



Programme and Course Description

User Experience Design

Master

Faculty of Computer Science

As per: 2020-11-19

Inhalt

1	Introduction.....	3
1.1	Effective Study and Examination Regulation.....	3
1.2	Overview.....	3
1.3	Academic Degree.....	4
1.4	Structure and duration of the study program.....	4
1.5	Advance and admission requirements.....	4
1.6	Degree Programme Coordination and Study Counseling.....	4
2	Curricular structure.....	5
2.1	Basic Structure of the Programme.....	5
2.2	Overview of Modules.....	6
3	Special note.....	7
4	Description of Modules.....	8
4.1	Compulsory Modules.....	8
	Research Methods in HCI.....	8
	Interaction Design.....	10
	Programming for Multimodal, Interactive Systems.....	12
	Natural User Interfaces (NUIs).....	14
	Agile Project Management.....	16
	Audio/Video Processing and 3D-Animation.....	18
	Augmented and Virtual Reality Applications.....	20
	Design Strategy and Management.....	22
	Project.....	23
	Master Thesis.....	25
	Master Thesis Seminar.....	27
4.2	Individual Electives.....	29
	German A1 intensive.....	29
	Interface Design.....	31
	Mobile App Development.....	33

1 Introduction

1.1 Effective Study and Examination Regulation

The currently applicable study and examination regulations for the Master UXD is SPO-2020 in the version of December 17, 2018 and come into effect on March 15, 2020. The English version as of August 05, 2019 is a translation of the German study and examination regulations with identical content.

Students who begin their studies in the summer term 2020 or later study according to SPO-2020. More information on the study and examination regulations can be found on the website of the legal department (<https://www.thi.de/en/university/university-profile/hochschulorganisation/legal-department>).

1.2 Overview

User experience describes „A person's perceptions and responses that result from the use and/or anticipated use of a product, system or service.“ (ISO 9241-201). It embraces the complete experience of using a product, including aesthetic and emotional factors, such as an appealing design, aspects of confidence building, or the joy of use. UX is one of the major criteria that decides over success or failure of a (digital) product or service.

In the three semester master program User Experience Design (UXD), students will get in-depth knowledge on interaction design, research methods in human-computer interaction, agile project management, and design strategy. Further on, they will be trained in audio-video processing and augmented and virtual reality technologies and learn how to implement multimodal and multisensory interface solutions. Practical projects and electives such as game design accompany the students throughout their studies. Practical projects and electives allow for specialization. Graduates will have developed intercultural and communicative competencies required to work in an international context. Graduates will be able to implement novel solutions for digital lifestyle and realize new visions and they are also qualified and welcome to pursue a PhD at THI or another university afterwards.

Testimonial

“I really like the concept of UXD, as it is organized workshop-like and combines theoretical foundations with practical application. THI is very open to international students, offers plenty of labs to gain practical experience, and hosts a center of entrepreneurship. Opportunities after graduation are excellent since employers such as Audi, Airbus or the electronic retailer MediaMarkt Saturn need UX designers and Ingolstadt is close to Munich with many digital/design agencies.”

1.3 Academic Degree

For the successful completion of the Master's examination, Technische Hochschule Ingolstadt awards the academic degree

Master of Science (M. Sc.)

A document attesting to the awarding of the academic degree is issued in accordance with the specimens contained in the Annex of the General Examination Regulations of Technische Hochschule Ingolstadt.

1.4 Structure and duration of the study program

The course is offered as a consecutive degree programme (full-time studies) with a standard study period of three theoretical semesters and a total credit point score of 90 ECTS. The Master's thesis must also be written during this standard study period. There is no entitlement to offer all modules of the degree programme every semester.

1.5 Advance and admission requirements

The legally binding regulations can be found in the Study and Examination Regulations (SER) of the Master User Experience Design in the current version (SPO-2020; note: legally binding is the German version from December 17, 2018 ; the English translation should have identical content and is only provided for convenience), in the General Examination Regulations (APO) of the Technical University of Ingolstadt, in the Framework Examination Regulations (RaPO), as well as in the Matriculation Statutes of the THI.

All documents are available on the webpage of the legal department, see:

<https://www.thi.de/en/university/university-profile/hochschulorganisation/legal-department>.

1.6 Degree Programme Coordination and Study Counseling

For subject-oriented questions and problems, please get in touch with the program advisor:

Prof. Dr. Andreas Riener, Room B-210, Phone 0841/9348-2833

Questions related to the organization will be answered by:

Prof. Dr. Simon Nestler, Room B-203, Phone 0841/9348-2727

The consultation hours that apply during the semester are announced via Moodle.

2 Curricular structure

2.1 Basic Structure of the Programme

The master programme User Experience Design takes three semesters. The first two semesters are dedicated to compulsory lectures, seminars, and project modules as well as elective modules. The third semester is reserved for the Master's thesis.

The programme starts every summer and winter semester. Due to the modular structure of the degree programme, it is possible to successfully complete the studies either with an entry in the summer or winter term.

Individual electives (no. 10 in the table below) are modules offered to students of the degree programme with contents that change from semester to semester. Each student must complete a total of two elective modules according to the study and examination regulations. The chosen modules are treated like compulsory modules. Which modules are offered in the respective semester is announced in the module handbook.

The following table gives a quick overview of the curriculum and further shows, that each module is typically offered once a year, either in winter or summer semester.

2.2 Overview of Modules

SPO No.	Module description	1 st semester (summer)			2 nd semester (winter)			3 rd semester	
		hours	credits	type of course	hours	credits	type of course	hours	credits
1	Research Methods in HCI	4	5	SU/Ü					
2	Interaction Design	5	6	SU/Ü +Pr					
3	Programming for Multimodal, Interactive Systems	5	6	SU/Ü					
4	Natural User Interfaces (NUIs)	4	5	Proj					
5	Agile Project Management	2	3	SU/Ü					
6	Audio/Video Processing and 3D Animation				5	8	SU/Ü +Pr		
7	Augmented and Virtual Reality Applications				5	7	SU/Ü +Pr		
8	Design Strategy an Management				4	5	SU/Ü		
9	Project				4	5	Proj		
10	Individual Electives (select 2 in total)	4	5	SU/Ü	4	5	SU/Ü		
11.1	Master's Thesis							0	28
11.2	Master's Thesis Seminar							1	2
	Total	24	30		22	25		1	30

Type of course

Pr Internship

Proj Project

S Seminar

SU Tuition in seminars

Ü Exercise

SU/Ü Tuition in seminars with exercise

3 Special note

Important for re- examination:

If active participation in a course not offered in the current semester is required in order to take a repeat examination, e.g. for practical courses or seminars, the student is obliged to discuss this with the responsible program advisor during the first three weeks of the semester.

