The Faculty of Engineering and Science
The Study Board for Media Technology

AALBORG UNIVERSITY
DENMARK

Curriculum for the bachelor's program in Medialogy

Aalborg University
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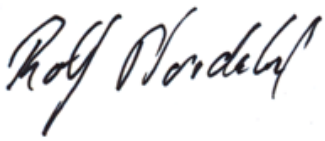
Eskild Holm Nielsen
dekan

Campus Aalborg, Esbjerg and Copenhagen

Preface:

Pursuant to Act 367 of March 25, 2013 on Universities (the University Act) with subsequent changes, the following curriculum for the Bachelor's program in Medialogy is established. The program also follows the Framework Provisions and the Examination Policies and Procedures for the Faculty of Engineering and Science.

Uffe Kjærulff
Head of School of Information and
Communication Technology (SICT)
Aalborg University, December 2013



Rolf Nordahl
Chairman
Studyboard for Media Technology
Aalborg University, December 2013

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Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in ministerial orders

The Bachelor's program in Medialogy is organized in accordance with the Ministry of Science, Technology and Innovation's Ministerial Order no. 1520 of December 19, 2013 on Bachelor's and Master's Programs at Universities (the Ministerial Order of the Study Programs) and Ministerial Order no. 1518 of December 19, 2013 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 1487 of December 18, 2013 (the Admission Order) and Ministerial Order no. 250 of March 15, 2007 (the Grading Scale Order) with subsequent changes.

1.2 Faculty affiliation

The Bachelor's program falls under the Faculty of Engineering and Science, Aalborg University.

1.3 Study Board affiliation

The Bachelor's program falls under the Study Board for Media Technology at School of Information and Communication Technology.

Chapter 2: Admission, Degree Designation, Program Duration and Competence Profile

2.1 Admission

Admission to the Bachelor's program in Medialogy requires an upper secondary education.

The program's specific entry requirements are:

- English B *or* an acceptable IELTS test score
- Mathematics B or better (or equivalent level or better from foreign upper secondary institutions)

cf. the Admission Order.

The University can stipulate requirements concerning conducting additional exams prior to the start of study.

2.2 Degree designation in Danish and English

The Bachelor's program entitles the graduate to the designation:

- Bachelor (BSc) i medialogi. The English designation is: Bachelor of Science (BSc) in Medialogy.

2.3 The program's specification in ECTS credits

The Bachelor's program is a 3-year, research-based, full-time study program. The program is set to 180 ECTS credits.

2.4 Competence profile on the diploma

The following will appear on the diploma:

- A graduate of the Bachelor's program has competences acquired through an educational program that has taken place in a research environment.
  A graduate of the Bachelor's program has fundamental knowledge of and insight into his/her subject's methods and scientific foundation. These properties qualify the graduate of the Bachelor's program for further education in a relevant Master's program as well as for employment on the basis of the educational program.

2.5 Competence profile of the program

Students who complete the Bachelor's program in Medialogy will obtain the following qualifications:

Knowledge	• Understanding of the basic function of the human senses, and their interaction, as they function in the perception of the surroundings in general and media in particular • Understanding of the duality between, on the one hand, computer-based recording and analysis of digital signals, and on the other, computer-based generation/synthesis and presentation of the corresponding signals • Understanding of the interactive processes between humans, computers and machines • Understanding of the structures of narrative forms and dissemination in relation to media and media technology characteristics, and understanding of the interplay between form and content regarding media and media technologies • Understanding of media history, including cultural, ethnographical, social and sociological perspectives of media • Understanding of media technological theories and methods, and of their respective foundations and validity areas. This concerns core media technological areas such as audio processing/analysis, image processing/analysis, computer graphics modelling/animation and rendering, computer games and virtual reality • Understanding of aspects of programming, from control structures to design patterns and communication protocols

Skills	• Ability to identify, phrase and operationalize constraints on a media technological system, taking into account the aim of the system, the users and the technological affordances • Ability to analyse and evaluate the validity, applicability and performance of media technological solutions in the context of a given problem domain • Ability to apply state-of-the-art media technologies in designing and implementing interactive systems • Ability to synthesize complex systems from existing elements, and/or to synthesize new functionality, methodology or knowledge regarding subsystems • Ability to design evaluations of, and to evaluate, media technological systems in relation of identified metrics and goals • Ability to communicate analyses, designs, implementations, and evaluations to peers orally, and in various forms of writing
Competences	• Ability to apply acquired skills to working independently in teams of peers and/or in interdisciplinary teams • Ability to identify own and well as group-related learning needs • Ability to independently acquire knowledge and connect new knowledge with existing knowledge and critically assess both • Ability to clearly and structurally disseminate relevant information, taking into account the target audience and show an alert and attentive attitude to other participants • Ability to define and respect own, and possibly also other participants', function compared to the whole – that is both to lead and be guided • Able to contribute to the joint development of knowledge and experience formation

Chapter 3: Content and Organization of the Program

The program is structured in modules and organized as a problem-based study. A module is a program element or a group of program elements, which aims to give students a set of professional skills within a fixed time frame specified in ECTS credits, and concluding with one or more examinations within specific exam periods. The examinations are defined in the curriculum.

The program is based on a combination of academic, problem-oriented and interdisciplinary approaches and organized based on the following work and evaluation methods that combine skills and reflection:

- lectures
- classroom instruction
- project work
- workshops
- exercises (individually and in groups)
- project work and exercises in labs
- teacher feedback
- reflection
- portfolio work

The BSc education in Medialogy is taught in English. All activities, including the above stated, are carried out in English. All exercise work and deliverables, project-work (as well as any documentation in connection to these) delivered by the student must be written in English and all exams are carried out in English. In accordance with the current Framework Provisions, The Study Board for Media Technology may choose to exempt from this rule in extra-ordinary cases, which in principle requires a well-documented application from the student and/or teacher.

Overview of the program:

All modules are assessed through individual grading according to the 7-point scale *or* Pass/Fail. All modules are assessed by external examination (external grading) or internal examination (internal grading or assessment by the supervisor only).

Semester 1: Designing from Both Sides of the Screen					
Semester	Module	ECTS	Assessment	Exam	Type
1st	Creative Play - Applied Technology	5	Pass/Fail	Internal	Mandatory
1st	Designing from Both Sides of the Screen	10	7-point scale	Internal	Mandatory
1st	Audio-Visual Sketching	5	7-point scale	Internal	Mandatory
1st	Introduction to Programming	5	7-point scale	Internal	Mandatory
1st	Problem Based Learning in Science, Technology and Society	5	Pass/Fail	Internal	Mandatory
Semester 2: Interaction Design					
Semester	Module	ECTS	Assessment	Exam	Type
2nd	Human-Computer Interaction	15	7-point scale	External	Mandatory

2nd	Interaction Design	5	7-point scale	Internal	Mandatory
2nd	Mathematics for Multimedia Applications	5	7-point scale	Internal	Mandatory
2nd	Programming for Interaction	5	7-point scale	Internal	Mandatory
Semester 3: Visual Computing – Human Perception					
Semester	Module	ECTS	Assessment	Exam	Type
3rd	Visual Computing-Human Perception	15	7-point scale	External	Mandatory
3rd	Image Processing	5	7-point scale	Internal	Mandatory
3rd	Human Senses and Perception	5	7-point scale	Internal	Mandatory
3rd	Programming of Complex Software Systems	5	7-point scale	Internal	Mandatory
Semester 4: Sound Computing and Sensor Technology					
Semester	Module	ECTS	Assessment	Exam	Type
4th	Sound Computing and Sensor Technology	15	7-point scale	Internal	Mandatory
4th	Audio Processing	5	7-point scale	Internal	Mandatory
4th	Design and Analysis of Experiments	5	7-point scale	Internal	Mandatory
4th	Physical Interface Design	5	7-point scale	Internal	Mandatory
Semester 5: Audio-Visual Experiments					
Semester	Module	ECTS	Assessment	Exam	Type
5th	Audio-Visual Experiments	15	7-point scale	External	Mandatory
5th	Computer Graphics Programming	5	7-point scale	Internal	Mandatory
5th	Rendering and Animation Techniques	5	7-point scale	Internal	Mandatory
5th	Screen Media	5	Pass/Fail	Internal	Mandatory
Semester 6: Interactive Systems Design					
Semester	Module	ECTS	Assessment	Exam	Type
6th	BSc Project (Interactive Systems Design)	15	7-point scale	External	Mandatory
6th	Artificial Intelligence Programming	5	7-point scale	Internal	Elective
6th	Ethnographically Informed Design	5	7-point scale	Internal	Elective
6th	Real-time Interfaces and Interactions	5	7-point scale	Internal	Elective
6th	Theory and Practice of Game Design and Development	5	7-point scale	Internal	Elective
6th	Technologies for Web and So-	5	7-point scale	Internal	Elective

	cial Media				
	Total	180			

On the 6^{6h} semester students must choose 3 out of 5 elective courses (15 ECTS in total).

Most courses introduce theories of science, scientific methods and scientific theories, which are specific to the topic of the courses and the overall education. The Medialogy curriculum includes theories of science and scientific theories and methods in courses (among others) such as interaction design, audio processing, in the scientific disciplines of Screen Media and audio-visual sketching, mathematics and programming, human and computer audition, vision and touch, evaluation of media products. Theory of science, scientific theory and scientific methods in general are included in the course Problem Based learning in Science, Technology and Society. Moreover, the students develop their skills in this area in their project work, where they will apply scientific methods in practice and reflect on their applicability in the subsequent process and project evaluation.

3.1 1st semester

Title:
Creative Play – Applied Technology
(Kreativ leg – teknologisk udformning)

Size: 5 ECTS

Prerequisites:
No special prerequisites for the module.

