Overview on Seminar Topics

Summer 2017

Institute of Information Systems and Marketing (IISM)
Karlsruhe Service Research Institute (KSRI)

Research Group "Information Systems and Service Design"

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Applying Gamification for Reinforcement of Energy-related Behaviors

Supervisor: *Nils Bergmann*

Student Level: *BA*

Problem Description: *Gamification, the use of game design elements respectively mechanisms in non-game contexts, has been applied to various practical contents. Amongst others, in some approaches game design elements are used in order to reinforce sustainable behaviors in the course of environment protection. Behaviors fostering sustainable habits are also including energy-related behaviors and often are targeting at saving energy. As Gamification is a comparatively new field in research, studies systematically investigating the separate influence of single game elements on these behaviors are missing. However, there are numerous practical examples in which combinations of game design elements were used in order to reinforce energy-related behavioral patterns. Because of gamification being a multi disciplinary field of research, the identification of relevant empirical results requires focusing on several types of literature including studies from psychology, behavioral economics and environmental research.*

Goal of the Thesis: *Which gamification approaches have already been implemented in the environment of energy-related behaviors? What are promising approaches for future application and why are they promising?*

Starting Literature:

- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness. In A. Lugmayr, H. Franssila, C. Safran, & I. Hammouda (Eds.), *Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek '11* (p. 9). New York, New York, USA: ACM Press.
- Grossberg, F., Wolfson, M., Mazur-Stommen, S., Farley, K., & Nadel, S. (2015). *Gamified Energy Efficiency Programs. American Council for an Energy-Efficient Economy. Washington, DC, Report*, (B1501).
- Dahlborn, B., Greer, H., Egmond, C., & Jonkers, R. (2009). *Changing Energy Behaviour: Guidelines for Behavioural Change Programmes.* Madrid: IDAE.

State-of-the-art literature review on decision support systems in business process management

Supervisor: *Christian Fleig*

Student Level: *BA*

Problem Description: *Organizations are required to conduct transformation activities of businesses and associated processes to survive, stay competitive, and thrive under new environmental conditions imposed by globalization, the ubiquitous pressure for cost reductions, the need to reduce time-to-market, and technological innovations such as "big data" or the "internet of things". Thus, decision-making becomes a decisive capability for organizations to succeed in increasingly complex and dynamic environments.*

Decision support systems (DSS) are information systems to support organizational decision-making processes by deciding between alternatives in highly dynamic and semi-structured or unstructured "wicked" problems. As a consequence of the increasing reliance of organizational decision-making on data available within and around organizations, DSSs are a promising way for organizations to derive decision guidance. However, literature on DSSs has been fragmented, with many individual contributions exploring separate facets of the phenomenon, such that a clear understanding of DSSs has been missing. To limit the scope of this literature review, the seminar paper should focus on DSS within the context of business process management.

Goal of the Thesis: *The aim of the seminar paper is to provide a structured literature review on decision support systems within the context of business process management. In particular, the contribution should include an explanation of the phenomenon, and identify current streams of research on decision support systems (DSS). Furthermore, the seminar paper should provide an overview of different types of DSS available and ideally propose a taxonomy of DSS in BPM.*

Starting Literature:

- *Sprague, R;(1980). "A Framework for the Development of Decision Support Systems." MIS Quarterly. Vol. 4, No. 4, pp.1-25*
- *F. Burstein; C. W. Holsapple (2008). Handbook on Decision Support Systems. Berlin: Springer Verlag*
- *Wright, A; Sittig, D (2008). "A framework and model for evaluating clinical decision support architectures q". Journal of Biomedical Informatics. **41**: 982–990*

Institute of Information Systems and Marketing (IISM)

Using Smart Meter Data to Save Energy– A Literature Review

Supervisor: *Ulrich Gnewuch*

Student Level: **BA**

Problem Description: *The large-scale deployment of smart metering technologies is planned or already underway in many European countries. In September 2016, the German Federal Council approved the implementation of a new law to support the country's nation-wide rollout of smart meters in order to follow the example of its neighbors in the UK and Spain. While the implementation of advanced meter infrastructure raises a number of major technical, regulatory and organizational issues, it also provides opportunities for new business models (e.g., flexible tariffs, big data analytics, …). Specifically, since smart meters collect high-frequency consumption data, consumers can obtain a near real-time view of energy use within their home. Several studies show that providing information about energy consumption and costs can positively influence consumption practices (i.e., reduce energy consumption). However, it is unclear how smart meter data can was be used to enable consumers to not only reduce their consumption (and costs), but also to be mindful of how and when they use energy.*