After this period, the student is no longer entitled to take this repeat examination in the current semester!

4 Description of Modules

4.1 Compulsory Modules

Research Methods in HCI			
Module abbreviation:	UXDM_RM	Reg.no.:	1
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	1
Responsible for module:	Riener, Andreas		
Lecturers:	Riener, Andreas; Tasoudis, Stavros		
Language of instruction:	English		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total:		125 h
Subjects of the module:	Research Methods in HCI (UXDM_RM)		
Lecture types:	UXDM_RM: SU/Ü - lecture with integrated exercises		
Examinations:	LN - oral exam, 15 minutes		
	The teaching concept of this course closely connects theoretical foundations and practical applications. Thus, this course is designed workshop-like: The learning contents are presented in relation to concrete areas of application and are deepened by concrete group and single tasks. An active participation of the students is explicitly desired.		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
There are no prerequisites or corequisites for this class. However, a basic understanding of Human Factors would be useful.			
Objectives:			
<p>The objective of this course is to provide students with the principles of human factors engineering, and the research tools that are used to examine these principles. The class will showcase (through weekly journal article readings) the value of qualitative (e.g., focus groups, interviews) and quantitative (e.g., controlled A/B testing, design of experiments) methods for human factors research. That is, how to capture abstract thoughts, people's opinions, and trends as well as design studies to capture the impact of design changes and interventions more formally. The focus of the class is centered on human factors design principles for safety, productivity, functionality, and usability. Upon course completion, students will be able to begin fundamental research in human factors. The journal articles will cover research methods and design issues related to operator performance given functional, psychological, physiological, and environmental constraints.</p>			

Successful students will understand:

- research methods to test human-machine interactions,
- measurement tools to capture human performance and behavior,
- task analysis to identify gaps in the process,
- examine user trust, acceptance, and satisfaction,
- differences in experimental designs and the corresponding analysis challenges,
- design studies to examine a product or service with the human operator in mind.

Content:

- Intro to Human Factors Engineering
- Task Analysis (Physical and cognitive task analysis).
- Design Methods (Iterative design and refinement, heuristic evaluations).
- Qualitative or descriptive methods (Usability testing, content analysis, interviews, focus groups)
- Controlled studies (Constructing laboratory studies, ecological, internal, and external validity)
- Data Analysis of Controlled Studies (Study designs, correlation vs. causality, AB testing)
- Quasi Experiments, Survey Design (Quasi experiments and evaluation research, developing survey instruments, survey sampling methods; analysis of survey data)
- Observational Methods and Naturalistic Research (Data recording instruments, Extraction of naturalistic data for analysis)
- Objective vs Subjective Measures (Performance and physiological measures, Capturing attitudes, perceptions, stress, workload, performance)
- Synthesizing Research Results (Data visualization, reporting results, how to prepare awesome presentations?)

The schedule is tentative and subject to change.

Literature:

- FIELD, Andy and Graham HOLE, 2008. *How to design and report experiments*. r. edition. Los Angeles [u.a.]: Sage. ISBN 978-0-7619-7383-6, 0-7619-7382-6
- LAZAR, Jonathan, Jinjuan Heidi FENG and Harry HOCHHEISER, 2017. *Research methods in human-computer interaction*. S. edition. Cambridge, MA: Morgan Kaufmann Publishers, an imprint of Elsevier. ISBN 978-0-12-809343-6, 0-12-809343-9
- LEE, John D. and others, 2017. *Designing for people: an introduction to human factors engineering*. 3. edition. Charleston, SC: CreateSpace. ISBN 978-1-5398-0800-8, 1-5398-0800-9
- Various journal articles (provided in Moodle). In: .
- VOLLRATH, Mark, 2015. *Ingenieurpsychologie: psychologische Grundlagen und Anwendungsgebiete*. 1. edition. Stuttgart: Kohlhammer. ISBN 978-3-17-022620-3, 978-3-17-028835-5

Interaction Design			
Module abbreviation:	UXDM_ID	Reg.no.:	2
Curriculum:	Programme	Module type	Semester
	User Experience Design		1
Responsible for module:	Ritzer, Veronika		
Lecturers:	UXDM_ID: Ritzer, Veronika UXD_IDP: Ritzer, Veronika		
Language of instruction:	English		
Credit points / SWS:	6 ECTS / 5 SWS		
Workload:	Contact hours:		59 h
	Self-study:		91 h
	Total:		150 h
Subjects of the module:	2.1 Interaction Design (UXDM_ID) 2.2 Practical Training in Interaction Design (UXD_IDP)		
Lecture types:	UXDM_ID: SU - lecture UXD_IDP: Pr - laboratory		
Examinations:	2.1 LN - project work 2.2 LN - participation without/with success		
	<p>Lecture (UXD_IP): Proof of course performance is provided by short presentations in the second half of the semester, in which the theory acquired in the first half of the semester is applied. In groups of two students, two short presentations of 10 minutes each have to be prepared and presented. The topics can be suggested by students or will be assigned by the lecturer.</p> <p>The aim and content of these short presentations is a critical presentation of the interaction design of an existing product or service. The course is considered passed if both presentations are held on time and in the given length. The grade results from a conclusive chain of argumentation taking into account / including theories (lecture material of the semester).</p> <p>Practical (UXD_IDP): During the internship, 5 concrete projects will be worked on individually/ as a team. The duration of the projects varies between 2 - 4 weeks. These are design projects, which include a quick idea generation, as well as the presentation in a tangible prototype. The quality of execution of the prototypes varies with the nature and duration of the projects and is described in detail at the beginning of each project. The idea is to be presented and argued on the basis of the prototype within the announced time schedule. Work statuses are to be presented in intermediate meetings. Only if all 5 projects are presented on time, the proof of performance is considered as achieved.</p>		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
After successfully completing this module, students will:			

- understand historical aspects, future trends, different approaches to and fundamental concepts of interaction design.
- understand basic advantages and challenges of visual, physical, and sensory dimensions in interaction design.
- have had an introduction to and practice in the fundamental methods and problem-solving strategies in design processes.
- be able to solve design problems including human centered design research, ideation, concepting, testing and prototyping.
- will be able to discuss interaction design concepts and products in regard to their functional and emotional qualities as well as their larger context within systems, digitalization and society.