Objectives:
Students who complete the project module will be able to demonstrate preliminary learning outcomes for advancing as a student. Expectations are that the student can design, partly implement and assess the development of a media oriented work, such as a poster, computer game, interactive homepage, etc.

Students who complete the project module will be able to:

Knowledge

- Explain problem-based study and the Aalborg model of PO PBL (**understanding**)
- Name prerequisites of group work ethics and organization (**knowledge**)
- Describe typical work processes in a problem based project related to Media Technology (**knowledge**)
- Describe individual as well as organizational learning processes (**knowledge**)

Skills

- Organize a short period of collaboration in-group and with a supervisor (**application**)
- **Apply** basic principles of scientific work and academic honesty including plagiarism rules and proper citations
- **Apply** taught methods to conceptualize, plan and organize own learning and knowledge sharing in a group situation
- Demonstrate basic analysis of media-oriented work (**analysis**)
- **Evaluate** practical problems and select relevant solutions in a media oriented context
- Formulate basic reflections and results of the problem based project work: orally, graphically and in writing (**synthesis**)

Competencies

- Take independent responsibility of one's own learning during a shorter project period (**application**)

Type of instruction:
Academically supervised student-governed problem oriented project work.

Exam format:
Oral group examination with internal censor based on a written project report and a media-technological product plus a written process analysis. The Study Board for Media Technology may decide or exempt that only a technical artifact with documentation can be the basis for the individual oral examination. Furthermore, The Study Board for Media Technology may decide or exempt from the demand for a process analysis.

The assessment is performed with the Pass/Fail grade.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Title:
Designing from Both Sides of the Screen
(Design fra begge sider af skærmen)

Size: 10 ECTS

Prerequisites:
The students must have passed the module: Creative Play – Applied Technology (Kreativ leg - teknologisk udformning)

Objectives:
To provide the student with practical experience defining a project within the area of information technology, communication and new media, which includes use of programming, to implement the project by working in groups and to document the solution in a project report.

Students who complete the project module will be able to:

Knowledge

- **Explain** basic theory, methods and practices used in media technology that relate to the project (**understanding**)
- **Describe** basic concepts of problem-based study and the Aalborg model of PO PBL (**knowledge**)

Skills

- Compose a problem formulation from a larger problem area that can be answered or addressed within the scope of the project (**synthesis**)
- **Understand** how the target group from the problem formulation interacts in a real world context of use with similar media products or artifacts, which address the initial problem formulation
- Apply scientific theory and methods in a media technology oriented project and discuss basic reflections on their use in the project **(analysis)**
- **Apply** a programming language and implement parts of programs or small programs in order to solve a specific problem
- Carry out a basic evaluation of an artifact with the target user group (ideally not a convenience sample) or domain experts (**application**)
- Relate findings from the evaluation to a wider context (**analysis**) and apply knowledge from the field of Science, Technology and Society (STS) to identify relevant contextual perspectives (**understanding**)
- Organize and communicate the reflections and results of the problem based project work; orally, graphically and in writing – for the latter by applying a provided template or creating their own version of it (**understanding**)
- Organize and manage a longer-term project considering group and supervisor collaboration (**application**)
- **Analyse** the process involved in carrying out the project from a project management point of view and reflect on individual as well as group learning (**analysis**)

Competencies

- Use proper terminology to discuss the project and Media Technology related aspects thereof (**understanding**)
- Take responsibility of one's own learning during a 2-3 month project period and generalize the gained experiences (**synthesis**)

Type of instruction:
Academically supervised student-governed problem oriented project work.

Furthermore the Study Board for Media Technology wishes to note for implementation:
1) Students have to prepare a written P1 process analysis
2) Students will get support to identify relevant contextual perspectives by receiving comments on papers and feedback at group meetings.
3) Students will get support to transfer project management theory to the projects by a PBL-seminar and related to this comments on papers as well as presentations in order to secure action on a mid-term process-analysis
4) A written comment to the group's process analysis will be provided to support project-examination

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:
Oral group examination with internal censor based on a written project report, evidence of design activities and their evolution (e.g., through sketchbooks, log books or a portfolio) and a media-technological product plus an A/V production that illustrates and summarizes the project plus a written process analysis.

The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Title:
Audio-Visual Sketching
(Audio-Visuel Sketching)

Size: 5 ECTS

Prerequisites:
No special prerequisites for the module.

Objectives:
Students who complete the course module will obtain the following qualifications:

Knowledge

- **Understanding** the fundamentals of camera usage and how it correlates with virtual cameras in 3D modelling software
- **Understanding** the fundamental principles of lighting a scene, both actual and in a virtual 3D environment
- **Knowledge** of the fundamentals of 3D modelling and compositing
- **Knowledge about** basic 2D and 3D animation principles, history, theories and techniques
- **Understanding** the concept and practice of key framing and in-betweens in animation
- **Knowledge of** how to combine virtual and physical objects in an animated sequence
- **Understanding** A/V and film techniques, such as editing, framing, image composition, types of shots, camera movement, focus, etc.
- **Knowledge** of basic sound-recording and –production, including knowledge about microphone types
- **Knowledge** of fundamental storytelling and storyboarding techniques in animation and A/V-productions
- **Knowledge** of the production pipeline in animation and A/V productions
- **Understanding** of sketching of objects, characters and storyboards and modelling of physical objects
- **Knowledge** of physical prototyping, including knowledge of preparing 3D models for 3D printing

Skills

- **Apply** knowledge of sketching of objects, characters and storyboards and physical modelling for prototypes, animatics and pre-visualizations
- **Apply** the fundamentals of key framing to create traditional animation
- **Apply** knowledge about 3D design, modelling, animation, and lighting to render a computer animated 3D scene
- **Apply** knowledge about principles and theories of traditional and 3D animation techniques, A/V-production theories and compositing to produce a short A/V production

Competencies

- **Knowledge** of fundamentals of software applications within 3D modelling, animation and A/V-production
- **Apply** camera and storytelling techniques in a production
- **Analyse** and **apply** basic lighting set-ups and compositing techniques, e.g., green screen
- **Evaluate** the use of techniques and principles in A/V productions

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in. If the student hands in a paper/exercise after the deadline, the student has used an examination attempt.

Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Title:
Introduction to Programming
(Grundlæggende programmering)

Size: 5 ECTS

Prerequisites:
No special prerequisites for the module.

Objectives:
Students who complete the module obtain a solid foundation in working with computers and other digital devices, which will be built upon in future coursework to enable programming for different media platforms and working with analogue and digital sensors.
Furthermore, the student will be provided with a foundation and basic introduction to the systematic development of programs. The student should acquire an understanding of basic concepts and mechanisms in an imperative programming language such that the student is able to use the language and associated library to implement small programs.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Understanding** of control flow structures, both branching (e.g., if, switch), and loops (e.g., for, while)
- **Understanding** variables, data types and structures (e.g., arrays, structs)
- **Understanding** functions including function parameters, function output, and recursion
- **Understanding** of design methodologies for programming and **understanding** of the distinction between good and bad programming practices
- **Understanding** top-down and bottom-up problem solving strategies.
- **Understanding** of the basic architecture and terminology related to computers (CPU, RAM, hard drive, I/O devices)
- **Understanding** of basic terminology related to information storage and processing (bits, bytes, binary and hexadecimal numbers, floating point numbers, 2's complement)
- **Understanding** of the basic steps of producing a runnable programme using an integrated development environment (IDE) (writing code, compiling, linking, debugging)
- **Understanding** of the basic steps of converting mathematical expressions into code (e.g., basic trigonometric functions and vector arithmetic)
- **Understanding** of the basic 2-D geometry needed to produce interactive 2-D graphics, e.g., vector arithmetic and trigonometric functions

Skills

- Ability to **apply** knowledge to the design of a simple event-driven interactive interface, e.g., a simple game
- Ability to interpret and **analyse** programming code
- Ability to **apply** programming skills to the implementation of input devices, e.g., keyboard, mouse
- Ability to **apply** programming skills to the design and implementation of basic functions and data structures
- Make use of built-in API functions and data types in synthesising new programmes (**application**)
- Ability to **apply** knowledge to the systematic design of software with proper documentation
- Must be able to plan and perform systematic test of small programs (e.g., black box and white box testing approaches) (**application**)

- Ability to **apply** programming skills to the implementation of basic mathematical expressions needed to create interactive 2D graphics
- Must be able to discuss/assess the quality of a given program (**analysis**)
- Must be able to use an IDE for software development, including a debugger (**application**)

Competencies

- **Evaluate** existing code, judge its design, and recommend changes
- Must have competencies in using programming to solve programming tasks, especially programming tasks related to medialogy, communication and IT/new media (**application**)

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in. If the student hands in a paper/exercise after the deadline, the student has used an examination attempt.

Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Title:

Problem Based Learning in Science, Technology and Society

(Problembaseret læring i videnskab, teknologi og samfund)

Size: 5 ECTS

Prerequisites:
No special prerequisites for the module.

Objectives:
The students shall theoretically as well as practically understand how to plan and carry out a basic scientific problem-based project with technological, social and humanistic relevance. This includes an understanding of how technological aspects and contextual circumstances can be identified and included in the development of a problem solution.