Goal of the Thesis: *How can smart meter data be used to stimulate energy-saving behavior?*

Starting Literature:
- *McKenna, E., Richardson, I., & Thomson, M. (2012). Smart meter data: Balancing consumer privacy concerns with legitimate applications. Energy Policy, 41, 807-814.*
- *Darby, S. (2010). Smart metering: what potential for householder engagement?. Building Research & Information, 38(5), 442-457.*
- *Buchanan, K., Russo, R., & Anderson, B. (2015). The question of energy reduction: The problem(s) with feedback. Energy Policy, 77, 89–96.*

Institute of Information Systems and Marketing (IISM)

Practices for User Participation & Involvement: A State-of-the-Art Overview

Supervisor: *Xuanhui Liu*

Student Level: *BA*

Problem Description: *User involvement is defined as "a psychological state reflecting the importance and personal relevance that a user attaches to a given system (Lin and Shao 2000)." While user participation is defined as "observable behavior of users during the development process of a system (Lin and Shao 2000)." There are some differences between design practices for user participation and user involvement. However, the different focuses are usually very confusing. There is a need to conduct a state-of-the-art review on design practices to see whether design practices emphasize more on user participation or user involvement and how to conduct design practices.*

Goal of the Thesis: *This seminar thesis aims to conduct a systematic literature review on design practices for user participation and involvement in the digital service design process.*

Starting Literature:
- *Harris, M. a., & Weistroffer, H. R. (2009). A New Look at the Relationship between User Involvement in Systems Development and System Success Development and System Success. Communications of the Association for Information Systems, 24(1), 739–756.*
- *Lasa, Ganix, Daniel Justel, and Aiur Retegi. 2015. "Eyeface: A New Multimethod Tool to Evaluate the Perception of Conceptual User Experiences." Computers in Human Behavior 52: 359–63.*

Eye-tracking Devices in Cognitive Information Systems – State-of-the-art Overview and Research Gaps

Supervisor: *Peyman Toreini*

Student Level: *BA*

Problem Description: *There is heated interest now in the social sciences in capturing presumably objective data directly from the human body, and this interest in neurophysiological tools has also been gaining momentum in information systems (IS) research (termed NeuroIS). Neurophysiological tools enable the measurement of human responses when people engage in various activities, such as decision making, or react to various stimuli, such as IT user interfaces(UI). One of these tools is eye-tracking devices that has recently been extended in IS research. These tools record eye relevant data and enable the measurement of human responses via objective data. The most important variables obtained by eye tracking tools include eye fixation, pupil dilation, gaze duration, and areas of interest. Analyzing such data collected through eye-tracking devices could be used in the design of IT systems that reduce cognitive overload by enhancing the user's capabilities.*

Goal of the Thesis: *(1) Investigate state-of-the-art for the use of eye-tracking devices in IS (2) Find the research gaps in use of eye-tracking devices in IS*

Starting Literature:

- *Dimoka, A., Davis, F.D., Pavlou, P.A., Dennis, A.R.: On the Use of Neurophysiological Tools in IS Research : Developing a Research Agenda for NeuroIS. MIS Quarterly. 36, 679–702 (2012).*
- Cyr, D., Head, M., Larios, H., & Pan, B.. *Exploring Human Images in Website Design: A Multi-method Approach. MIS Quarterly*, 539-566. (2009)
- Brocke, Jan Vom, René Riedl, and Pierre-Majorique Léger. "*Application strategies for neuroscience in information systems design science research.*" *Journal of Computer Information Systems* 53.3 (2013)

Supporting Industry 4.0 introductions: Business Modeling in vague situations

Supervisor: *Dominik Augenstein*

Student Level: *MA*

Problem Description: *Industry 4.0 gains lots of opportunities for a company: Besides new products and services, the production of existing products can be rebuilt or new channels can be used. As these are only few examples, companies have various possibilities to create their business model. However, to decide for the suitable business model for the own company, managers have to consider a lot of factors: Environment, markets, self-conception, competitive value propositions and many more are only a selection. To get an overview about the current situation of doing business, manager can use business model concepts to see rapidly their standing in this complex environments. However, these concepts don't support decisions for the right arrangement of the new possibilities. For example, they do not show the impacts of different alternatives like internal vs. external production. This is because existing business model concepts are less executable to support such decisions.*