Content:

- An analytic view on basic ideas and paradigms in interaction design, different design approaches and the role of interaction design in the larger context of product development processes and digitalization.
- Discussion of existing products regarding the design concept, formal execution and social relevance.
- Familiarization with the fundamental aspects of visual, physical and sensory interactions patterns in stand-alone products, connected systems and services.
- Simple design concepts will be created emphasizing the human perspective on technology through functional and emotional qualities in the interaction design.
- Creation of experience prototypes applying different prototyping techniques in various degrees of fidelity

Literature:

- COOPER, Alan, Robert REIMANN and Dave CRONIN, 2010. *About face: Interface- und Interaction-Design ; [die Ziele und Erwartungen Ihrer User untersuchen und verstehen ; die Methode des Goal-Directed-Designs anwenden ; Produkte entwickeln, mit denen Ihre User optimal interagieren können]*. 1. edition. Heidelberg [u.a]: mitp. ISBN 978-3-8266-5888-4, 978-0-470-08411-3
- MOGGRIDGE, Bill, c2007. *Designing interactions*. Cambridge, Mass.: MIT Press. ISBN 0-262-13474-8, 978-0-262-13474-3
- DAWES, Brendan, 2007. *Analog in, digital out: Brendan Dawes on interaction design*. Berkeley, Calif.: New Riders. ISBN 0-321-42916-8
- O'SULLIVAN, Dan and Tom IGOE, 2009. *Physical computing: sensing and controlling the physical world with computers*. [. edition. Mason, OH: Course Technology. ISBN 978-1-59200-346-4, 1-59200-346-X
- NORMAN, Donald A., 2013. *The design of everyday things*. R. edition. New York, NY: Basic Books. ISBN 978-0-465-07299-6, 0-465-07299-2
- DAHM, Markus, 2006. *Grundlagen der Mensch-Computer-Interaktion*. München [u.a.]: Pearson Studium. ISBN 3-8273-7175-9
- STAPELKAMP, Torsten, 2007. *Screen- und Interfacedesign: Gestaltung und usability für Hard- und Software* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 3-540-32949-8, 978-3-540-32949-7. Available via: <https://doi.org/10.1007/978-3-540-32950-3>.

Programming for Multimodal, Interactive Systems			
Module abbreviation:	UXDM_MIS	Reg.no.:	3
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	1
Responsible for module:	Nestler, Simon		
Lecturers:	UXDM_MIS: Nestler, Simon UXD_MISUE: Nestler, Simon		
Language of instruction:	English		
Credit points / SWS:	6 ECTS / 5 SWS		
Workload:	Contact hours:		59 h
	Self-study:		91 h
	Total:		150 h
Subjects of the module:	3.1 Programming for Multimodal, Interactive Systems (UXDM_MIS) 3.2 Exercises in Programming for Multimodal, Interactive Systems (UXD_MISUE)		
Lecture types:	UXDM_MIS: SU/Ü - lecture with integrated exercises UXD_MISUE: Ü - exercise course		
Examinations:	3.1 schrP90 - written exam, 90 minutes 3.2 LN - without assessment		
	The teaching concept of this course closely connects theoretical foundations and practical applications. Thus, this course is designed workshop-like: The learning contents are presented in relation to concrete areas of application and are deepened by concrete group and single tasks. An active participation of the students is explicitly desired.		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
On successful completion of the course, students will be able to			
<ul style="list-style-type: none"> • use and combine different modalities when prototyping and developing interactive systems, • evaluate the suitability for perception and action modalities for their specific use case. On the basis of this evaluation, students will be able to build a multi-modal user interface, • evaluate the practical suitability of their developed applications. 			
Content:			
<ul style="list-style-type: none"> • Introduction: Voice User Interfaces, Chatbots, Alexa Skills, Amazon Echo, Chatbot User Experience • Design: Design Fundamentals, Voice User Interface Design, Personas, Avatars • Concepts: Cognitive Load, Error Recovery, Grammars, "Put-that-there" • Technologies: Modalities, Devices, Speech Recognition, Voice-Enabled Devices • Evaluation: User Testing, Mock-Ups, Wizard-of-Oz-Experiments, Prototype Implementation 			

Literature:

- KRISHNA, Golden, 2015. *The best interface is no interface: the simple path to brilliant technology*. San Francisco, Calif.: Pearson Education, New Riders. ISBN 978-0-133-89033-4, 0-133-89033-3
- PEARL, Cathy, December 2016. *Designing voice user interfaces: principles of conversational experiences*. F. edition. Beijing ; Boston ; Farnham ; Sebastopol ; Tokyo: O'Reilly. ISBN 1-4919-5541-4, 978-1-491-95541-3
- COHEN, Michael H., James P. GIANGOLA and Jennifer BALOGH, 2004. *Voice user interface design*. 1. edition. Boston [u.a.]: Addison-Wesley. ISBN 0-321-18576-5
- LEE, Henry, 2018. *Voice user interface projects: build voice-enabled applications using Dialogflow for Google Home and Alexa Skills Kit for Amazon Echo*. Birmingham, UK: Packt Publishing. ISBN 978-1-78847-335-4
- WILLIAMS, Sam, October 2016. *Hands-on chatbot development with Alexa Skills and Amazon Lex: create custom conversational and voice interfaces for your Amazon Echo devices and web platforms*. Birmingham ; Mumbai: Packt. ISBN 978-1-78899-348-7