Students who complete the project module will be able to:

Knowledge

- Must have **knowledge** of basic learning theories
- Must have **knowledge** of project planning and management techniques
- Must have **knowledge** of different approaches of problem based learning (PBL) including the Aalborg model of PO PBL
- Must have **knowledge** about the history of media and its social-cultural context/application
- Must have **knowledge** about what a technology is, including how it can be assessed in a larger context, e.g., using technology assessment techniques
- Must be able to **describe** fundamental concepts regarding creativity and **relate** them to creative methods applied in a problem solving context

Skills

- Must be able to **apply** basic principles and study techniques related to planning and management of a problem-based project; especially including phases in a problem-oriented project, from initial problem to problem analysis and problem formulation, design, implementation and evaluation
- Must be able to analyse and evaluate the organisation of the project group work, identifying strong and weak factors within, e.g., group dynamics, team roles, internal/external communication and time management; reflecting on improvements for future situations and documenting the applied methods for the analysis **(application)**
- Must be able to analyse group conflicts: causes and possible solutions **(application)**
- Must be able to analyse and evaluate own contribution to studying and learning, e.g., by identifying continuous course of events influencing own learning, reflecting on how these events form the learning processes, learning style and the personal study experience **(application)**
- Must be able to **apply** basic methods for analysis and evaluation of a Medialogy-problem from a scientific, ethical, technological and societal perspective
- Must be able to **apply** basic creative design methods for problem solving tasks, especially considering wider contexts, e.g., assessing life styles, consumption, communication and common practices

Competencies

- Must be able to apply knowledge (**application**) and **understanding** regarding being part of a team-based project work
- Must be able to **understand** and communicate project work (**application**)
- Must be able to **analyse** own learning processes
- Must be able to **analyse** and document learning processes within the group

- Must be able to establish optimal collaborative learning processes (**application**)
- Must be able to apply knowledge and understanding of science, technology and society (**application**) from a technological and holistic perspective
- Must be able to **understand** basic methodological strategies for evaluating Medialogy problems (e.g., applying concepts from Theory of Science for evaluating projects)

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in. If the student hands in a paper/exercise after the deadline, the student has used an examination attempt.

Individual oral or written examination with internal censor. The assessment is performed with the Pass/Fail grade.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

3.2 2nd semester

Title:
Human-Computer Interaction
(Menneske-Computer Interaktion)

Size: 15 ECTS

Prerequisites:
1st semester or similar

Objectives:
After completing the project module the student shall be able to demonstrate knowledge, skills and competencies in how to design, develop and evaluate an artefact, such as a desktop or a mobile application, using a user-centred approach. The students shall develop their theoretical and methodological skills by designing an application complete with a user interface. They shall examine new modalities for individual and/or group perception, action and experience. With the aim of delivering unified experiences and/or new forms of perception/action, the students foster key competences in using development and design processes for creating media-technological artefacts and in working with requirements specifications developed from user needs. While pursuing this aim, they will be able to apply their knowledge and skills in mathematics, programming and interaction design.

As specified by the Study Board for Media Technology, a sub-theme description is formulated in connection with the project. In connection with the project a minimum of five related seminars /lectures are offered.

Students who complete the project module will be able to:

Knowledge

- Describe new forms of interaction with the real world, data sources, and/or physical/virtual models (**understanding**)
- Explain how human computer confluence can enhance the foundations for future applications of societal value (**understanding**)
- Explain the methods for planning and developing an IT application (**understanding**)
- Explain the iterative nature of interaction design (**understanding**)

Skills

- **Apply** a human centred design approach in the context of use, design, development and evaluation of a new interface (**understanding**)
- Design, plan, organize and conduct a user needs study of a target group (**synthesis**)
- **Analyse** how a chosen target group interacts in a real world context of use with similar media products or artefacts and **apply** this to novel designs through, e.g., scenarios and storyboards, and later with early prototypes
- **Apply** methods, tools and theories to allow people to explore and augment human interaction capabilities and awareness in action and interaction
- **Synthesise** technical requirement specifications as a basis for developing a media technology project
- Design and implement a simple artefact based on fundamental object-oriented programming (OOP) strategies, models and development environments (**application)**
- Prepare and perform standardized testing of an artefact with the target user group (not a convenience sample) or domain experts and analyse and discuss the findings (**application)**

Competencies

- **Apply** the gained experiences with project management to the future course of study (**evaluation**)
- **Evaluate** the ethical perspective of engineering and science and discuss implications of a responsible professional practice (**analysis**)
- Explain basic quantitative results with descriptive statistics in writing and in figures **(application)**

Type of instruction:
Academically supervised student-governed problem oriented project work.
Furthermore the Study Board for Media Technology wishes to note for implementation that the students will get support to identify, analyse and assess relevant contextual perspectives by attending “Problem Based Learning in Science, Technology and Society” (STS) seminars, receiving comments on papers and feedback at group meetings. This will be facilitated or achieved through co-supervision from STS experts.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

Oral group examination with external censor based on:

- a written project report
- a media-technological artefact
- evidence of design activities and their evolution (e.g., sketchbooks or portfolios)
- a written P2 process analysis
- an A/V production that illustrates and summarizes the project

The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Interaction Design
(Interaktionsdesign)

Size: 5 ECTS

Prerequisites:
All course and project-modules on the 1st semester must have been followed by the student.

Objectives:
The objective of the course is to provide the students with an understanding of the theories and methods of interaction and graphics design and the ability to apply these theories and methods for concrete design problems.

Students who complete the course module will obtain the following qualifications:

Knowledge

- Must have **knowledge** and **understanding** of interaction design basics, different interaction models and user input/output modalities and their interplay
- Must have **knowledge** about iterative process of interaction design and user centred methods for design
- Methods for user tests **(application**)
- Must have an **understanding** about conceptualizing interaction
- The use of conceptual modelling (e.g., mental models) in design (**application**)
- Must have **knowledge** about the use of storyboards and scenarios
- Must have knowledge about the basics of qualitative and quantitative data gathering, analysis and interpretation
- Must have **understanding** of designing interfaces which go beyond the traditional graphical user interfaces, such as physical and mobile computing
- Must have **understanding** about the concept of designing and building lo-fi and hi-fi prototypes as an integral part of the iterative design process and to evaluate these in user tests
- Must have **understanding** of usability test design including establishing goals and measures such as user friendliness, learnability, likeability, sociability, playability, accuracy, speed, etc., for empirical and theoretical methods
- Must have **knowledge** about the basic theory of Graphical User Interfaces (GUIs), including graphic design and aesthetics
- Must have **understanding** of the visual relationships in a composition of GUIs and images
- Must have **knowledge** about the state-of-the-art techniques used in graphic design for human-computer interaction

Skills

- Must have ability to **apply** a qualitative approach (e.g., interviewing, contextual inquiry, etc.) to elicit user needs, preferences and capabilities in a real world context, **analyse** and explain the findings (**understanding**)
- Design (**apply**) solutions to interaction design related problems
- **Understanding** and **applying** how to perform user evaluations, and present basic quantitative results using descriptive statistics in writing and figures
- Ability to demonstrate **(application)** the concept behind the interface design through conceptual models
- Must be able to **understand**, evaluate and **apply** different graphical communication forms such as typefaces, shapes, contrasts, colors, balance, proportion and flow

Competencies

- **Analyse** needs of different target groups
- **Compare** different user-centred evaluation methods, on a level to decide which of them are applicable and suitable for certain evaluations
- **Apply** and **evaluate** user-centred evaluation methods
- **Apply** the iterative method for interaction design
- **Apply** graphical design principles in interaction design

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in. If the student hands in a paper/exercise after the deadline, the student has used an examination attempt.
Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Title:

Mathematics for Multimedia Applications
(Matematik til multimedie-applikationer)

Size: 5 ECTS

Prerequisites:
No special prerequisites for the module.

Objectives:
Introduction of the mathematics needed for media technology applications.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Understand** trigonometric functions and identities
- **Understand** logarithmic and exponential functions
- **Understand** differentiation and integration of functions of one variable, including numerical methods
- **Understand** vectors and basic vector operations, dot product and cross product
- **Understand** basic geometry in 2 and 3 dimensions: points and distance; lines, planes, spheres and their intersections
- **Understand** parametric curves: position, velocity and acceleration
- **Understand** matrices, basic matrix operations and linear transformations
- **Understand** systems of linear equations
- **Understand** matrix inversion
- **Understand** the relevance and application of mathematics to modeling and understanding systems and phenomenon

Skills

- Ability to perform basic algebraic calculations (**application**)
- Ability to work with trigonometric, logarithmic and exponential functions (**application**)
- Ability to calculate derivatives of functions of one variable (**application**)
- Ability to calculate integrals of functions of one variable (**application**)
- Ability to perform calculations involving vectors, vector operations, matrices and matrix operations (**application**)
- Ability to determine equations for lines, spheres and planes, to calculate intersections and find distances (**application**)
- Ability to differentiate and integrate vector functions (**application**)
- Ability to determine solvability and complete solutions for systems of linear equations (**application**)
- Ability to determine the invertability of a small square matrix and its inverse if it exists (**application**).

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in. If the student hands in a paper/exercise after the deadline, the student has used an examination attempt.
Individual written examination with internal censor. The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Programming for Interaction
(Programmering af interaktive systemer)

Size: 5 ECTS

Prerequisites:
Introduction to Programming or Equivalent.

Objectives:
By completing the module, the students will be able to design, program, and evaluate interactive applications both on the standard PC platform as well as mobile platforms. Furthermore, the module will seek to introduce basic concepts from object-oriented programming. The module covers the fundamentals of the programming of graphical user interfaces (GUIs) as well as interactions in mobile and pervasive environments that afford touch or sensor-based interaction. The objective is that the students acquire the knowledge, skills, and competencies required for the actual planning, implementing, code generation, and evaluation of interactive applications.