Goal of the Thesis: *Which requirements on a business model concept are necessary, to support decisions in vague situations like the introduction of Industry 4.0?*

Starting Literature:
- *Chesbrough, Henry (2007): Business model innovation. It's not just about technology anymore. In Strategy & Leadership 35 (6), pp. 12-17. DOI: 10.1108/10878570710833714.*
- *Johnson, Mark W.; Christensen, Clayton M.; Kagermann, Henning (2008): Reinventing your business model. In Harvard business review 86 (12), pp. 57-68.*
- *Zott, Christoph; Amit, Raphael (2010): Business Model Design: An Activity System Perspective. In Business Models 43 (2-3), pp. 216-226. DOI: 10.1016/j.lrp.2009.07.004.*

Disruptive Innovations in Business Modeling

Supervisor:　　　　*Dominik Augenstein*　　　　　　　　　　　　**Student Level:**　*MA*

Problem Description: *Industry 4.0 and new technologies enable new possibilities for a company. However, new products and services also creates pressure on companies, to sustain in markets. Adapting their business model steadily is important to expand leading positions.*

Next to developments, which are foreseeable, disruptive innovations (e.g. the Ipod or the smartphone) can surprise competitors, which have to adapt their business model. The adaption of the business model in such disruptive situations follows an unstructured frame. Existing business model approaches as the business model canvas are thereby to rigid. As a consequence, the success of such an adaption is based on the management's knowledge, which can lead to wrong decisions (e.g. Nokia).

Goal of the Thesis:　　　*What are the demands for business model approaches to support business model changes after disruptive innovations/situations?*

Starting Literature:
- *Demil, Benoît; Lecocq, Xavier (2010): Business Model Evolution: In Search of Dynamic Consistency. In Business Models* 43 (2-3), pp. 227-246. DOI: 10.1016/j.lrp.2010.02.004.
- *Sosna, M.; Trevinyo-Rodríguez, R.; Velamuri, S. R. (2010): Business Model Innovation throughTrial-and-Error Learning: The Naturhouse Case. In Business Models* 43 (2-3), pp. 383-407. DOI: 10.1016/j.lrp.2010.02.003.
- *Casadesus-Masanell, Ramon; Ricart, Joan Enric (2010): From Strategy to Business Models and onto Tactics. In Business Models* 43 (2–3), pp. 195–215. DOI: 10.1016/j.lrp.2010.01.004.

Inter-individual Differences regarding the Effects of Gamification

Supervisor: *Nils Bergmann*

Student Level: *MA*

Problem Description: *Gamification, the use of game design elements respectively mechanisms in non-game contexts, has been applied to various practical contents in order to evoke certain behavioral patterns. Usually the implementation of game design elements is not adapted in respect to inter-personal differences between human beings. Therefore, an identical gamified approach is provided for every single user. Given that many empirical studies control for inter-personal differences like at least demographic variables, it is important to provide an overview of differential effects which were already observed. Furthermore, concepts for example from differential psychology provide useful frameworks for identifying relevant inter-personal dimensions which might lead to differences in the effects of gamification. As a result, research is needed in order to define suitable variables for predicting how game elements are influencing the individual human being's behavior.*

Goal of the Thesis: *What are known inter-personal differences regarding the effects of gamification? Which inter-personal differing variables are promising for future investigations and why are they promising?*

Starting Literature:

- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness. In A. Lugmayr, H. Franssila, C. Safran, & I. Hammouda (Eds.), *Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek '11* (p. 9). New York, New York, USA: ACM Press.
- Koivisto, J., & Hamari, J. (2014). Demographic differences in perceived benefits from gamification. *Computers in Human Behavior,* 35, 179–188
- Akasaki, H., Suzuki, S., Nakajima, K., Yamabe, K., Sakamoto, M., Alexandrova, T., & Nakajima, T. (2016). One Size Does Not Fit All: Applying the Right Game Concepts for the Right Persons to Encourage Non-game Activities. In S. Yamamoto (Ed.), *Lecture Notes in Computer Science. Human Interface and the Management of Information: Applications and Services* (Vol. 9735, pp. 103–114). Cham: Springer International Publishing.

