TECHNISCHE HOCHSCHULE LÜBECK

Module: Human-Computer Interaction

Level	Master	**Short Name**	HCI
Responsible Lecturers	Prof. Dr. Monique Janneck, Prof. Dr. Denys Matthies		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades

Learning Outcomes

By the end of this module, students will be able to:

- **Understand key concepts in Human-Computer Interaction (HCI):** Define and apply foundational terminology in UI and UX, recognizing how these concepts influence user needs and behaviors in interactive systems.
- **Analyze and apply HCI models:** Use models such as Fitts' Law, Hick's Law, and Norman's Seven Stages of Action to predict and improve user interactions within a system.
- **Design human-centered interfaces:** Apply human-centered design principles, including mental models, metaphors, and usability principles, to create intuitive and effective user interfaces.
- **Evaluate human factors in design:** Analyze human capabilities like perception, cognition, and motor functions to inform interface design decisions, optimizing for both usability and accessibility.
- **Implement prototyping techniques:** Develop and utilize low-functional prototypes, including the Wizard of Oz method, to test and iterate interface designs in the early stages of development.
- **Apply design principles in practice:** Use design elements such as color, composition, and form, alongside interaction design methods, to create aesthetically and functionally sound interfaces.
- **Conduct usability evaluations:** Perform usability tests, cognitive walkthroughs, and heuristic evaluations to identify and address usability issues in interface designs.
- **Engage in empirical research:** Design and conduct experiments using empirical methods to validate interface designs, employing techniques such as hypothesis testing and grounded theory.

	These outcomes will equip students with the skills and knowledge needed to design, prototype, and evaluate user interfaces that align with human cognitive and physical capabilities, ensuring optimal user experience.
Participation Prerequisites	

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	The module can be used within the Master of Computer Science/Software Engineering for Distributed Systems
Remarks	The project work (examination) includes, e.g., the implementation of a self-chosen HCI project, a written report, and an oral presentation of the project.

TECHNISCHE HOCHSCHULE LÜBECK

Module Course: Human-Computer Interaction (Lecture)

(of Module: Human-Computer Interaction)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	30
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents

- **Introduction:** introduces the fundamental concepts of user interfaces (UIs) and the role they play in Human-Computer Interaction (HCI). You will learn about the core terminologies in both general UI design and specifically within the context of User Experience (UX). Understanding these terms helps establish a solid foundation for identifying and addressing user needs when designing interfaces. The discussion will extend to Ubiquitous Human-Computer Interaction, where interaction happens seamlessly across devices and environments, reflecting the ever-growing pervasiveness of technology in our daily lives.
- **Models in HCI:** are key to understanding and predicting how users interact with systems. This module begins with an introduction to the role of models in HCI and covers important foundational models, such as Fitts' Law, which explains the relationship between the distance to a target and the time required to reach it. Applications of Fitts' Law in interface design will be explored, followed by the concept of "steering through tunnels," which describes navigation in constrained environments. Hick's Law and the Keystroke-Level Model (KLM) will help us understand decision-making time and task execution at a granular level. We will also delve into the GOMS (Goals, Operators, Methods, and Selection rules) model for task analysis and Norman's Seven Stages of Action, which outline user interaction from goal formulation to system feedback. Finally, we'll explore additional models and their applications in HCI.

- **Basics and Principles:** examines user illusions and how UIs can shape user perception. A key emphasis will be placed on focusing on the human side of the interaction, particularly through mental models and metaphors, which help users make sense of unfamiliar systems. Human-centered design (HCD) principles will be introduced, emphasizing usability and user satisfaction. We'll discuss strategies to better know your users and their tasks, and dive into established principles like the Eight Golden Rules of interface design. This module will also cover the potential for human error in interaction and how proper design can mitigate these risks. Style guides, UI guidelines, and the concepts of constraints and mappings will offer practical approaches to achieving consistency and usability in design.
- **Human:** has capabilities and limitations in perception, cognition, and interaction. We begin with visual perception, understanding how the brain processes visual stimuli, and move on to cognition, focusing on how people process information, solve problems, and make decisions. We'll look at Gestalt laws and how they influence perception, alongside human hearing, haptics, attention, and memory. Cognitive models will offer insights into how users think and act, and we'll also address the emotional aspect of interaction and how it affects user experience. Finally, this module will examine the motor system and its role in physical interaction with interfaces.
- **Input and Output**: starts with an exploration of the ultimate user interface, questioning what constitutes a perfect interface. We will then discuss the design space and taxonomy of input devices, focusing on their types, affordances, and limitations. Pointing devices and their associated transfer functions will be examined, followed by an exploration of various output methods, including visual, auditory, and physical (printing and tactile) outputs. We'll also cover emerging technologies such as olfactory and taste outputs and dive into advanced interaction techniques like eye gaze interaction.
- **Prototyping**: is a crucial part of the design process. Here, we introduce the various types of prototypes and methods for systemizing them based on their functionality and fidelity. You'll learn about low-functional prototypes, which are used for early testing and iteration, and how to employ the Wizard of Oz technique, where users interact with a system they believe to be autonomous but is controlled behind the scenes by a human. These methods allow designers to simulate functionalities without full implementation, saving time and resources.
- **Design**: covers the essentials in HCI. We begin with an introduction to design, discussing its purpose and importance in creating effective user interfaces. You will then explore various design methods, including user-centered and participatory approaches. The discussion will continue into advanced design techniques, including the use of color, composition, and form to create aesthetically pleasing and functional interfaces. Additionally, we will cover interaction design, focusing on how users engage with and navigate through interfaces.
- **Evaluation & Experiments**: focuses on evaluating designs and conducting experiments to ensure usability. We will cover cognitive walkthroughs, where experts evaluate an interface by stepping through user tasks, and heuristic evaluation, which identifies usability problems through expert review. You will