Natural User Interfaces (NUIs)			
Module abbreviation:	UXDM_NUI	Reg.no.:	4
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	1
Responsible for module:	Nestler, Simon		
Lecturers:	Georges, Munir; Nestler, Simon		
Language of instruction:	English		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total:		125 h
Subjects of the module:	Natural User Interfaces (NUIs) (UXDM_NUI)		
Lecture types:	UXDM_NUI: Prj - project		
Examinations:	Project report and oral presentation 15 min.		
	Form of examination: Project report (10 pages without tables and graphics, font size 10-12pt) and oral presentation (15 min).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
On successful completion of the course, students will be able to			
<ul style="list-style-type: none"> • understand basic terms, methods and concepts for natural user interfaces, • apply principles of project management and teamwork within the scope of a project on natural user interfaces, • choose appropriate hard- and software solutions for realizing on projects on natural user interfaces, • plan, design and develop their own natural user interfaces, • evaluate the practical suitability of their developed applications. 			
Content:			
<ul style="list-style-type: none"> • Technologies: Hard- and software solutions for natural interfaces, frameworks, best practices, • Types: Touch interfaces, multi-touch interfaces, pen-based interfaces, gestural interfaces, • Interaction: Interaction paradigms, gesture sets, primitives, design principles, interaction with natural interfaces, • User Experience: User-centered gesture design, Testing gestures, NUI Mock-Ups, Wizard-of-Oz experiments for gesture interfaces, Prototype implementation. 			
Literature:			
<ul style="list-style-type: none"> • WIGDOR, Daniel and Dennis WIXON, 2011. <i>Brave NUI World: designing natural user interfaces for touch and gesture</i>. Amsterdam [u.a.]: Morgan Kaufmann. ISBN 978-0-12-382231-4 			

- SCHLEGEL, Thomas, 2013. *Multi-Touch: Interaktion durch Berührung* [online]. Berlin ; Heidelberg: Springer Vieweg PDF e-Book. ISBN 978-3-642-36113-5, 978-3-642-36112-8. Available via: <https://doi.org/10.1007/978-3-642-36113-5>.
- LAVIOLA, Joseph J., Ernst KRUIJFF and Ryan P. MCMAHAN, 2017. *3D user interfaces*. s. edition. Boston: Addison-Wesley. ISBN 978-0-13-403432-4
- PREIM, Bernhard and Raimund DACHSELT, . *Interaktive Systeme Band 2: User Interface Engineering*. Berlin [u.a.]: Springer.

Agile Project Management			
Module abbreviation:	UXDM_APM	Reg.no.:	5
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	1
Responsible for module:	Riener, Andreas		
Lecturers:	Haller, Gabriele		
Language of instruction:	English		
Credit points / SWS:	3 ECTS / 2 SWS		
Workload:	Contact hours:		24 h
	Self-study:		51 h
	Total:		75 h
Subjects of the module:	Agile Project Management (UXDM_APM)		
Lecture types:	UXDM_APM:		
Examinations:	schrP90 - written exam, 90 minutes		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>On successful completion of the course, students will be able to</p> <ul style="list-style-type: none"> • understand and explain the most important methods currently use for agile project management, • apply agile project management methods in corporate, start-up and scientific environments, • manage complex projects by the consistently focusing on generating customer value • use kanban and scrum methodologies in order to catalyze cultural change and deliver better business agility. 			
Content:			
<ul style="list-style-type: none"> • Foundations: agile mindset, project stages, breaking down complex tasks, prioritization, building project teams, avoiding common mistakes. • Scrum: getting started, team structure, sprints, metrics for tracking progress, anti-patterns, daily stand-ups, retro perspectives, scrum masters. • Kanban: getting started, cross-functional teams, kanban boards, differences to scrum, time management, leadership, practical examples, typical pitfalls. • Agility & UX: Target customers, customer needs, product strategy, MVP prototype, testing MVPs, rapid iterations, product-market fit. • Application: running self-organizing teams, managing stakeholders, feedback culture, continuous improvement, team collaboration, multi-team projects, cross location projects. 			
Literature:			
<ul style="list-style-type: none"> • FLEWELLING, Paul, 2018. <i>The Agile developer's handbook: get more value from your software development : get the best out of the Agile methodology</i>. Birmingham, UK: Packt Publishing. ISBN 978-1-78728-073-1, 1-78728-073-X 			

- SUTHERLAND, Jeff, 2015. *Scrum: the art of doing twice the work in half the time*. London: Random House Business Books. ISBN 978-1-847-94110-7
- KNIBERG, Henrik and Mattias SKARIN, 2010. *Kanban and Scrum: making the most of both*. s. l.: C4Media Inc.. ISBN 978-0-557-13832-6
- ANDERSON, David J., 2010. *Kanban: successful evolutionary change for your technology business*. Sequim, Wash.: Blue Hole Press. ISBN 978-0-9845214-0-1
- LEOPOLD, Klaus, 2017. *Practical Kanban: From team focus to creating value*. Vienna, Austria: LEANability Press.
- RIES, Eric, 2017. *The lean startup: how today's entrepreneurs use continuous innovation to create radically successful businesses*. 2017. edition. New York: Currency. ISBN 978-1-5247-6240-7
- OLSEN, Dan, 2015. *The lean product playbook: how to innovate with minimum viable products and rapid customer feedback* [online]. Hoboken: Wiley PDF e-Book. ISBN 978-1-118-96102-5, 1-118-96102-1. Available via: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119154822>.
- CHRISTENSEN, Clayton M., 2016. *The innovator's dilemma: when new technologies cause great firms to fail*. Boston, Massachusetts: Harvard Business Review Press. ISBN 978-1-4221-9602-1, 978-1-63369-178-0