What are we talking about? Towards a typology of business processes

Supervisor: *Christian Fleig*   **Student Level:** *MA*

Problem Description: A large number of organizations nowadays relies on Business Process Management (BPM) to steer, control, analyze, and improve processes to achieve higher levels of customer satisfaction, performance, or lower production times or costs. As BPM increasingly provides the foundations and inputs for organizational decision-making on business processes, organizational decision-makers are frequently lost with a large spectrum of different types of business processes which require different forms of managerial care.

Although research has accepted the existence of different "types" of business processes such as primary versus secondary activities (Porter), mass-customized/automatized versus creative/individualized processes or knowledge-intensive processes and many others, literature has been unable to provide a satisfactory framework of how to classify business processes.

As solid decision-making on business processes requires a clear understanding of what type of process the decision focuses on, this absence of a clear typology of business processes imposes a daunting challenge for decision-makers.

Goal of the Thesis: *The seminar paper is expected to perform a (structured or unstructured) literature review to identify different types of processes, and cluster them into a typology. Ideally, the seminar work aditionally provides suggestions for how to quantitatively measure these process characteristics.*

Starting Literature:

- vom Brocke J, Schmiedel T, Recker J, Trkman P, Mertens W, Viaene S (2014) Ten Principles of Good Business Process Management. Business Process Management Journal 20(4):530-548
- vom Brocke J, Zelt S, Schmiedel T (2016) On the role of context in business process management. International Journal of Information Management, 36(3):486-495
- Ould MA (1995) Business Processes: Modelling and analysis for re-engineering and improvement. Wiley, Chichester
- Rosemann M, Recker J, Flender C (2008) Contextualization of Business Processes. International Journal of Business Process Integration and Management 3(1):47-60

IT-related Assistance and Frustration

Supervisor: *Celina Friemel*   **Student Level:** *MA*

Problem Description: *In psychology research, frustration is conceptualized as an emotion people experience when opposing goals or a goal blocking events hinder the satisfaction of a pursued goal or need (Klein et al. 2002). Within Human-Computer-Interaction (HCI) frustration of users can play a significant role in explaining IT-related behavior (Ceaparu et al. 2004). When trying to avoid biases with self-reported data on frustration during the use of a system like user assistance the approach of applying neurophysiological measurements can serve as an additional source of data (Dimoka et al. 2012). With the help of NeuroIS tools, affective user states like frustration can be measured objectively and in real-time and provide new insights on how the users feel when working on a task (Scheirer et al. 2002). As the field of NeuroIS is still in its early stages, the measurement of frustration mainly is discussed in psychological research. In order to replicate the methodologies in IS, it is important to have an overview on how to measure frustration and how to analyze resulting data.*

Goal of the Thesis: *The goal of this seminar thesis is to derive a list of identified bio-signals that have been discussed and tested in existing literature to measure frustration. Moreover, a possible IS context experiment should be conceptualized and the possibilities of data analysis should be discussed and evaluated.*

Starting Literature:

- *Klein, J., Moon, Y., & Picard, R. W. (2002). This computer responds to user frustration: Theory, design, and results. Interacting with Computers, 14(2), 119–140.*
- *Ceaparu, I., Lazar, J., Bessiere, K., Robinson, J., & Shneiderman, B. (2004). Determining Causes and Severity of End-User Frustration. International Journal of Human-Computer Interaction, 17(3), 333–356.*
- *Dimoka, A., Banker, R. D., … Weber, B. (2012). On the Use of Neuropyhsiological Tools in IS Research: Developing a Research Agenda for NeuroIS. MIS Quarterly, 36(3), 679–702.*
- *Scheirer, J., Fernandez, R., Klein, J., & Picard, R. W. (2002). Frustrating the user on purpose: a step toward building an affective computer. Interacting with Computers, 14(2), 93–118.*