Students who complete the project module will obtain the following qualifications:

Knowledge

- **Knowledge** of fundamental object-oriented programming (OOP) strategies and models used in software development
- **Knowledge** of rich pictures and use case diagrams to facilitate a user centered design approach
- **Knowledge** of mobile development environments, debugging tools and methods for **evaluation** of mobile applications
- **Understanding** of basic design patterns relevant to mobile development (Model-View-Controller (MVC), singleton, etc.)
- **Knowledge** of GUI programming on both PC and mobile platforms
- **Understanding** the difference between sequential and event based program structures (e.g., event listeners, call-back functions)
- **Understanding** of working with files and file systems in programming
- **Understanding** different development methods (e.g., Waterfall, Spiral, Agile) in relation to software development

Skills

- Ability to **apply** OOP in development and design of interactive applications.
- **Analyse**, interpret and **apply** design patterns and basic models (entity-relationship diagrams, UI storyboards, or flowcharts, etc.)
- Must be able to implement event based designs into functioning **applications**
- Must be able to **apply** an object-oriented approach to software implementation
- Must be able to implement an **application** with a GUI
- Must be able to develop, deploy, and test an application on a mobile device such as a smart phone or tablet (**application**)

Competencies

- Must be able to **understand** how to systematically design, program, and **evaluate** interactive applications
- Must be able to **analyse** the problem domain and user requirements
- Must be able to **synthesise** the domain understanding into models (entity-relationship diagrams, UI storyboards, flowcharts, design patterns, etc.)

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in. If the student hands in a paper/exercise after the deadline, the student has used an examination attempt.
Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

3.3 3rd semester

Title:
Visual Computing-Human Perception
(Visual Computing-Human Perception)

Size: 15 ECTS

Prerequisites:
2nd Semester or similar

Objectives:
One of the cornerstones in Medialogy is to build systems that automatically react to humans in ways that may or may not involve visual output. In this module the focus is on doing so using visual computing, i.e., automatically analysing visual information recorded by one or more cameras. For example, a computer game controlled by human movements or a dynamic art installation reacting to the constellation of people in an environment. Having humans as end-users also means a need to consider what we can and cannot perceive, and how we use perceptual information in relation to digital media application.

The students will work with a concrete problem where automatic analysis of visual data is central. The problem will be analysed and a concept for a solution suggested. The concept (or parts hereof) will be designed, implemented and evaluated using relevant theories and methods from the sub-fields of visual computing: image processing, programming and perception.

As specified by the Study Board for Media Technology, a sub-theme description is formulated in connection with the project. In connection with the project a minimum of five related seminars /lectures are offered.

Students who complete the project module will obtain the following qualifications:

Knowledge

- Must have **knowledge** about the terminology within visual computing
- Must be able to **understand** how a particular visual computing system, e.g., the semester project of the student, works
- Must be able to **understand** and compare a particular visual computing system, e.g., the semester project, to similar systems and to the surrounding society
- Must be able to **understand** and explain the mathematical fundamentals of visual computing

Skills

- Must be able to **analyse** a problem and (if possible) suggest a solution that uses relevant theories and methods from visual computing
- Must be able to **analyse** a system that is based on visual computing and identify relevant constraints and assessment criteria. This relates both to the usability of the system, the technical aspects of the system and (if relevant) the usefulness to society
- Must be able to design and implement (**apply**), a system (or parts hereof) using relevant theories and methods (if possible) from visual computing

- Must be able to test and evaluate (**analyse)** a visual computing system (or parts hereof) with respect to the aforementioned assessment criteria
- Must be able to communicate the above knowledge and skills (using proper terminology) both orally and in a written report

Competencies

- Must be able to discuss relevant theories and methods of visual computing and general theories on perception and **apply** to concrete problems and situations
- Must be able to **apply** current knowledge on human perception and visual computing in the evaluation of an implemented systems

Type of instruction:

Academically supervised student-governed problem oriented project work.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

Oral group examination with external censor based on:

- a written project report
- a media-technological artefact
- an A/V production that illustrates and summarizes the project

The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:

Image Processing

(Billedbehandling)

Size: 5 ECTS

Prerequisites:

Mathematics for Multimedia Applications

Objectives:

Cameras capture visual data from the surrounding world. Building systems which can automatically process such data requires image processing methods. Students who complete the module will understand the nature of digital images and have an overview of different theories and methods within image processing and their applicability.

Students who complete the project module will obtain the following qualifications:

Knowledge

- Must have **knowledge** about basic and linear algebra
- Must have **knowledge** about the primary parameters of the camera and lens
- Must have **knowledge** about the representation of a digital image
- Must be able to **understand** the general framework of image processing
- Must be able to **understand** and interpret image histograms
- Must be able to **understand** color images and their different representations
- Must be able to **understand** the principle of point processing
- Must be able to **understand** principle of neighborhood processing
- Must be able to **understand** what a BLOB is and how it can be extracted
- Must be able to **understand** how moving objects can be segmented in a video sequence

Skills

- Must be able to **apply** matrix calculations
- Must be able to **apply** the following point processing methods: grey-level mapping, histogram stretching, thresholding and image arithmetic
- Must be able to **apply** the following neighborhood processing methods: median filter, mean filter and edge detection
- Must be able to **apply** the following morphologic operations: dilation, erosion, opening and closing
- Must be able to **apply** basic feature extraction and matching
- Must be able to **apply** image differencing and background subtraction
- Must be able to **apply** geometric transformations to an image
- Must be able to **apply** convolution/correlation to an image by using the corresponding mathematical operation

Competencies

- Must be able to **apply** the general framework of image processing in a new context. This includes choosing the relevant methods and evaluating the output

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor. The assessment is performed with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:

Human Senses and Perception

(Perception)

Size: 5 ECTS

Prerequisites:

Interaction Design (2nd semester)

Objectives:

We perceive and interpret the world around us using our senses. The same senses can also be deceived, often because we expect the world to look, sound or feel as we have been used to. Students who complete this module should be able to design systems that take advantage of the sensitivies and insensitivies of the human senses.

Students who complete the project module will obtain the following qualifications:

Knowledge

- Must have **knowledge** of the basic physiology of the human senses (vision, hearing, touch and vestibular)
- Must have **knowledge** about the sensitivity and limitations of the human senses (vision, hearing, touch and vestibular)
- Must have **knowledge** about the basic principles of neural function and communication: neural firing, receptive fields and after-effects
- Must be able to **understand** how objects and scenes are perceived
- Must be able to **understand** attention theories
- Must be able to **understand** motion perception theories
- Must be able to **understand** frequency, amplitude, pitch, loudness and timbre of a sound
- Must be able to **understand** masking effects
- Must be able to **understand** Gestalt theories

Skills

- Must be able to **apply** a list of constraints with regards to human sensitivity when designing a medialogy application: limits of audibility and visibility; latency vs. reaction times, etc.
- Must be able to **apply** knowledge of sensitivity when assigning computational resources in the design of digital media applications

Competencies

- Must be able to **apply** general theories on perception to concrete phenomena and situations
- Must be able to **apply** current knowledge on human perception in the evaluation of systems, reflecting on what users can and cannot perceive
- Must be able to **apply** theories on human perception and attention in designs that take the human user into account

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for

this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:

Programming of Complex Software Systems

(Programmering af komplekse software-systemer)

Size: 5 ECTS

Prerequisites:

Programming for Interaction and Introduction to Programming.

Objectives:

Many real world software systems are complex, involving multiple devices, processors, users, and complex algorithms. To allow the students to work with such software systems, this module introduces several methods that are relevant when developing and using large software systems. The objective is to give the students an understanding of object-oriented software analysis and design methods. Furthermore, an introduction to network programming and parallel programming, data structures and algorithms is also given. Several of these aspects of the module can also support the Image Processing course running in parallel.

Students who complete the project module will obtain the following qualifications:

Knowledge

- **Understanding** of the basic concepts of object-oriented design and analysis (e.g., encapsulation, inheritance, composition, association, interfaces)
- **Understanding** of using the UML language to produce and communicate an object-oriented software design (structure, behaviour, and interaction diagrams)
- **Understanding** of structure and tools for documenting codebases
- **Understanding** of data structures used for search and sort algorithms (graphs, linked lists, queues, stacks, trees, heaps, hash tables)
- **Understanding** of the concept of the complexity of an algorithm and big-O notation
- **Understanding** of programming concepts related to networks: clients and servers, sockets, ports, IP address (static/dynamic), Ethernet address
- **Understanding** digital application and communication protocols: the OSI model, TCP and UDP.
- **Understanding** the concepts behind parallel programming: processes and threads, scheduling, bottlenecks and deadlocks, shared data, mutex locks, race conditions
- **Understanding** of common versioning software practices and terminology

Skills

- Ability to both produce and understand UML-based diagrams in order to work with object-oriented design and analysis (**application, analysis**)
- Ability to implement an object-oriented design from a UML description (**application**)
- Ability to choose and **apply** appropriate data-structures to create efficient programmes for searching and sorting
- Ability to **apply** to design a fitting software solution both in the field of networking and multi-threaded programming
- Ability to **apply** programming skills to implement a multithreaded program that uses the network to communicate between two digital devices (**application**)
- Ability to use a commonly used software versioning system (**application**)

Competencies

- Produce and implement object-oriented software designs (**application**)
- Document an object-oriented software system using UML (**application**)
- **Evaluate** existing code in the fields of network and multithreading, judge its design and recommend changes
- Must have competencies in designing efficient solutions using advanced data structures to solve programming tasks, especially programming tasks related to medialogy, communication and IT/new media (**application**)
- Read and design algorithms and **analyse** their complexity

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

3.4 4th semester

Title:

Sound Computing and Sensor Technology

(Lyd- og sensorteknologi)

Size: 15 ECTS

Prerequisites:
3rd semester or similar

Objectives:
Hearing is one of the fundamental senses of the human perceptual system. Being able to understand how auditory signals are created and how they can be used as input or output devices in solving problems in interactive media is an essential element of the Medialogy program. In this semester project, students pose problems that include the design and implementation of computer systems being able either to analyse an auditory signal in real-time or to produce interactive auditory feedback. Such feedback is either created from scratch using sound synthesis techniques or obtained by manipulating recorded samples. Examples of such systems are an interface which is controlled by the human voice or an interactive installation where the sounds change according to users' motions, or a tangible sonic interface embedded with sensors. The posed problem must be motivated, analysed and its solution evaluated using quantitative experiments and statistics.