Audio/Video Processing and 3D-Animation			
Module abbreviation:	UXDM_AVP	Reg.no.:	6
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	2
Responsible for module:	Riener, Andreas		
Lecturers:	UXDM_AVP: Aubreville, Marc; Saleem, Dina UXDM_AVPP: Aubreville, Marc; Saleem, Dina		
Language of instruction:	English		
Credit points / SWS:	8 ECTS / 5 SWS		
Workload:	Contact hours:		59 h
	Self-study:		141 h
	Total:		200 h
Subjects of the module:	6.1 Audio/Video Processing and 3D-Animation (UXDM_AVP) 6.2 Practical Training in Audio/Video Processing and 3D-Animation (UXDM_AVPP)		
Lecture types:	UXDM_AVP: SU/Ü - lecture with integrated exercises UXDM_AVPP: Pr - laboratory		
Examinations:	6.1 schrP90 - written exam, 90 minutes The teaching concept of this course closely connects theoretical foundations and practical applications. Thus, this course is designed workshop-like: The learning contents are presented in relation to concrete areas of application and are deepened by concrete group and single tasks. An active participation of the students is explicitly desired.		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
On successful completion of the course, students will be able to			
<ul style="list-style-type: none"> • understand the basic principles of different audio-visual media technologies, • apply appropriate audio-visual media solutions for solving concrete practical problems, • design and develop 3D-animations and integrate them in interactive systems, • develop and evaluate new combinations of audio-visual media solutions, • evaluate techniques for image recording, image recognition, audio recording and audio reproduction in a qualitative and quantitative manner. 			
Content:			
<ul style="list-style-type: none"> • Rendering: Rendering pipeline, Texture analysis, Shader (CPU & GPU), image based and procedural textures. • Video processing: Digital image recording, (digital) cameras, RAW workflow, HDR, Lightfield, Highspeed cameras, image processing, color science, standards. 			

- Audio processing: Audio recording, audio reproduction, microphones, digital audio recorders, binaural technologies, media formats, codecs, audio broadcast, standards.
- 3D animation: Lighting, animation, motion graphics, rule-based animation, dynamics, photo-realistic visualization, camera matchmoving, image compositing, stereoscopic visualization.

Literature:

- HUGHES, John F., 2014. *Computer graphics: principles and practice*. 3. edition. Upper Saddle River, N.J.: Addison-Wesley. ISBN 978-0-13-337372-1, 0-13-337372-X
- WILLIAMS, Richard, 2009. *The animator's survival kit: [a manual of methods, principles and formulas for classical, computer, games, stop motion and internet animators]*. E. edition. London: Faber and Faber. ISBN 978-0-571-23833-0, 978-0-571-23834-7
- THOMAS, Frank and Ollie JOHNSTON, c1995. *The illusion of life: Disney animation*. 1. edition. New York, NY: Disney Ed.. ISBN 0-7868-6070-7
- RICKITT, Richard, 2007. *Special effects: the history and technique*. 2. edition. London: Aurum. ISBN 1-84513-130-4, 978-1-84513-130-2
- BRINKMANN, Ron, 2008. *The art and science of digital compositing: techniques for visual effects, animation and motion graphics*. 2. edition. Amsterdam [u.a.]: Elsevier [u.a.]. ISBN 978-0-12-370638-6
- POYNTON, Charles A., 2012. *Digital video and HD: algorithms and interfaces*. 2. edition. Waltham, MA: Morgan Kaufmann. ISBN 978-0-12-391932-8, 0-12-391932-0
- BIRN, Jeremy, c2014. *Digital lighting & rendering*. 3. edition. [S.l.]: New Riders. ISBN 978-0-321-92898-6, 0-321-92898-9
- PALAMAR, Todd, 2015. *Mastering Autodesk Maya 2016: Autodesk Official Press*. 1. edition. ISBN 978-1-119-05982-0
- PARENT, Rick, 2012. *Computer animation: algorithms and techniques*. 3. edition. Amsterdam [u.a.]: Elsevier. ISBN 978-0-12-415842-9, 0-12-415842-0

Augmented and Virtual Reality Applications			
Module abbreviation:	UXDM_AVR	Reg.no.:	7
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	2
Responsible for module:	Riener, Andreas		
Lecturers:	UXDM_AVR: Grauschopf, Thomas UXDM_AVRP: Riegler, Andreas; von Sawitzky, Tamara		
Language of instruction:	English		
Credit points / SWS:	7 ECTS / 5 SWS		
Workload:	Contact hours:		59 h
	Self-study:		116 h
	Total:		175 h
Subjects of the module:	7.1 Augmented and Virtual Reality Applications (UXDM_AVR) 7.2 Practical Training in Augmented and Virtual Reality Applications (UXDM_AVRP)		
Lecture types:	UXDM_AVR: SU/Ü - lecture with integrated exercises UXDM_AVRP: Pr - laboratory		
Examinations:	7.1 LN - project work		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>In this module, students will be equipped with the theoretical and practical knowledge to enable them to participate in the design and development of AR/VR technology as well as providing transferable skills relevant in the wider area of interactive entertainment. This is an interdisciplinary course combining technical skills with an understanding of the psychology of VR/AR and the creativity need to develop novel experiences.</p> <p>On successful completion of this module, students will have</p> <ul style="list-style-type: none"> • the ability to review and assess the state-of-the-art in AR and VR technologies and use this knowledge to select appropriate technologies for a project, • the skills to critically evaluate current research and practice in virtual and mixed reality, • an interdisciplinary understanding of VR and AR encompassing psychology, technology and creative practice, • technical development skills that enable a personal VR and AR creation practice, • the expertise to critically assess AR/VR experiences in different creative contexts (e.g., gaming, education, healthcare, shopping or telepresence), • developed an AR/VR solution including implementation, testing, evaluation, demonstration, and documentation based on own ideas (in the practical). 			
Content:			
This course covers fundamentals and state-of-the-art in virtual and augmented reality, as well as related areas of 3D computer vision and graphics. Theoretical background as well as practical solutions and applications will			

be presented in the lectures. AR/VR topics covered in the course range from applications to Gaming, Entertainment, Education, Healthcare, Architecture, Engineering and Construction, Shopping, or Telepresence.