Differences and Similarities of User Assistants

Supervisor: *Celina Friemel*   **Student Level:** *MA*

Problem Description: *Digital assistants (Sarikaya 2017), bots (Ferrara et al. 2016), recommender agents (Montaner et al. 2003) and other forms of personal intelligent assistance strongly developed over the last years and the trend is ongoing. Personal assistants like Siri, Cortana, Google Assistant or Alexa are springing up like mushrooms. What at first sounds like much differing offerings bears the common idea of assisting users with different tasks in varying contexts (Maedche et al. 2016). So far, the naming and conceptual background of assistants varies and a classification is not available. Yet, it would be valuable to have a conceptual classification (Nickerson et al. 2013) of existing types of user assistance. In order to receive a holistic view on the topic it seems essential to merge empirical research work as well as real-world examples into a common overview of what forms of user assistance systems exist and what characteristics define them.*

Goal of the Thesis: *The goal of the seminar thesis is to conduct a systematic literature review on user assistance systems. The results could be used to derive a classification approach for existing systems.*

Starting Literature:

- *Sarikaya, R. (2017). The Technology Behind Personal Digital Assistants: An overview of the system architecture and key components. IEEE Signal Processing Magazine, 34(1), 67–81.*
- *Ferrara, E., Varol, O., Davis, C., Menczer, F., & Flammini, A. (2016). The Rise of Social Bots. Communications of the ACM, 59(7), 96–104.*
- *Montaner, M., López, B., & de la Rosa, J. L. (2003). A Taxonomy of Recommender Agents on the Internet. Artificial Intelligence Review, 19(4), 285–330.*
- *Maedche, A., Morana, S., Schacht, S., Werth, D., & Krumeich, J. (2016). Advanced User Assistance Systems. Business & Information Systems Engineering, 58(5), 2–5.*
- *Nickerson, R. C., Varshney, U., & Muntermann, J. (2013). A method for taxonomy development and its application in information systems. EJIS, 22(3), 336–359.*

The Rise of Chatbots - A State-of-the-Art Review

Supervisor: *Ulrich Gnewuch*   **Student Level:**   *MA*

Problem Description: *Chatbots (or conversational agents) have been around since the early days of computers. While early chatbots could only make simple responses based on user prompts, recent advances in artificial intelligence, machine learning and natural language processing have paved the way for more sophisticated bots, particularly in business contexts. Combining these advances with the consumer trend towards messaging, it is not surprising that almost all tech giants invest heavily in bot technologies (e.g., Microsoft's BotFramework or Facebook's Messenger Platform). Some people even predict that bot technology will be so disruptive that it will eliminate the need for websites and apps.*

However, despite the current excitement around bots, it is still unclear how chatbots should be designed to improve user experience. Consequently, many questions are still unanswered: What is important for designing successful chatbots? When are they useful? Should they be simple and focused on a specific domain? Should they allow for free text input or create IVR-like options? How can businesses leverage them to interact with their customers?

Goal of the Thesis: *What is the current state of the art in designing chatbots?*

Starting Literature:

- *McTear, M., Callejas, Z., & Griol, D. (2016). The Conversational Interface: Talking to Smart Devices. Berlin: Springer.*
- *Shawar, B. A., & Atwell, E. (2007). Chatbots: Are they really useful? LDV-Forum, 22 (1), 29–49*
- *Schuetzler, R. M., Grimes, M., Giboney, J. S., & Buckman, J. (2014). Facilitating natural conversational agent interactions: lessons from a deception experiment. In ICIS 2014 Proceedings.*

State-of-the-Art Literature Review on the Application of Card Sorting

Supervisor: *Xuanhui Liu*

Student Level: *MA*

Problem Description: *Card sorting is a useful technique to classify and structure information in web design, user experience, and marketing research. There are studies depicting methods of performing card sorting (e.g., physical cards, online tool) and how to analyzing card sorting (e.g., item-by-item matrix, dendrogram). However, the application analysis of card sorting varies with the changing of research objectives. So far there is no systematic literature review on the application and analysis of card sorting. It is necessary to systematically review the state-of-the-art studies to understand how can card sorting be applied.*

Goal of the Thesis: *This seminar thesis aims to conduct a state-of-the-art systematic literature review on the application of card sorting.*

Starting Literature:
- *Righi, C., James, J., Beasley, M., & Day, D. (2013). Card Sort Analysis Best Practices. Journal of Usability Studies, 8(3), 69–89.*
- *Burnay, C. (2016). Are Stakeholders the Only Source of Information for Requirements Engineers? Toward a Taxonomy of Elicitation Information Sources. ACM Transactions on Management Information Systems, 7(3), 8:1-8:29. http://doi.org/10.1145/2965085*

