level of guidance.

Further, estimating the duration of tasks was found to be particularly difficult. To provide additional guidance, the system could provide more tangible suggestions for duration (e.g., how much time one should take to write down lessons learned or document processes) based on learning from inputs.

6. Summary

This study investigates goal-setting in persuasive systems by selecting persuasive design principles, developing a goal-setting process and implementing it in a mobile application as a persuasive system. Persuasive systems focus on supporting behavior change without using coercion or deception [8, 9]. Deriving specific persuasive design principles for goal-setting therefore provides an intrinsic point of view to goal-setting. We applied the persuasion context to knowledge documentation because knowledge documentation is a complex environment that is perceived with a high threshold and research has not applied goal-setting prominently in the context of knowledge documentation so far.

The findings from designing and evaluating the artifacts emphasize that guidance in this context is an aspect that is perceived as useful and valuable. We present the selection of design principles and apply them in a process as well as a persuasive system. The evaluations did not indicate that users with experience in knowledge documentation perceive the artifacts much differently than users with less experience.

While we conducted the evaluations with only a limited number of participants, we are confident that the detailed answers provide tenable responses and contribute to a greater understanding of designing goal-setting in persuasive systems, especially in the context of knowledge documentation. For the evaluation, we deliberately decided to observe and interview users instead of providing a questionnaire. While this may influence behavior, it provides a high level of detail and insight into the thoughts of the users to assess the acceptance and impact of the system. For further evaluations the artifact should be improved and applied in more practical use cases. In this study, we investigated goal setting as an independent activity to allow for a generalization beyond knowledge documentation. Further development of an artifact should consider functions regarding cooperation and interaction with other users and stakeholders, and integration into other information systems (e.g., calendar, task management systems) and workflows.

Combining persuasive systems and knowledge documentation addresses the behavioral aspects of knowledge documentation and focuses on attitudes and behavior instead of technical aspects. We hope that our findings help researchers and developers to create meaningful persuasive systems and further engage discussions on the implementation of goal-setting.

7. References

[1] Girard, J. and J. Girard, "Defining Knowledge Management: Toward an Applied Compendium", Online Journal of Applied Knowledge Management, 3(1), 2015, 1-20.

[2] Buck, C., T. Grüneke, and K. Stelzl, "Structuring the Jungle of Capabilities FosteringDigital Innovation", in 16th International Tagung Wirtschaftsinformatik, Universität Duisburg-Essen, Germany, Mar 09-11. 2021.

[3] Fakhar Manesh, M., M.M. Pellegrini, G. Marzi, and M. Dabic, "Knowledge Management in the Fourth Industrial Revolution: Mapping the Literature and Scoping Future Avenues", IEEE Transactions on Engineering Management, 68(1), 2021, pp. 289–300.

[4] Kautz, K. and V. Mahnke, "Value Creation through IT-supported Knowledge Management? The Utilisation of a Knowledge Management System in a Global Consulting Company", Informing Science, 6, 2003, pp. 75–88.

[5] Curtis, M.B. and E.Z. Taylor, "Developmental Mentoring, Affective Organizational Commitment, and Knowledge Sharing in Public accounting firms", Journal of Knowledge Management, 22(1), 2018, pp. 142–161.

[6] Jennex, M.E. and A. Durcikova, "Assessing Knowledge Loss Risk", in 46th Hawaii International Conference on System Sciences, Wailea, HI, USA, Jan 07-10. 2013.

[7] Ferenhof, H.A., S. Durst, and P.M. Selig, "Knowledge Waste & Knowledge Loss? What is it All About?", Navus - Revista de Gestão e Tecnologia, 6(4), 2016, pp. 38–57.

[8] Oinas-Kukkonen, H. and M. Harjumaa, "Persuasive Systems Design: Key Issues, Process Model, and System Features", Communications of the AIS, 24, 2009.