In the accompanied practical and based on the principle of problem-based learning, students will be asked to design an own project (individual or groups) from idea, via implementation, testing, evaluation, demonstration, to documentation. In this way they will experience the full lifecycle of a practical project in AR/VR, as they will face it once they leave the university in either industry or research. A default project will be suggested as fall back, still covering the full lifecycle except the idea.

Literature:

- AUKSTAKALNIS, Steve, 2017. *Practical augmented reality: a guide to the technologies, applications, and human factors for AR and VR*. Boston ; Columbus ; Indianapolis ; New York ; San Francisco ; Amsterdam ; Cape Town ; Dubai ; London ; Madrid ; Milan ; Munich [und 12 weitere]: Addison-Wesley. ISBN 978-0-13-409432-8, 0-13-409432-8
- PANGILINAN, Erin, Steve LUKAS and Vasanth MOHAN, April 2019. *Creating augmented and virtual realities: Theory and Practice for Next-Generation Spatial Computing*. F. edition. Beijing ; Boston ; Farnham ; Sebastopol ; Tokyo: O'Reilly. ISBN 978-1-492-04419-2
- GLOVER, Jesse and Jonathan LINOWES, 2019. *Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications*. Birmingham: Packt Publishing. ISBN 978-1-83864-818-3
- SCHMALSTIEG, Dieter and Tobias HÖLLERER, 2016. *Augmented reality: principles and practice*. Boston ; Columbus ; Indianapolis: Addison-Wesley. ISBN 978-0-321-88357-5, 0-321-88357-8

Design Strategy and Management			
Module abbreviation:	UXDM_DS	Reg.no.:	8
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	2
Responsible for module:	Ritzer, Veronika		
Lecturers:	Ritzer, Veronika		
Language of instruction:	English		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total:		125 h
Subjects of the module:	Design Strategy and Management (UXDM_DS)		
Lecture types:	UXDM_DS: SU/Ü - lecture with integrated exercises		
Examinations:	LN - oral exam, 15 minutes		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>On successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • analyze the function-related role of the design in the overall entrepreneurial context, • evaluate basic business goals, strategies and actions, • develop creative problem solving considering the basic knowledge content of design management, • recognize interactions between social and technical development and reflect creative innovations from a specific technical-sociological perspective, 			
Content:			
<ul style="list-style-type: none"> • Company forms and organizational principles. • The role of design in terms of business success. • Business-related planning of design processes. • Importance of invention and innovation in an entrepreneurial context. • Social-structural aspects of user groups, in particular milieu-specific forms of use-relevant interests. • Coevolution of media and society. • Modern public in the epoch of digitization. 			
Literature:			
<ul style="list-style-type: none"> • BEST, Kathryn, 2015. <i>Design management: managing design strategy, process and implementation</i>. S. edition. London: Bloomsbury. ISBN 978-1-4725-7367-4 • WITTMANN, Robert G., Matthias REUTER and Michael JÜNGER, 2019. <i>Strategy Design Innovation: How to create business success using a systematic toolbox</i>. • LEVY, Jaime and Jason CALACANIS, 2015. <i>UX strategy: how to devise innovative digital products that people want</i>. 1. edition. Sebastopol: O'Reilly. ISBN 978-1-449-37286-6, 1-449-37286-4 			

Project			
Module abbreviation:	UXDM_PR	Reg.no.:	9
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	2
Responsible for module:	Riener, Andreas		
Lecturers:	Neff, Christian; Riener, Andreas; Schuß, Martina		
Language of instruction:	English		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total:		125 h
Subjects of the module:	Project (UXDM_PR)		
Lecture types:	UXDM_PR: Prj - project		
Examinations:	<p>project report (min. 5 pages excluding tables and graphs, font size 10-12 pt.) and a presentation (10-15 minutes)</p> <p>Basic knowledge of (agile) project management and PM tools will be required.</p> <p>Primary and secondary literature will be provided in the course (depending on the topic of the project).</p>		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The project serves the development of interdisciplinary contexts as well as the development of methodological and social competence. This involves</p> <ul style="list-style-type: none"> • the development of alternatives from literature and/or lectures to solve a given problem, • the implementation of a solution (approach), and • the presentation of the results in a project report. <p>At the same time, the project serves to gain experience in interdisciplinary cooperation and the organization of team processes as well as in the application of creativity techniques, moderation and presentation.</p>			
Content:			
<p>Working on a semester-related project task in a team (size ca. 10 students). In many cases, the offered projects are carried out in cooperation with external companies or the university's research center FORTEC. Alternatively, lecturers also specifically present project topics that are to be processed as part of their teaching or research activities.</p> <p>Project management and organization are carried out by students. The lecturer acts only as a coach and/or client (product owner). The project management method can be classical methods or agile methods such as Scrum or Kanban. The decision about which method to use is up to the project team as are the tools that are used for project management.</p> <p>At the beginning of the project, the lecturer clearly communicates his expectations regarding the dates, form and proof of the individual achievements to be provided by all students. The project team agrees with the</p>			

lecturer on the forms of communication and documentation to be adhered to by all project participants (students, lecturer, client) during the project period.

To clarify are:

- frequency and duration of planning sessions
- type and conduct of meetings (shared or virtual / electronic)
- regular meetings (possibly daily in the form of Scrum-Meatings etc.)
- type and scope of deliverables
- type and extent of individual amounts by students
- criteria for assessment/ rating by the lecturer

Topics of the projects offered in this term are: TBD

Literature:

Master Thesis			
Module abbreviation:	UXDM_MT	Reg.no.:	11.1
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	3
Responsible for module:	Riener, Andreas		
Lecturers:			
Language of instruction:	English		
Credit points / SWS:	28 ECTS / 0 SWS		
Workload:	Contact hours:		0 h
	Self-study:		750 h
	Total:		750 h
Subjects of the module:	Master Thesis (UXDM_MT)		
Lecture types:	UXDM_MT: MA - Master thesis		
Examinations:	Master-Thesis		
	<p>A master's thesis contains 60-80 pages (format A4, font size 10-12pt) plus preliminary pages including a table of contents, a list of references and optional appendices. It should demonstrate sound theoretical and methodological knowledge and expertise in an area or issue relevant to the content of the master program.</p> <p>Literature: Own research, depending on the subject of work.</p>		
Prerequisites according examination regulation:			
Acquirement of 30 ECTS in form of completed modules according to §9(1)			
Recommended prerequisites:			
All theory modules should have been attended and successfully completed, at least those which are closely related to the area of the thesis' topic.			
Objectives:			
<p>In the master thesis, the student will have to demonstrate its ability to scientifically work on a current research topic in the broader domain of user experience design, HCI, interaction design. The thesis needs to be completed within a specified time frame (six month, according to the SPO, §9(2)).</p> <p>The master's thesis will show that the student:</p> <ul style="list-style-type: none"> • is able to define and process the chosen research problem, • has become familiar with the subject matter of the thesis and the literature of the field of study, • is able to come-up with a research approach and define research questions/hypotheses, • is able to execute research on the chosen problem independently, • has a command of the theories and appropriate research methods, • is able to develop a solution or prototype, collect data, run a user study or perform user research • has the expertise to evaluate data and present the results in a scientifically appropriate form, • draw defensible conclusions and make recommendations. <p>In addition, the student</p> <ul style="list-style-type: none"> • shows a readiness in academic thinking, • has skills in academic communication, 			

- is able to give constructive criticism,
- has learned to manage different phases of the research process.

After completing the thesis, a student will be able to show in-depth knowledge of the chosen topic, mastery of appropriate theories and research methods and capability of scientific academic writing.

The objective of the accompanied master thesis seminar is in supporting the progress of the thesis and to learn presenting and defending research results to the community.

Content:

The master thesis is a self study aimed at deepening a student's understanding of a selected key subject area in user experience design, HCI, interaction design, usability research, etc. The work should have elements of research (new knowledge or methods). It typically starts with a related work analysis of the state-of-the-art, continued with the problem statement. The thesis report must further contain research questions/hypotheses to be answered with a usability study. Prototypes or products developed within the the work may be included as part of the thesis. Focus should be on the results of the study, data evaluation and interpretation as well as the derivation of recommendations.

Literature:

- FIELD, Andy and Graham HOLE, ca. Jan. 2020. *How to design and report experiments*. 2. edition. Los Angeles: SAGE Publications Ltd. ISBN 978-0-85702-829-7
- LAZAR, Jonathan, Jinjuan Heidi FENG and Harry HOCHHEISER, 2017. *Research methods in human-computer interaction*. S. edition. Cambridge, MA: Morgan Kaufmann Publishers, an imprint of Elsevier. ISBN 978-0-12-809343-6, 0-12-809343-9

Master Thesis Seminar			
Module abbreviation:	UXDM_MTS	Reg.no.:	11.2
Curriculum:	Programme	Module type	Semester
	User Experience Design	Compulsory Subject	3
Responsible for module:	Riener, Andreas		
Lecturers:			
Language of instruction:	English		
Credit points / SWS:	2 ECTS / 1 SWS		
Workload:	Contact hours:		12 h
	Self-study:		38 h
	Total:		50 h
Subjects of the module:	Master Thesis Seminar (UXDM_MTS)		
Lecture types:	UXDM_MTS: S - seminar		
Examinations:	Presentation, 30 minutes		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The thesis seminar will accompany the master thesis. Each student is required to present the results of his/her master thesis (prior to the submission of the final version). Participation in the seminar sessions is compulsory, and the students are required to actively take part in the seminar by asking questions and providing argued comments/feedback.</p> <p>Students will be able to design, plan, and carry out research necessary for the master thesis. Students will have acquired the ability to write effectively and communicate individual research findings in the thesis document. Attention will be given to:</p> <ul style="list-style-type: none"> performing related work analysis, formulating the research question, research objectives, structuring the thesis, planning the research, effective writing. <p>Students are able</p> <ul style="list-style-type: none"> to search for high-quality scientific information systematically and object-oriented have a basic understanding of strategy and methodology of researching information for scientific papers learn the steps necessary to create a scientific work act responsibly with information: they can quote scientifically correct, create a bibliography for a research paper and interpret references to present and defend research results and to hold a scientific discourse 			

Content:

The purpose of the master's thesis seminar is to assist students through all stages of the master's thesis. The students of the program are expected to, firstly, produce a concrete master's thesis research plan. The master's thesis seminar supplies guidance in the process of revising the master's thesis proposal and moving from the proposal towards conceptual and empirical work on the master's thesis itself (this will be done bilaterally between student and teacher). The classroom-section of the master's thesis seminar provides a forum for the presentation and in-depth discussion of the master's thesis proposals (for new students) and the results of the thesis (for those ready to submit).

Literature:

- ZOBEL, Justin, 2014. *Writing for Computer Science* [online]. London ; Heidelberg ; New York ; Dordrecht: Springer PDF e-Book. ISBN 978-1-4471-6639-9, 978-1-4471-6638-2. Available via: <https://doi.org/10.1007/978-1-4471-6639-9>.

4.2 Individual Electives

German A1 intensive			
Module abbreviation:	SZ_GERM_INTENS_A1	Reg.no.:	10
Curriculum:	Programme	Module type	Semester
	User Experience Design	Elective subject	
Responsible for module:	Riener, Andreas		
Lecturers:	Copelea, Michaela		
Language of instruction:	German		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total:		125 h
Subjects of the module:	German A1 intensive (SZ_GERM_INTENS_A1)		
Lecture types:	SZ_GERM_INTENS_A1: SU/Ü - lecture with integrated exercises		
Examinations:	LN - written exam, 90 minutes		
	Minimum number of students: 8		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students are able to</p> <ul style="list-style-type: none"> • understand and use familiar everyday expressions and simple phrases, which relate to the satisfaction of concrete needs • introduce themselves and others • ask and answer questions about personal details (name, origin, interests, ...) • communicate in a simple manner 			
Content:			
<p>Acquisition of most fundamental language concepts allowing students to communicate in everyday situations, evaluate situations, communicate wishes and preferences and gain basic communication skills, e.g.</p> <ul style="list-style-type: none"> • alphabet, numbers and ordinal numbers • pronunciation • word types (nouns, verbs, adjectives, pronouns, prepositions) • tenses (present tense, perfect tense, past tense) • most common regular and irregular verbs, reflexive verbs, modal verbs, separable verbs • negation and questions 			