As specified by the Study Board for Media Technology, a sub-theme description is formulated in connection with the project. In connection with the project a minimum of five related seminars /lectures are offered.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Knowledge** about theories and techniques within audio design and computing
- **Describe** basic concepts and terminologies in the field of sound design and processing
- **Understand** how to evaluate the proposed solution using quantitative experiments and statistics
- **Knowledge** about how to create interactive sound systems that react to users' action
- **Knowledge** about applications of sensors technologies (electrical transducers) to interactive systems

Skills

- **Analyse** a problem and suggest a solution that uses relevant theories and methods from interactive sound design and computing
- **Apply** programming in a multimedia system where sound and interaction play an important role
- Identify relevant constraints and assessment criteria for a system based on audition, in terms of usability and technical aspects **(analysis**)
- Design an interactive system wherein audio is used as either input and/or output, using relevant theories from sound and music computing (**application**)
- **Apply** electrical transducer(s) as input devices for an interactive system
- **Apply** passive electronics to interface the transducer(s) with the computer
- Assess the proposed solution using a quantitative experiment and statistics (**analysis**)
- Describe, communicate and argue the designed solution using proper terminologies and

theories from the fields of sound and music computing and experiment design, both orally and in a written report (**synthesis**)

Competencies

- Select relevant theories and methods from the field of sensors technology, mathematics and programming and apply these to solve a problem in sonic interaction (**synthesis**)
- Plan, structure, execute and evaluate a project within the field of sonic interaction (**synthesis**)

Type of instruction:

Academically supervised student-governed problem oriented project work

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

Oral group examination with internal censor based on:

- a written project report
- a media-technological artefact
- an A/V production that illustrates and summarizes the project

The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Audio Processing
(Lydbehandling)

Size: 5 ECTS

Prerequisites:

Human Senses and Perception, Programming of Complex Software Systems, Mathematics for Multimedia Applications

Objectives:
The objective of this course is to give the students an introduction to audio processing, including a basic understanding of audio and music signals, how these are generated and what their properties are. The course takes its starting point in the physics of sound and how audio signals are measured using computers by sampling and quantization. The course then covers how to manipulate audio signals using filters and audio effects, like chorus, flanger, phaser, reverb, and equalizer, and how to design and analyse such effects. Moreover, it covers how to synthesise sound and music signals using, for example, physical models. Finally, the course covers how to analyse audio signals using the Fourier transform and auto-correlation.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Apply** knowledge from auditory perception in working with sound
- **Knowledge** of the physics of sound
- **Knowledge** of how to measure physical properties of sound
- **Understand** sampling, aliasing, quantization and signal-to-noise ratio
- **Understand** the time and frequency domains
- **Understand** the properties of audio signals in the time and frequency domains
- **Understand** filters and filtering in the time domain and frequency domain
- **Understand** convolution, impulse responses and transfer functions
- **Understand** correlation
- **Understand** basic sound synthesis techniques
- **Understand** basic filter-based sound effects
- **Understand** aspects of audio processing in real-time and off-line

Skills

- Implement filters for processing digital audio (**application**)
- Quantitatively **analyse** audio signals using correlation and the Fourier transform
- Implement sound effects and sound synthesis techniques (**application**)
- Express and analyse filters as rational functions (**application**)
- Apply complex numbers, finite/infinite sums, and integrals to analyse signals and filters (**application)**

Competencies

- Students who complete this module will be able to build audio processing systems for interactive multimedia applications (**synthesis**)

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor.

The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Design and Analysis of Experiments
(Design og analyse af eksperimenter)

Size: 5 ECTS

Prerequisites:
Interaction Design, Mathematics for Multimedia Applications, Human Senses and Perception

Objectives:
A crucial aspect of designing medialogy systems, tools or applications is the need to evaluate the work experimentally. The knowledge of how to properly design experiments to collect and evaluate data is essential to answer many of the problems within medialogy. Examples are testing which of two tracking algorithms is the most efficient; how users perform with different kinds of feedback; possible relationship between age and performance, etc.

Students who complete the course module will obtain the following qualifications:

Knowledge

- Must be able to **understand** the basic concepts of probability: sample space of all possible events; combinatorics; independent events; conditional probability; Bayes' formula; binomial distribution, etc.
- Must display **knowledge** about basic statistic terminology and treatment of data: distributions (probability density function, cumulative distribution function, quantile function); measures of central tendency and variability; histogram; central limit theorem, significance, power, type I and II errors, etc.
- Must be able to **understand** advantages and disadvantages with different types of designs and studies (between-group and within-group designs; correlational studies; blind/double blind, complete/incomplete and balanced/unbalanced designs)
- Must be able to **understand** the difference between common experimental designs, e.g., single sample experiments, two sample experiments, and factorial/multifactorial experiments
- Must **understand** the basic experimental design principles of independence, randomization, replication, and blocking and how these can be applied in experiments.
- Must be able to relate frequency distributions to the concept of hypothesis testing (**understanding**)
- Must be able to **understand** possible ethical concerns for a study

Skills

- Must be able to design an experiment to measure changes in a dependent variable, identifying and efficiently controlling relevant independent variables (**application**)
- Must be able to properly inform and instruct persons participating in a study (**application**)
- Must be able to **understand** and select among the most common methods for statistical analysis and assessment of experimental data (e.g., t-test, analysis of variance, chi-square tests, binomial test, correlation, and simple linear and logistic regression)
- Must be able to **understand** the difference between parametric and non-parametric analysis methods
- Must be able to **understand** different measurement scales and discuss experiments in terms of reliability, bias and sensitivity
- Must be able to discuss own data in terms of assumptions for statistical testing (**application**)
- Must be able to use an existing statistical package to **analyse** and present experimental results
- Must be able to discuss and represent empirical data in different ways (describing text,

numbers, formulas, graphs and figures) and shift between these according to the needs of the situation and context (**application**)
- Must be able to read, understand and implement experimental and empirical work as described in relevant literature (**application**)

Competencies

- Students who complete this module will be able to systematically design quantitative, scientific experiments, taking into account relevant factors (**application**)
- Students who complete this module will be able to use a statistical software package to analyse experimental data (**application**)
- Students who complete this module will be able to document their experimental results, and to understand experimental results presented by others (**application**)

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in..
The exam format is individual assessment based on a written or oral exam with an internal censor. The assessment is performed with the 7-step grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Physical Interface Design
(Fysisk interfacedesign)

Size: 5 ECTS

Prerequisites:
Introduction to Programming, Interaction Design, Mathematics for Multimedia Applications

Objectives:
Physical Interface Design is a course module where students learn about basic principles of electronics and how different sensors can be interfaced to a microcontroller to design novel forms of interactions between man and machines.

Students who complete the course module will obtain the following qualifications:

Knowledge

- Should be able to recall basic circuit theory concepts and rules, including resistance, voltage, current, Ohm's law, and Kirchoff's laws (**knowledge**)
- Should be able to describe basic analog (e.g., potentiometers, force sensitive resistors) and digital (e.g., push button, touch interface) sensing technologies (**knowledge**)
- Should be able to express how a micro-controller can be used for measuring/actuating analog and digital inputs/outputs by the use of sensors and output devices (e.g., displays, LEDs, and vibrators) (**understanding**)
- Should be able to recall that some functionalities can be implemented using both hardware and software (**knowledge)**, and to discuss the pros and cons of either solution (**understanding**)
- Should be able to identify practical needs in electric circuits such as DC filtering and circuit protection (**understanding**)
- Should be able to describe basic amplification (e.g., OpAmp) and filtering (e.g., RC and RL) circuits (**knowledge**)
- Should be able to explain basic concepts such as sampling and scaling in context of real-time use of signals (**understanding**)

Skills

- Should be able to apply the taught skills and methods on physical interface design to develop a prototype/artifact, and to demonstrate its use (**application**)
- Should be able to formulate a linear system of equations for voltage, current and resistance relationships in an electric circuit, and to solve the system to find unknown currents, voltages, or resistances (**application**)
- Should be able to use an electronic circuit simulator (**application**)
- Should be able to sketch and interpret an electric circuit diagram (**application**)
- Should be able to program a microcontroller to make it read inputs from sensor circuits and produce output(s) to a user (e.g., vibration, light, and text) (**application**)
- Should be able to examine and verify basic electric circuit designs using, e.g., a multimeter, and to test if a build electric circuit has the desired functionalities (**analysis**)
- Should be able to apply basic interface design principles for realizing a physical interface for human-computer interaction in the context of use (**application**)
- Should be able to assess the artifact by applying taught evaluation method(s) (**evaluation**)

Competencies

- Should be able to summarize the whole design process of the artifact (**synthesis**)

- Should be able to use correct technical and theoretical terms in dissemination (**application**)

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

3.5 5th semester

Title:
Audio-Visual Experiments
(Audio-visuelle eksperimenter)

Size: 15 ECTS

Prerequisites:
4th semester or similar

Objectives:

Computer generated imagery (CGI) is an integral part of visual media products. It is so abundant and of so high quality that oftentimes it is no longer noticed. We find CGI and animation in movies that are either entirely computer generated or substantial elements are made as special effects and we find CGI in commercials, music videos or for example visualizations of molecular biology. Interactive 3D computer graphics and animation applications are also becoming increasingly abundant and find them-selves into ever more aspects of our lives. They range from 3D computer games and animations for entertainment over mobile augmented-reality applications for navigation to visualizations of abstract phenomena in web-based applications. In addition to its wide range of applications areas, interactive 3D computer graphics and animation is also mediated in many different ways, from high-end desktop computers to hand-held devices, from projection screens to head-mounted displays, from monitors to laser light displays.