Institute of Information Systems and Marketing (IISM)

Neurophysiology / Psychophysiology of Flow

Supervisor: *Raphael Rissler* **Student Level:** *MA*

Problem Description: *The state of the art to measure the phenomenon of flow, defined as „the holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi 1975, p. 36) is to measure it via self-reported scales such as the „flow short scale" from Rheinberg and Engeser (2008).* However, considering neurophysiological / psychophysiological measurements of flow seems to be a promising research avenue, as flow may appear only briefly during activities and such neurophysiological measurements enable the researcher to analyze flow in situations without interrupting the user.

Goal of the Thesis: *Hence, the goal of this thesis is to conduct a systematic literature review on the state-of-the-art in psychophysiological flow measures.*

Starting Literature:

- *Peifer, C. (2012). "Psychophysiological Correlates of Flow-Experience." In: S. Engeser (Ed.), Advances in Flow Research (pp. 140–164). New York, NY: Springer Science.*
- *Léger, P. M., F. D. Davis, T. P. Cronan and J. Perret. (2014). "Neurophysiological correlates of cognitive absorption in an enactive training context." Computers in Human Behavior, 34, 273–283.*
- *Mauri, M., P. Cipresso, A. Balgera, M. Villamira and G. Riva. (2011). "Why is facebook so successful? Psychophysiological measures describe a core flow state while using facebook." Cyberpsychology, Behavior, and Social Networking, 14(12), 723–731.*

Sensing the User of Information Systems (IS)

Supervisor: Raphael Rissler

Student Level: *MA*

Problem Description: *An ongoing discussion in academic literature as well as in practice is the question, which real-world input data (e.g., mouse movement, keyboard usage, web-cam) can be used to determine the actual state of a information system (IS) users. One state of interest is the state of flow, defined as „the holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi 1975, p. 36). However, despite growing interest of researchers and practitioners in the phenomenon of flow, knowledge about how to asses flow during task execution with real-world input data is scares and an holistic view on possible data sources is missing.*

Goal of the Thesis: *Hence, the goal of this thesis is to conduct a systematic literature review on possible real-world input data (e.g., web-cam, mouse-movement, etc.) to assess individuals' flow.*

Starting Literature:

- *Sun, D., P. Paredes and J. Canny. (2014). "MouStress: Detecting Stress from Mouse Motion." CHI '14- Proceedings Conference on Human Factors in Computing Systems.*
- *Ikehara, C. S. and M. E. Crosby. (2005). "Assessing Cognitive Load with Physiological Sensors." Proceedings of the 38th Annual Hawaii International Conference on System Sciences, 0(C), 1–9.*
- *Tan, C. T., D. Rosser, S. Bakkes and Y. Pisan. (2012). "A feasibility study in using facial expressions analysis to evaluate player experiences." In: ACM International Conference Proceeding Series.*

Attention-aware Human-Computer Interaction – State-of-the-art Overview and Research Gaps

KIT
Karlsruher Institut für Technologie

Supervisor: *Peyman Toreini*

Student Level: *MA*

Problem Description: *Researchers refer to attention as the set of processes enabling and guiding the selection of incoming perceptual information. User interfaces (UI) that are sensitive to the users' visual attention are called attentive UI and managing the users' attention is one of the most pressing but also difficult challenges in human-computer interaction (HCI) research. Visual attention is particularly relevant to attention-aware systems since the current predominant modality for computer-to-human communication is visual. Using eye movement information when users are interacting with visual information can enable a computer system to gain more contextual information about the user's. This information can be leveraged to design interfaces which are more intuitive and intelligent UI, such as attentive UI.*

Goal of the Thesis: *(1) Investigate state-of-the-art for the attention-aware human-computer interaction approaches (2) Find the research gaps in investigating attention-aware human-computer interaction*

Starting Literature:

- Bulling, Andreas. "Pervasive Attentive User Interfaces." *IEEE Computer* 49.1 (2016): 94-98.
- Vertegaal, Roel. "Attentive user interfaces." *Communications of the ACM* 46.3 (2003): 30-33.
- Roda, Claudia, and Julie Thomas. "Attention aware systems: Theories, applications, and research agenda." *Computers in Human Behavior* 22.4 (2006): 557-587.