[9] Fogg, B.J., "Persuasive Technology: Using Computers to Change What we Think and Do", Ubiquity(December), 2002, p. 2.
[10] Oinas-Kukkonen, H., "A Foundation for the Study of Behavior Change Support Systems", Personal and Ubiquitous Computing, 17(6), 2013, pp. 1223–1235.
[11] Consolvo, S., P. Klasnja, D.W. McDonald, and J.A. Landay, "Goal-setting Considerations for Persuasive Technologies that Encourage Physical Activity", in Proceedings of the 4th International Conference on Persuasive Technology, S. Chatterjee and P. Dev, Editors, Claremont, California, April 26-29. 2009. ACM.
[12] Graml, T., C.-M. Loock, M. Baeriswyl, and T. Staake, "Improving Residential Energy Consumption at Large Using Persuasive Systems", in 19th European Conference on Information Systems, June 9-11. 2011. Association for Information Systems: Helsinki, Finland.
[13] Fogg, B.J., "A Behavior Model for Persuasive Design", in Proceedings of the 4th International Conference on Persuasive Technology - Persuasive '09, S. Chatterjee and P. Dev, Editors, the 4th International Conference, Claremont, California, 26.04.2009 - 29.04.2009. 2009. ACM Press: New York, New York, USA.
[14] Gregor, S., L.C. Kruse, and S. Seidel, "The Anatomy of a Design Principle", Journal of the Association for Information Systems, 21(6), 2020, pp. 1622–1652.
[15] Gregor, S. and A. Hevner, "Positioning and Presenting Design Science Research for Maximum Impact", MIS Quarterly, 37, 2013, pp. 337–355.
[16] Peffers, K., T. Tuunanen, M.A. Rothenberger, and S. Chatterjee, "A Design Science Research Methodology for Information Systems Research", Journal of Management Information Systems, 24(3), 2008, pp. 45–77.
[17] Klinker, K., L. Przybilla, A. Viljoen, and Uebernickel, Falk & Krcmar, Helmut, "Design Principles for mHealth Application Development in Rural Parts of Developing Countries: The Case of Non-Communicable Diseases in Kenya", IEEE Transactions on Engineering Management, 2021, 1-18.
[18] Peffers, K., T. Tuunanen, and B. Niehaves, "Design Science Research Genres: Introduction to the Special Issue on Exemplars and Criteria for Applicable Design Science Research", European Journal of Information Systems, 27(2), 2018, pp. 129–139.
[19] Locke, E.A. and G.P. Latham, "A Theory of Goal Setting and Task Performance", The Academy of Management Review, 16(2), 1991.
[20] Gregor, S., "The Nature of Theory in Information Systems", MIS Quarterly, 30(3), 2006, p. 611.
[21] Fu, K.K., M.C. Yang, and K.L. Wood, "Design Principles: Literature Review, Analysis, and Future Directions", Journal of Mechanical Design, 138(10), 2016.
[22] Locke, E.A., K.N. Shaw, L.M. Saari, and G.P. Latham, "Goal Setting and Task Performance: 1969-1980", Psychological Bulletin, 90(1), 1981, pp. 125–152.
[23] Hollenbeck, J.R. and H.J. Klein, "Goal Commitment and the Goal-setting Process: Problems, Prospects, and Proposals for Future Research", Journal of Applied Psychology, 72(2), 1987, pp. 212–220.
[24] Erez, M. and I. Zidon, "Effect of Goal Acceptance on the Relationship of Goal Difficulty to Performance", Journal of Applied Psychology, 69(1), 1984, pp. 69–78.
[25] Werle Lee, K.P., "Planning for success: setting SMART goals for study", British Journal of Midwifery, 18(11), 2010, pp. 744–746.
[26] Locke, E.A. and G.P. Latham, "Building a Practically Useful Theory of Goal Setting and Task Motivation: A 35-year Odyssey", American Psychologist, 57(9), 2002, pp. 705–717.
[27] Earley, P.C., C. Lee, and L.A. Hanson, "Joint Moderating Effects of Job Experience and Task Component Complexity: Relations Among Goal Setting, Task Strategies, and Performance", Journal of Organizational Behavior, 11(1), 1990, pp. 3–15.
[28] Otyepka, S., Beiträge zur IT-gestützten Verhaltensänderung, Augsburg, 2018.
[29] Wiafe, I., K. Nakata, and S. Gulliver, "Categorizing Users in Behavior Change Support Systems Based on Cognitive Dissonance", Personal and Ubiquitous Computing, 18(7), 2014, pp. 1677–1687.
[30] Möller, F., T.M. Guggenberger, and B. Otto, "Towards a Method for Design Principle Development in Information Systems", in Designing for Digital Transformation: Co-Creating Services with Citizens and Industry, S. Hofmann, O. Müller, and M. Rossi, Editors. 2020. Springer International Publishing: Cham.
[31] Boell, S.K. and D. Cecez-Kecmanovic, "On Being 'Systematic' in Literature Reviews", in Formulating Research Methods for Information Systems: Volume 2, L.P. Willcocks, C. Sauer, and M.C. Lacity, Editors. 2015. Palgrave Macmillan UK: London.
[32] Boell, S. and D. Cecez-Kecmanovic, "A Hermeneutic Approach for Conducting Literature Reviews and Literature Searches", Communications of the Association for Information Systems, 34, 2014, p. 12.
[33] Rieder, A., C. Lehrer, and R. Jung, "How Behavior Change Support Systems Influence Self-Efficacy: A Qualitative Study Using Wearables", in 27th European Conference on Information Systems, Stockholm, Sweden, Jun 8-14. 2019. AIS.
[34] den Akker, R.o., R. Klaassen, K. Bul, P.M. Kato, G.-J. van der Burg, and P. Di Bitonto, "Let Them Play: Experiences in the Wild with a Gamification and Coaching System for Young Diabetes Patients", in 11th EAI International Conference on Pervasive Computing Technologies for Healthcare, Barcelona Spain, May 23-26. 2017. ACM.
[35] Katule, N., M. Densmore, and U. Rivett, "Leveraging Intermediated Interactions to Support Utilization of Persuasive Personal Health Informatics", in Proceedings of the 8th International Conference on Information and Communication Technologies and Development, Michigan, USA, June 03-06. 2016. ACM.
[36] Wilson, E.V., S. Djamasbi, D. Strong, and C. Ruiz, "Using a Key Informant Focus Group, Formative User Testing, and Theory to Guide Design of a Sleep Health