The students shall learn about screen media production, computer graphics, animation and rendering techniques, including the analysis of relationships between audio-visual communication and the communication offered by animation and computer graphics technologies. The students shall develop their technical and methodological skills by creating audio-visual experiments and experiences that are pre-rendered and/or interactive.

In this project module students will be working with analysing, designing and implementing (parts of) applications and media-technological experiments in which pre-rendered and/or real-time, interactive 3D computer graphics and animation are essential parts.

This can, for example, be a 3D game based on a game-engine consisting of an animated short story, a custom-designed application for data visualization, an interactive edutainment installation, a mobile navigation application or even developing a technology and/or a methodology for a special effect or production tools for aiding in the implementation/production of such products.

It is essential that projects contain elements of pre-rendered and/or real-time, interactive 3D computer graphics and animation and address an audio aspect, if applicable (and it has to be considered that many of the desired impacts on an audience can be achieved through the use of audio instead of, or in combination with, visuals). Film theory and cinematography must be applied wherever it can be applicable for the project or wherever the project can benefit from such theoretical and practical considerations. Evaluations of the designed solution must be conducted to investigate experiences, design criteria or formulated hypotheses.

As specified by the Study Board for Media Technology, a sub-theme description is formulated in connection with the project. In connection with the project a minimum of five related seminars /lectures are offered.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Understanding** of modeling, animation and rendering techniques for high quality computer graphics imagery
- **Understanding** of film form and dramaturgic models
- **Analysis** of fundamental concepts and theories within screen media production, animation, rendering and computer graphics

Skills

- Ability to **analyse**, design and implement/produce an audio-visual pre-rendered and/or interactive artifact with a narrative element and aimed at communicating a formulated message or experience to a human user or group of users
- Ability to **analyse** relationships between established theories for audio-visual communication and the communicative possibilities offered by animation and computer graphics rendering technologies
- Ability to **apply** theories, methods and techniques within animation, rendering and computer graphics (to create a pre-rendered and/or interactive application or a communicative artefact/installation)
- Ability to analyse theoretical and practical issues in pre-rendered and/or interactive 3D computer graphics and to synthesise solutions for such issues **(application)**
- Ability to **apply** 3D modeling, animation and rendering techniques to synthesise pre-rendered and/or interactive 3D computer graphics content.
- Ability to **apply** cinematographic concepts in state-of-the-art graphics rendering tools for pre-rendered and/or interactive content
- Ability to **analyse** the audio-visual communication possibilities and requirements associated with a chosen project subject
- Ability to **analyse** the technical requirements associated with the chosen project subject
- Ability to **synthesise** an effective solution to the chosen project domain by bringing together relevant concepts, theories and techniques from the fields of film theory and 3D computer animation, rendering and graphics

Competencies

- Ability to **synthesise** knowledge, methodology, theories and/or techniques concerning a problem centered around computer generated pre-rendered and/or interactive imagery or animation content that are effective according to some chosen communication requirements
- Ability to **analyse** the product requirements of a pre-rendered and/or interactive graphics application and to synthesise a functional/formal specification for it
- Ability to critically **evaluate** knowledge in comparison to the knowledge required for the project work - in particular knowledge in 3D computer graphics rendering, animation, human-computer interaction and/or audio visual design and programming
- Ability to **evaluate** the designed solution in order to investigate experiences, design criteria or formulated hypotheses.

Type of instruction:

Academically supervised student-governed problem oriented project work.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

Oral group examination with external censor based on:

- a written project report
- a media-technological artefact
- an A/V production that illustrates and summarizes the project

The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Computer Graphics Programming
(Computergrafik programmering)

Size: 5 ECTS

Prerequisites:
Introduction to Programming, Mathematics for Multimedia Applications, Image Processing, and Programming of Complex Software Systems

Objectives:
The course provides an introduction to real-time computer graphics concepts and techniques. The focus is on programmable functionalities (i.e., shader programs) of modern Graphics Programming Units (GPUs) as offered by graphics APIs such as OpenGL. It also covers the relevant underlying mathematical concepts (e.g., transformations between coordinate systems) and mathematical models (e.g., Phong's reflection model), as well as how these are applied in GPU-based shader programs.

Students who complete the course module will obtain the following qualifications:

Knowledge

- Ability to describe the programmable, hardware-accelerated graphics rendering pipeline as exposed, for example, by OpenGL, and its relationship and interaction with the central processing unit (**knowledge**)
- Ability to describe the concepts of vector bases, vector spaces, and coordinate systems as well as transformations between them (**application**)
- Ability to describe the mathematical representation of any rotation of 3D space by a matrix, by an axis and an angle, and by a quaternion (**application**)
- Ability to explain the computation of quadratic Bezier curves and splines (**application**)
- Ability to describe the interpolation of vertex attributes such as colors (e.g., for pre-vertex lighting), normals (e.g., for per-pixel lighting), and texture coordinates (**knowledge**)
- Ability to describe framebuffer operations including blending and depth tests (**knowledge**)
- Ability to explain acceleration techniques such as viewport clipping and backface culling (**understanding**)
- Ability to explain techniques to improve image quality such as antialiasing by supersampling and mipmap texture filtering (**understanding**)
- Ability to explain common performance bottlenecks of GPUs – including GPUs for mobile devices (**understanding**)

Skills

- Ability to describe the 4x4 matrix representation and application of any 3D affine transformation in homogeneous coordinates and apply it in a GPU-based shader program (**application**)
- Ability to describe real-time local illumination models, in particular the Phong reflection model and apply them in a GPU-based shader program (**application**)
- Ability to explain texture mapping techniques including compositing of multiple textures, normal mapping, environment/reflection mapping, and shadow mapping and apply them in a GPU-based shader program (**application**)

Competencies

- Ability to create a program for procedurally generating and interactively controlling and rendering three-dimensional content (**application**)

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Rendering and Animation Techniques
(Rendering og animation)

Size: 5 ECTS

Prerequisites:
Audio-Visual Sketching, Mathematics for Multimedia Applications, Human Senses and Perception, Programming of Complex Software Systems

Objectives:
Rendering is the last major step in the graphical pipeline, giving the final appearance to the models and animation. 3D computer animation combines 3D models of objects and motion based on key-frames, procedural-, or interactive input. This course empowers students to synthesise (design, create and render) image sequences and/or animations, 3D content or related assets, including animation for real-time applications, according to some desired visual expression by using state-of-the-art rendering platforms.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Knowledge** of basic concepts of radiometry/photometry
- **Understanding** of the ray tracing technique
- **Understanding** of the differences between local and global illumination
- **Understanding** of trade-offs between rendering quality and rendering time
- **Understanding** camera matching, illumination matching, and High Dynamic Range environment maps for augmentation/compositing
- **Understanding** modelling, rigging, and skinning for animation
- **Understanding** kinematic constraints, forward and inverse kinematics needed for character- and procedural animation
- **Understanding** of mathematical concepts to compute radiance/luminance levels in scenes with known illumination sources: solid angles and integration over spherical domains
- **Understanding** concepts of procedural animation

Skills

- Ability to **apply** cinematographic elements to rendered sequences, i.e., working with camera effects (depth-of-field, motion blur, lens flares, etc.) and illumination, in order to achieve a desired visual expression
- Ability to **apply** camera matching and image-based illumination for rendering virtual objects into image sequences
- Ability to prepare 3D models for real-time and rendered animation by the **application** of rigging and skinning to them
- Ability to **apply** various animation techniques to models, primarily those that are utilized in procedural animation, like forward/inverse kinematics, blending of animations, as well as morph target animation, per-vertex animation, shape interpolation, blend shapes
- Ability to **apply** state-of-the-art modelling/animation/rendering tools in a production workflow involving export of models, key-framed animations and light maps to real-time rendering 3D platforms in order to utilize procedural and interactive user-controlled animation
- Ability to **apply** mathematical knowledge from Mathematics for Multimedia Applications course to understand/program/debug relevant material in this course (spherical coordinates, numerical integration, and mathematics for ray tracing: vector/matrix calculation, line and plane equations, their intersections, quadratic equation of a circle/sphere, trigonometry in order to calculate distances and angles); and apply knowledge of basic calcu-

lus (position, velocity, acceleration of the body) for procedural animation

Competencies

- Ability to **synthesise** (design and create) rendered image sequences and/or real-time animations, 3D content or related assets according to some desired visual expression

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology.

To be eligible to take the exam the students must have fulfilled:

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

The exam is an individual written or oral examination with internal censor. The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Screen Media
(Screen Media)

Size: 5 ECTS

Prerequisites:
Audio-Visual Sketching, Human senses and Perception

Objectives:

Students who complete the course module will obtain the following qualifications:

Knowledge

- Must have **knowledge** of historical and theoretical aspects of motion picture and screen media production and technology
- Must be able to **understand** general theories and practices within film/media productions
- Must be able to **understand** film form
- Must be able to **understand** dramaturgic models for scriptwriting
- Must be able to **understand** continuity and discontinuity editing; spatial and temporal relations
- Must be able to **understand** film production elements

Skills

- Must be able to **apply** theoretical aspects of motion picture in analysis of production
- Must be able to **understand** mise-en-scene, cinematography and framing
- Must be able to **analyse** traditional narrative theories and interactive narrative forms
- Must be able to **analyse** film types and genres
- Must be able to **analyse** major film theories and approaches
- Must be able to **apply** theoretical knowledge to conduct film/media analysis

Competencies

- Ability to **synthesise** new audio-visual artifacts based on theories and techniques
- Ability to **synthesise** theoretical knowledge to construct audiovisual sequences and/or tools for designing audiovisual experiences or effects
- Ability to **synthesise** soundscapes and audio-visual artifacts

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor. The assessment is performed with the Pass/Fail grade.
Evaluation criteria: The criteria for the evaluation are specified in the Framework Provisions.