Literature:

- KRENN, Wilfried and Herbert PUCHTA, 2016. *Motive: Kompaktkurs DaF : Deutsch als Fremdsprache : Kursbuch, Lektion 1–30 : A1, A2, B1*. München: Hueber Verlag. ISBN 978-3-19-001878-9, 3-19-001878-2

Interface Design			
Module abbreviation:	UXDM_FWID	Reg.no.:	10
Curriculum:	Programme	Module type	Semester
	User Experience Design	Specialised Elective Subject	1
Responsible for module:	Stahl, Ingrid		
Lecturers:	Stahl, Ingrid		
Language of instruction:	English		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total:		125 h
Subjects of the module:	Interface Design (UXDM_FWID)		
Lecture types:	UXDM_FWID: SU/Ü - lecture with integrated exercises		
Examinations:	LN - project work		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>On successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> • know basic aspects of interface design, including design and technical aspects, • appropriate technical as well as methodical skills, • acquire knowledge about development history, conception and design of user interfaces, • are capable of assigning potential areas of application and designing appropriate usage and operating scenarios, • know basic methods of conception, design, linear and interactive simulation and the prototypical realization of interfaces. 			
Content:			
<ul style="list-style-type: none"> • Development history of graphic surfaces and input/output devices. • Conception, design, variant development of hardware and/or software interfaces. • Evaluation (visual design, interaction design) as well as prototypical realization. • Getting to know the users with their physical, motor, cognitive and perceptual abilities. • Introduction to the use of design templates (design manuals and style guides), design, presentation and simulation tools and their use. • Orientation knowledge in development and realization processes. 			
Literature:			
<ul style="list-style-type: none"> • NORMAN, Donald A., 1988. <i>The psychology of everyday things</i>. New York: Basic Books. ISBN 0-465-06709-3 • NORMAN, Donald A., 1993. <i>Things that make us smart: defending human attributes in the age of the machine</i>. 2. edition. Reading, Mass. u.a.: Addison-Wesley. ISBN 0-201-58129-9 			

- SHNEIDERMAN, Ben, Catherine PLAISANT and Maxine COHEN, 2018. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. s. edition. ISBN 978-1-292-15391-9
- , 1992. *Macintosh human interface guidelines*. 1. edition. Reading, Mass. u.a.: Addison-Wesley. ISBN 0-201-62216-5
- , 1996. *Newton 2.0 user interface guidelines*. Reading, Mass. [u.a.]: Addison-Wesley. ISBN 0-201-48838-8

Mobile App Development			
Module abbreviation:	UXDM_FWMAD	Reg.no.:	10
Curriculum:	Programme	Module type	Semester
	User Experience Design	Specialised Elective Subject	2
Responsible for module:	Nestler, Simon		
Lecturers:	Nestler, Simon		
Language of instruction:	English		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total:		125 h
Subjects of the module:	Mobile App Development (UXDM_FWMAD)		
Lecture types:	UXDM_FWMAD:		
Examinations:	LN - presentation		
	The teaching concept of this course closely connects theoretical foundations and practical applications. Thus, this course is designed workshop-like: The learning contents are presented in relation to concrete areas of application and are deepened by concrete group and single tasks. An active participation of the students is explicitly desired.		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
On successful completion of the course, students will be able to			
<ul style="list-style-type: none"> • create web apps that behave just like native apps on iOS and Android (progressive web apps), • apply the push notification approach for creating new app user experiences, • successfully deal with new user experience opportunities and challenges of progressive web apps, • implement the offline-first paradigm and deal with loss of connectivity 			
Content:			
<ul style="list-style-type: none"> • Foundations: Web development, traditional app development, challenges, best practices, progressive web apps, Popular PWAs. • Technologies: Load times, push notifications, offline access, home screen shortcuts, app-like experience, browser APIs, service workers, full-screen web apps. • PWA Frameworks: Angular, Cache API, Push API, Payment Request API. • Web App Design: App design, native fonts, CSS. • Evaluation: Evaluating App Experiences, Lighthouse. 			
Literature:			
<ul style="list-style-type: none"> • ATER, Tal, 2017. <i>Building Progressive Web Apps: bringing the power of native to the browser</i>. F. edition. Beijing ; Boston ; Farnham: O'Reilly. ISBN 978-1-4919-6165-0 			

- LIEBEL, Christian, 2019. *Progressive Web Apps: das Praxisbuch*. 1. edition. Bonn: Rheinwerk Computing. ISBN 978-3-8362-6494-5, 3-8362-6494-3
- NEIL, Theresa, c2014. *Mobile design pattern gallery: UI patterns for smartphone apps*. 2. edition. Sebastopol, CA: O'Reilly. ISBN 978-1-4493-6363-5
- JOOSR, , 2016. *A Joosr guide to How to build a billion dollar app by George Berkowski*. Hove: Joosr Ltd. ISBN 978-1-78567-516-4, 1-78567-516-8
- SEMLER, Jan and Kira TSCHERSCHKE, 2019. *App-Design*. 2. edition. Bonn: Rheinwerk Verlag. ISBN 978-3-8362-7050-2, 3-8362-7050-1
- STAUFFER, Matt, 2018. *Laravel: up and running: a framework for building modern PHP apps*. T. edition. Beijing ; Boston ; Farnham ; Sebastopol ; Tokyo: O'Reilly. ISBN 978-1-491-93608-5
- TIDWELL, Jenifer, Charles BREWER and Aynne VALENCIA, 2020. *Designing interfaces: Patterns for effective interaction design*. T. edition. Beijing ; Boston ; Farnham ; Sebastopol ; Tokyo: O'Reilly. ISBN 978-1-492-05196-1