BCSS", in 50th Hawaii International Conference on System Sciences, Hawaii, USA. 2017. AIS.
[37] Shahri, A., M. Hosseini, M. Almaliki, K. Phalp, J. Taylor, and R. Ali, "Engineering Software-based Motivation: A Persona-based Approach", in Proceedings of the 10th International Conference on Research Challenges in Information Science, S. España, J. Ralyté, C. Souveyet, and Science, Editors, Grenoble, France, May 1 - Jun 3. 2016. IEEE: Piscataway, NJ.
[38] Yoganathan, D. and S. Kajanan, "Designing Fitness Apps Using Persuasive Technology: A Text Mining Appproach", in Pacific Asia Conference on Information Systems. 2015. AIS.
[39] Sunio, V., J.-D. Schmocker, and M.R.J. Estuar, "Implementation of a Mobility Behavior Change Support System in Manila Philippines", in 20th International Conference on Intelligent Transportation Systems, Yokohama, Japan, Oct 16-19. 2018. IEEE.
[40] Oyebode, O., D. Maurya, and R. Orji, "Nourish Your Tree! Developing a Persuasive Exergame for Promoting Physical Activity Among Adults", in Proceedings of the 8th International Conference on Serious Games and Applications for Health, N. Rodrigues, Editor, Vancouver, BC, Canada, Aug 12-14. 2020. IEEE.
[41] Ren, J., D. Schulman, B. Jack, and T.W. Bickmore, "Supporting Longitudinal Change in Many Health Behaviors", in 32nd annual ACM Conference on Human Factors in Computing Systems (CHI EA '14), M. Jones, P. Palanque, A. Schmidt, and T. Grossman, Editors, Toronto, Ontario, Canada, April 26 - May 01. 2014. ACM: New York, USA.
[42] Vassileva, J., "Motivating Participation in Social Computing Applications: a User Modeling Perspective", User Modeling and User-Adapted Interaction, 22(1-2), 2012, pp. 177–201.
[43] Yoganathan, D. and S. Kajanan, "Persuasive Technology for Smartphone Fitness Apps", in Pacific Asia Conference on Information Systems. 2013. AIS.
[44] Paraschivoiu, I., J. Sypniewski, A. Lupp, M. Gärtner, N. Miteva, and Z. Gospodinova, "Coaching Older Adults: Persuasive and Multimodal Approaches to Coaching for Daily Living", in International Conference on Multimodal Interaction, K. Truong, Editor, Netherlands, Oct 25 - 29. 2020. ACM: New York, USA.
[45] Harjumaa, M. and S. Muuraiskangas, "Building Persuasiveness into Information Systems", Electronic Journal Information Systems Evaluation, 17(1), 2014, pp. 23–35.
[46] Soror, A. and F. Davis, "Using Self-Regulation Theory to Inform Technology-Based Behavior Change Interventions", in Proceedings of the 47th Annual Hawaii International Conference on System Sciences, R.H. Sprague, Editor, Waikoloa, Hawaii, Jan 06-09. 2014. IEEE: Piscataway, NJ.
[47] Ping, L.K., J.P. Poh, L.K. Meng, W. Husain, and M.H. Muhamad Adnan, "A Framework of a Childhood Obesity Intervention Using Persuasive Web-mobile Technology", in International Conference on Computer & Information Science, Kuala Lumpur, Malaysia, Jun 06-14. 2012. IEEE: Piscataway, NJ.
[48] Kuonanoja, L., S. Langrial, R. Lappalainen, P. Lappalainen, and H. Oinas-Kukkonen, "Treating Depression with a Behavior Change Support System without Face-to-Face Therapy without Face-to-Face Therapy", AIS Transactions on Human-Computer Interaction(7), 2015, pp. 192–210.
[49] Langrial, S., T. Lehto, H. Oinas-Kukkonen, M. Harjumaa, and P. Karppinen, "Native Mobile Applications For Personal Well-Being: A Persuasive Systems Design Evaluation", in Pacific Asia Conference on Information Systems. 2012. AIS.
[50] Rieder, A., S. Vuckic, K. Schache, and R. Jung, "Technostress from Persuasion: Wearable Users' Stressors, Strains, and Coping", in International Conference of Information Systems, Dec 13-16. 2020. AIS: India.
[51] Mohamed, N.F.F., A.A. Rahman, and N.A. Iahad, "Managing Sedentary Behavior with Smartphone", in 21 Pacific-Asia Conference on Information Systems, Malaysia. 2017. AIS.
[52] McIntosh, M.J. and J.M. Morse, "Situating and Constructing Diversity in Semi-Structured Interviews", Global qualitative nursing research, 2, 2015.
[53] Davis, F.D., "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", MIS Quarterly, 13(3), 1989, p. 319.