3.6 6th semester

Title:
BSc Project (Interactive Systems Design)
Bachelorprojekt (Design af interaktive systemer)

Size: 20 ECTS

Prerequisites:
All previous semesters (projects and course-modules) must have been passed
(1st to 5th semester)

Objectives:
Interactive Systems Design is a core element of Medialogy. The goal of the Medialogy 6th semester project module is for students to use the acquired knowledge, skills and competences from previous semesters and combined with what is learnt in this semester how to create their final bachelor project. Concerning design, analysis and evaluation, the final semester demands an advanced theoretical, methodological and reflective thinking.

Students who complete the course module will obtain the following qualifications:

Knowledge

- Understanding of emerging technologies when designing interactive media (**synthesis**)
- Understanding of theories and methods for processing of sensory input, synthesising of outputs (sounds, graphics, touch) and design rules and concepts of software systems (**application**)
- Understanding of societal contexts of a Medialogy application (**analysis**)
- Understanding of the 'vocabularies' of specialized Medialogy disciplines to be able to communicate ideas and processes to experts (**synthesis**)
- Knowledge of principles for designing, realizing, analysing and evaluating an interactive media product (**evaluation**)
- **Synthesis** of methodological consideration to describe the theoretical and empirical foundation of the project
- Understanding of theories of interactive systems design (application areas can be, e.g., a game, an art installation, an edutainment system, a rehabilitation system or a different service to the public) (**application**)

Skills

- Ability to **analyse** previous research, theories and current trends concerning interactive and converging media
- Ability to use such an analysis to **synthesise** an interactive media system involving auditory, visual and/or haptic feedback and alternative input devices (i.e., computer vision or tangible interfaces)
- Ability to **synthesise** learned theories and methods in the design and implementation of an interactive media application
- Ability to **synthesise** scientific methods in the investigation of previous research in the related field of interest
- Ability to discuss the developed system with both end users and peers/professional experts (**evaluation**)
- Ability to plan, design and perform and evaluate systematic test(s) of the media-technological artefact from a human-centered and/or system-based perspective wherever

applicable in the specific context of the interactive system (**analysis**)
- Ability to implement and discuss feasibility, design requirement specifications and sustainability of the developed interface (**evaluation**). Furthermore feasibility should not be limited to economic considerations such as cost/benefit, but go beyond and include e.g., societal, political and technological impact-factors
- Must be able to discuss/assess the quality of the solution(s) of the project in a wider context (**evaluation)**

Competencies

- Generalize the gained experiences with managing the bachelor project and put them into perspective of the future course of study (**evaluation**)
- Ability to **synthesise** knowledge, methods, theories and techniques concerning a problem centered around an interactive system
- Must have competencies in combining a wide range of technologies, such as auditory and visual displays, input- and output devices, network and communication protocols in order to realize advanced and non-trivial applications and solutions (**synthesis**)
- Ability to collaborate with industry professionals, e.g., game designers, interaction designers, designers of interfaces for children and the disabled, GUI designers, in order to participate in the design and implementation of an interactive media product (**evaluation**)
- Ability to **synthesise** knowledge in various forms of documentation, e.g., written, oral presentations, A/V productions, portfolio and prototypes
- Ability to communicate and present the project applying scientific-based descriptions of aspects such as design, construction, analysis and evaluation of an interactive media including consideration of human factors (**evaluation**)
- Reflect on the possible ethical perspective of the interactive system, the science behind and discuss implications of a responsible professional practice (**analysis**)
- Must have competencies in comparing and assessing the potential of different technologies, methods and approaches in order to make the proper design choices for optimum functionality (**synthesis**)
- Must show command of the **knowledge**, skills and competencies acquired in the semesters 1-5 at least to the level of learning as described for the individual respective courses and project modules

Type of instruction:
Academically supervised student-governed problem oriented project work.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

Oral group examination with external censor based on:
- a written project report
- a media-technological artefact
- an A/V production that illustrates and summarizes the project

The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Title:
Artificial Intelligence Programming
(Programmering af kunstig intelligens)

Size: 5 ECTS

Prerequisites:
Computer Graphics Programming

Objectives:
Concepts of artificial intelligence (AI) are central to the design and development of contemporary systems, e.g., database search and management, handheld devices (e.g., smartphones and tablets), games (e.g., chess), various adapting or learning systems, and so on. The objective of this course is to give students exposure to and an understanding of the fundamentals of AI programming, including: rational agents and their environment, knowledge representation, formal languages and logic, reasoning, basic graph theory, pathfinding algorithms, finite state automata, steering behaviors, and decision making. Students will develop practical skills in AI programming useful for the development and deployment of intelligent systems.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Understand** different levels of intelligent agent architectures, environments, and their application domains
- **Understand** basic graph theory
- **Understand** finite state machines, decision trees, and behaviour trees, and their implementation
- **Understand** different search strategies, and their implementation and underlying data-structures
- **Understand** different pathfinding algorithms and their implementation
- **Understand** steering algorithms and their implementation
- **Understand** classical planning approaches
- **Understand** knowledge representation, formal logic, and reasoning
- **Understand** basic fuzzy logic

Skills

- **Apply** the above knowledge to construct an intelligent system using available technologies
- Choose appropriate methods and technologies for a given problem (**analysis**)
- Interpret and **evaluate** AI systems and their behaviour
- Use agent simulation systems for prototyping system behaviour (**apply**)

Competencies

- Ability to **synthesise** knowledge, methodology or techniques concerning a problem centred around intelligent systems
- Ability to integrate AI-based libraries into larger projects (**apply**)
- Ability to learn the use of AI tools like agent-based simulators, planning systems, network simulators, etc. (**apply**)

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions

are decided and given by the Study Board for Media Technology.
Exam format: In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology: To be eligible to take the exam the student must have fulfilled: • handing in of written assignments or the like • completion of certain – or all – study activities Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in. Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.
Evaluation criteria: The criteria for the evaluation are specified in the Framework Provisions.

Title:
Ethnographically Informed Design
(Etnografisk inspireret design)

Size: 5 ECTS

Prerequisites:
No special prerequisites for the module.

Objectives:
In this course, we consider the larger picture and the situated nature of where and how people act and interact with media technologies. We work with theories, methods and material developed in successful design companies such as IDEO and Frog Design, which continue to evolve. The students will work with multiple evaluation methods that they apply in a hands-on approach that they consider as part of their ongoing critical reflection to the design process. The course will give students a better understanding of how chosen approaches, conceptual frameworks and methods produce different kinds of possible analyses for both the development, use and improvement of media technologies. The students will understand and apply selected user-centered, contextual and situational theories which can include ethnographic, psychological and sociological approaches and methods when analysing the use of media technology. The course will cover some of the large ranges of responses (e.g., interaction, reaction, deliberation, active and passive engagement) users can make when consuming media technologies, and provide students with methodological and analytic tools to analyse these responses in a given context and to implement these tools in their future design work.

Students who complete the course module will obtain the following qualifications:

Knowledge

- Must have **knowledge** and **understanding** of empirical and critical research, including systematic quantitative and qualitative research data gathering, analysis and interpretation methods
- Must **understand** and **apply** interpretative paradigms to media development. This includes **evaluation** of those approaches that promote qualitative methodologies, such as ethnography, grounded theory, case studies, discourse analysis, narrative research, diary studies, cultural probes and video interaction analysis, as well as **application** of quantitative methods including, for example, logging of use, physiological capture, or statistical analysis
- Must **understand** that the theories and methodology adopted impact on the nature of evidence gathered in media related research **(evaluation)**
- Must have **knowledge** of psychological, statistical, ethnographic, or sociological approaches to the study of contextual behaviour and their relevance and implications to media development and design (**understand**)
- Must have **knowledge** and **understanding** how a variery of ethnographic methods including contextual data capture are useful for guidelines for testing and evaluation and iterative design (**application**) which can be implemented for user-oriented problems

Skills

- Must have ability to **apply** a range of qualitative methods (e.g., interviewing, contextual inquiry, etc.) to elicit user needs, preferences and capabilities and be able to **analyse** and explain the findings (**understanding**)
- Must have ability to **apply** a range of quantitative methods**,** which may include logging and analysis, statistical tests, correlation and cluster analysis to assess perception and user behavior (**understanding**).
- **Apply** observational methods to situations as they happen in real time and **evaluate** da-

ta in relation to end-user groups
- **Apply, analyse** and **evaluate** social, situated and digital micro and macro acts in interactions
- Design **(apply)** guidelines and **apply** adequate theories and study designs, using advanced qualitative and quantitative methods for collection and analysis of data (**analysis**)
- Design **(apply)** guidelines and **apply** different observational methods, including video observations and exploration of user states (e.g., immersed, engaged, emotional, pleasant).
- Design (**apply**) solutions to design and situated context related problems (**synthesis**)

Competencies

- Plan, organize and implement a full cycle of design, evaluation and re-design for a real world problem (**evaluation**)
- **Synthesise** and **apply** knowledge and understanding gained in the course regarding the consequence of choosing a specific approach, method, conceptual framework and theory in relation to media technology and a specific research question or problem
- **Understand** advantages, disadvantages, possibilities and limitations regarding the use of specific methods, for example, video card game, video Interaction analysis, discourse analysis, interviewing, questionnaires, storyboards, scenarios, and **know** statistical methods (e.g., tests, clustering, correlation analysis) or various psychological experimental paradigms (e.g., free categorization) **(analysis)**
- Synthesise, **understand** and **apply** in situ observational strategies, for example, shadowing, participation, video-observation for user evaluation and analysis in a context of media technologies (**application)**

Type of instruction:

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:

In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Real-time Interfaces and Interactions
(Realtids interfaces og interaktioner)

Size: 5 ECTS

Prerequisites:
No special prerequisites for the module.