	also learn about usability testing, where real users interact with a system to provide feedback. The module concludes with an introduction to empirical research methods, including grounded theory and hypothesis testing, essential for validating design decisions with data.
Literature	• B. Shneiderman (2002). Leonardo's Laptop: Human Needs and the New Computing Technologies. http://mitpress.mit.edu/main/feature/leonardoslaptop/index.html • B. Buxton (2010). Sketching user experiences: getting the design right and the right design. Morgan Kaufmann. • Harry Brignull (2006). Bad usability is like a leaky pipe. https://90percentofeverything.com/2006/11/13/bad-usability-is-like-a-leaky-pipe/ • Thomas T. Hewett, Ronald Baecker, Stuart Card, Tom Carey, Jean Gasen, Marilyn Mantei, Gary Perlman, Gary Strong, and William Verplank. 1992. ACM SIGCHI Curricula for Human-Computer Interaction. Technical Report. Association for Computing Machinery, New York, NY, USA. • Standard, ISO 9241:210 https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed- 2:v1:en • https://www.interaction-design.org/literature/article/what-is-interaction-design by Yu Siang Teo • Jakob Nielsen's Alertbox, August 25, 2003: Usability 101: Introduction to Usability https://www.nngroup.com/articles/usability-101-introduction-to-usability/ • Jakob Nielsen. 2009. Powers of 10: Time Scales in User Experience. https://www.nngroup.com/articles/powers-of-10-time-scales-in-ux/ • Jennifer Preece, Yvonne Rogers, Helen Sharp (2002) Interaction Design, ISBN: 0471492787, http://www.id-book.com/, Chapter 9 • Winograd, T. (1997). From computing machinery to interaction design. In Denning, P., & Metcalfe, R. (Eds.), Beyond calculation: The next fifty years of computing, 149-162. Springer-Verlag. http://hci.stanford.edu/~winograd/acm97.html. • Foreword “What is Interaction Design?”. Interview with Gillian Crampton Smith. Moggridge, Bill, and Bill Atkinson. Designing interactions. Vol. 17. Cambridge, MA: MIT press, 2007. page xvii • https://www.interaction-design.org/literature/article/what-is-interaction-design by Yu Siang Teo • Pine, B. Joseph, and James H. Gilmore. "Welcome to the experience economy." Harvard business review 76 (1998): 97-105. https://hbr.org/1998/07/welcome-to-the-experience-economy • Hassenzahl, Marc (2013): User Experience and Experience Design. In: Soegaard, Mads and Dam, Rikke Friis (eds.). "The Encyclopedia of Human- Computer Interaction, 2nd Ed.". Aarhus, Denmark: The Interaction Design Foundation. http://www.interaction- design.org/encyclopedia/user_experience_and_experience_design.html • Effie Lai-Chong Law, Virpi Roto, Marc Hassenzahl, Arnold P.O.S. Vermeeren, and Joke Kort. 2009. Understanding, scoping and defining user experience: a survey approach. In Proceedings of the 27th international conference on Human factors in computing systems(CHI '09). ACM, New York, NY, USA, 719-728. DOI=10.1145/1518701.1518813 http://doi.acm.org/10.1145/1518701.1518813

	• Maslow, A. H. (1943): A theory of human motivation. Psychological Review, 50(4), 370-396. https://doi.org/10.1037/h0054346 • John M. Carroll. (1990): Infinite detail and emulation in an ontologically minimized HCI. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '90). Association for Computing Machinery, New York, NY, USA, 321–328. DOI:https://doi.org/10.1145/97243.97303 • John M. Carroll.(2013): Human Computer Interaction - brief intro. In: Soegaard, Mads and Dam, Rikke Friis (eds.). "The Encyclopedia of Human-Computer Interaction, 2nd Ed.". Aarhus, Denmark: The Interaction Design Foundation. http://www.interaction-design.org/encyclopedia/human_computer_interaction_hci.html • Alan Cooper, Robert Reimann, and Hugh Dubberly (2003): About face 2.0: The essentials of interaction design. John Wiley & Sons, Inc.
Remarks	(add. literature incl. current research papers presented in script)

Module Course: Human-Computer Interaction (Practical Training)

(of Module: Human-Computer Interaction)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	2
Group Size	12	**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	60
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The student will develop an individual or team project.
Literature	See lecture
Remarks	