Objectives:
Real-time Interfaces and Interactions is a course module offering the students opportunities to investigate technologies addressing different modalities that are commonly associated with creation of integrated multimodal interactive systems. The course is built upon the previous five semesters to augment foundational knowledge, skills and competences needed to achieve integration of technologies and evaluation methods.

Students who complete the course module will obtain the following qualifications:

Knowledge

- **Understanding** of the state-of-the-art in the field of alternative input and output technologies for uni- and multimodal applications (application)
- **Understanding** of visualization techniques such as virtual or augmented reality (application)
- **Understanding** of sound design methods and real-time audio processing techniques such as interactive auralization and sonification (application)
- **Understanding** of the measurement and analysis of physiological data via sensors detecting signals present in the human body for techniques such as affective computing
- **Understanding** of haptic interfaces, theory and implementation of haptic feedback systems using vibrotactile stimulation
- **Understanding** adaptive systems which change behaviour according to user input within a session
- **Understanding** of iterative design processes as used in the design of real-time interfaces and multimodal interactive systems

Skills

- Ability to **synthesise** new interface components of responsive Human-Computer Interaction systems, and log data from users and/or their interactions for data analysis
- Ability to scientifically **analyse** and argue with theoretical and methodological justification to demonstrate understanding of related research/work in the current scientific discourse
- Ability to **apply** real-time sensor inputs in the design of an interactive media product
- Ability to **synthesise** and **apply** contextual understanding and knowledge related to human factors in the design of novel interfaces
- Ability to **apply** theories, techniques and methods for the design and implementation of systems which can adapt to human needs and level of expertise

Competencies

- Ability to **synthesise** knowledge and understanding regarding previous research and current trends concerning interactive media systems
- Ability to **apply** such knowledge, understanding and skills toward creation of new interfaces and interactive systems that function in real-time (low latency response)

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction

for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination based on mandatory exercises and mini-project with internal censor. The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Title:
Theory and Practice of Game Design and Development
(Teori og praksis af spildesign og -udvikling)

Size: 5 ECTS

Prerequisites:
5th semester

Objectives:
This course provides students with the foundational knowledge and practices in the design and development of games such as the social and economic context of gaming and game production, the game industry, formal and dramatic elements of games, system dynamics of games, iterative game design through playtesting, completeness and balance of games, and game technologies. It is a hands-on course in which the students are expected to create actual prototypes, evaluate and iteratively redesign them.

Students who complete the course module will obtain the following qualifications:

Knowledge

- Discuss the structure and formal elements of games – in particular players, objectives, procedures, rules, resources, conflict, boundaries and outcome – and dramatic elements of games – in particular challenge, play, premise, character, story, world building, and the dramatic arc (**understanding**)
- Review the context of games, game classifications and players (**understanding**)
- Explain game technologies including controllers, game engines (and their components such as render engines, audio engines, physics engines, etc.), and game development tools (**understanding**)
- Describe the game development pipeline from idea via iterative design and development to product launch (**understanding**)
- Describe the game industry and game entrepreneurship including platforms for distribution, independent developers, development studios, and publishers (**understanding**)

Skills

- **Analyse** and summarize (**application**) system dynamics of existing games
- Create, present, critique and revise original game ideas (**evaluation**)
- Iteratively produce (**application**) and **evaluate** key game features through playtesting of physical and/or digital prototypes
- Judge completeness and balance (**evaluation**) and **evaluate** player experience of games and/or gameprototypes with established metrics
- Produce pitch materials including game demos and design documents (**application**)

Competencies

- **Plan**, **organize** and **implement** a game (pre)production (**application**)

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination with internal censor. The assessment is performed in accordance with the 7-point scale.

Evaluation criteria:

The criteria for the evaluation are specified in the Framework Provisions.

Title:
Technologies for Web and Social Media
(Teknologier til internet og sociale medier)

Size: 5 ECTS

Prerequisites:
All previous programming courses

Objectives
Web technologies are pervasive in the everyday life of most people in modern-day society and most public and private digital services are delivered through the world wide web.
This course aims to introduce the students to the technologies and the practices adopted in web-based applications and web sites.

The students will learn to develop new web-based systems, and maintain and extend existing systems. Furthermore, the students will learn to evaluate existing technologies and platforms, such as social media and web based services, and to develop integrated applications that make use of these platforms and contribute to them.

Students who complete this course module will achieve the following competencies:

Knowledge

- **Understand** client-server architectures and basic networking
- **Know** the purpose, structure and basic functionalities of the hypertext transfer protocol
- **Understand** the purpose, characteristics and components of XML, HTML and CSS
- **Know** the basic principles of server-side development
- **Analyse** and explain the document object model
- **Understand** the principles of client-side development and DOM manipulation
- **Apply** techniques to debug and profile web systems
- **Apply** the principles of asynchronous client/server interaction
- **Know** the state-of-the art technologies in both server-side and client-side development.
- **Understand** the concept of mash-up and how to interact with external services (e.g., social media)

Skills

- **Synthesise** and **evaluate** static and dynamic web pages and web based applications
- **Analyse**, correct and extend existing client- and server-side programs
- **Apply** external frameworks and API to integrate advanced functionalities and connections to existing services.
- **Evaluate,** employ and personalise existing web platforms - e.g., wiki, CMS or blogs

Competencies

- **Evaluate** emerging web technologies
- **Evaluate** the limitations and the potentials of different web technologies and choose the most appropriate for a specific project

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided in accordance with the current Framework Provisions and directions are decided and given by the Study Board for Media Technology.

Exam format:
In accordance with the current Framework Provisions and directions on examination from the

Study Board for Media Technology:

To be eligible to take the exam the student must have fulfilled:

- handing in of written assignments or the like
- completion of certain – or all – study activities

Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.

Individual oral or written examination based on mandatory exercises and mini-project with internal censor. The assessment is performed in accordance with the 7-point grading scale.

Evaluation criteria:
The criteria for the evaluation are specified in the Framework Provisions.

Chapter 4: Entry into Force, Interim Provisions and Revision

The curriculum is approved by the Dean of the Faculty of Engineering and Science and enters into force for 1. semester students from September 2014.

Other students must conclude their studies under the previous curriculum from September 2010 by autumn 2016 at the latest, since examinations under the previous curriculum are not offered after this time.

In accordance with the Framework Provisions for the Faculty of Engineering and Science at Aalborg University, the curriculum must be revised no later than 5 years after its entry into force.

Chapter 5: Other Provisions

5.1 Rules concerning written work, including the Bachelor's project

In the assessment of all written work, regardless of the language it is written in, weight is also given to the student's spelling and writing ability, in addition to the academic content. Orthographic and grammatical correctness as well as stylistic proficiency are taken as a basis for the evaluation of language performance. Language performance must always be included as an independent dimension of the total evaluation. However, no examination can be assessed as 'Pass' on the basis of good language performance alone; similarly, an examination normally cannot be assessed as 'Fail' on the basis of poor language performance alone.

The study board can grant exemption from this in special cases (e.g., dyslexia).

The Bachelor's project must include an English summary. The summary must be at least 1 page and not more than 2 pages (this is not included in any fixed minimum and maximum number of pages per student). The summary is included in the evaluation of the project as a whole.

5.2 Rules concerning credit transfer (*merit*), including the possibility for choice of modules that are part of another program at a university in Denmark or abroad

In the individual case, the study board can approve successfully completed (passed) program elements from other Bachelor's programs in lieu of program elements in this program (credit transfer). The study board can also approve successfully completed (passed) program elements from another Danish program or a program outside of Denmark at the same level in lieu of program elements within this curriculum. Decisions on credit transfer are made by the study board based on an academic assessment. See the Framework Provisions for the rules on credit transfer.

5.3 Rules concerning the progress and completion of the Bachelor's program

The student must participate in all first year examinations by the end of the first year of study in the Bachelor's program, in order to be able to continue the program. The first year of study must be passed by the end of the second year of study, in order that the student can continue his/her Bachelor's program.

In special cases, however, there may be exemption from the above if the student has been on a leave of absence. Leave is granted during first year of study only in the event of maternity, adoption, military service, UN service or where there are exceptional circumstances.

The Bachelor's program must be completed no later than six years after it was begun.

5.4 Special project process

In the 3rd, 4th and 5th semesters, the student can upon application, design an educational program where the project work is replaced by other study activities; cf. the Framework Provisions section 9.3.1.

5.5 Rules for examinations

The rules for examinations are stated in the Examination Policies and Procedures published by the Faculty of Engineering, Science and Medicine on their website.

5.6 Exemption

In exceptional circumstances, the study board can grant exemption from those parts of the curriculum that are not stipulated by law or ministerial order. Exemption regarding an examination applies to the immediate examination.

5.7 Rules and requirements for the reading of texts in foreign languages and a statement of the foreign language knowledge this assumes

It is assumed that the student can read academic texts and in modern English and use reference works and similar.

5.8 Additional information

The current version of the curriculum is published on the study board's website, including more detailed information about the program, including exams.