INTERACTION TECHNOLOGY

FACULTY OF ELECTRICAL ENGINEERING,
MATHEMATICS AND COMPUTER SCIENCE

UNIVERSITY OF TWENTE

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REPORT ON THE MASTER'S PROGRAMME INTERACTION TECHNOLOGY OF THE UNIVERSITY OF TWENTE

This report takes the NVAO's Assessment Framework for the Higher Education Accreditation System of the Netherlands for limited programme assessments as a starting point (September 2018).

ADMINISTRATIVE DATA REGARDING THE PROGRAMME

Master's programme Interaction Technology

Name of the programme:	Interaction Technology
CROHO number:	60030
Level of the programme:	master's
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	Interaction Technology Human Computer Interaction and Design (double degree)
Location(s):	Enschede
Mode(s) of study:	full time
Language of instruction:	English
Joint programme:	
partner institutions involved:	Kungliga Tekniska Hogskolan Universita dit Trento Aalto University Université Paris-Sud TU Berlin Universidad Politecnica de Madrid
type of degree awarded:	double degree (UT + one of the partner institutions)
Submission deadline NVAO:	01/05/2020

The visit of the assessment panel Computer Science to the Faculty of Electrical Engineering, Mathematics and Computer Science of the University of Twente took place on 9 and 10 December 2019.

ADMINISTRATIVE DATA REGARDING THE INSTITUTION

Name of the institution:	University of Twente
Status of the institution:	publicly funded institution
Result institutional quality assurance assessment:	positive

COMPOSITION OF THE ASSESSMENT PANEL

The NVAO has approved the composition of the panel on 15 April 2019. The panel that assessed the master's programme Interaction Technology consisted of:

- Em. prof. dr. T. (Theo) D'Hondt, emeritus professor in Software Languages and Software Engineering at the Faculty of Sciences and Bioengineering Sciences of Vrije Universiteit Brussel (Belgium) [chair];
- Prof. dr. ir. W.E.A. (Wim) Van Petegem, professor and policy coordinator Learning Technologies at the Faculty of Industrial Engineering Technology of KU Leuven (Belgium);

- Prof. dr. S. (Sjouke) Mauw, professor in Security and Trust of Software Systems at the Department of Computer Science of the University of Luxembourg (Luxembourg);
- Prof. dr. B.A.M. (Ben) Schouten, full professor Playful Interactions at Eindhoven University of Technology;
- Dr. ir. N. (Nico) Plat, owner/CEO at Thanos IT-consultancy and architecture;
- M. (Martijn) Brehm, third-year bachelor's student Computer Science at University of Amsterdam [student member].

The panel was supported by P.A. (Peter) Hildering MSc, who acted as secretary.

WORKING METHOD OF THE ASSESSMENT PANEL

The site visit to the master's programme Interaction Technology at the Faculty of Electrical Engineering, Mathematics and Computer Science of the University of Twente was part of the cluster assessment Computer Science, and also included the bachelor's programme Technical Computer Science and the master's programme Computer Science in Twente. Between June and December 2019 the panel assessed 29 programmes at 10 universities. The following universities participated in this cluster assessment: Leiden University, Delft University of Technology, University of Utrecht, Eindhoven University of Technology, Open University, University of Amsterdam, Vrije Universiteit Amsterdam, Radboud University, University of Groningen and University of Twente.

On behalf of the participating universities, quality assurance agency QANU was responsible for logistical support, panel guidance and the production of the reports. P.A. (Peter) Hildering MSc. was project coordinator for QANU. P.A. (Peter) Hildering MSc. and M. (Mark) Delmartino MA acted as secretary in the cluster assessment.

During the site visit at the University of Twente, the panel was supported by P.A. (Peter) Hildering MSc, who is a certified NVAO secretary.

Panel members
The members of the assessment panel were selected based on their expertise, availability and independence. The panel consisted of the following members:
- Em. prof. dr. T. (Theo) D'Hondt, emeritus professor in Software Languages and Software Engineering at the Faculty of Sciences and Bioengineering Sciences of Vrije Universiteit Brussel (Belgium) [chair];
- Prof. dr. ir. W.E.A. (Wim) Van Petegem, professor and policy coordinator Learning Technologies at the Faculty of Industrial Engineering Technology of KU Leuven (Belgium);
- Prof. dr. S. (Sjouke) Mauw, professor in Security and Trust of Software Systems at the Department of Computer Science of the University of Luxembourg (Luxembourg);
- Prof. dr. J.J. (John-Jules) Meyer, full professor Computer Science and Artificial Intelligence at the University of Utrecht;
- Drs. L. (Lennart) Herlaar, owner/director at Redbits.nl, a company specialised in software development and IT consultancy, and assistant professor Computer Science at the Faculty of Science of Utrecht University;
- A. (Antonia) Wildvank, owner/CEO at Wildvank, Management en Advies, specialised in IT-management and -consultancy;
- Prof. dr. ir. J. (Jan) Aerts, full professor Visual Data Analysis at the University of Hasselt and associate professor Visual Data Analysis at the faculty of Engineering Science at KU Leuven (Belgium);
- Drs. H.C. (Jeroen) Borst, senior consultant Smart Cities at TNO;
- Prof. dr. P. (Petros) Koumoutsakos, full professor Computational Science at ETH Zürich (Switzerland);
- Prof. dr. ir. J.M.W. (Joost) Visser, Chief Product Officer at Software Improvement Group (SIG) Nederland and professor Large-scale Software Systems at Radboud University;

- Drs. E.A.P. (Ewine) Smits, Manager in Advanced Analytics & Big Data at KPMG Nederland;
- Prof. dr. D.P. (Danilo) Mandic, full professor Signal Processing at the department of Electrical and Electronic Engineering of Imperial College London (United Kingdom);
- Dr. ir. J.C. (Job) Oostveen, Research Manager at the Department Monitoring and Control Services at TNO;
- Prof. dr. B.A.M. (Ben) Schouten, full professor Playful Interactions at Eindhoven University of Technology;
- Dr. ir. N. (Nico) Plat, owner/CEO at Thanos IT-consultancy and architecture;
- N. (Nienke) Wessel BSc, master's student Computing Science and bachelor's student Mathematics and Linguistics at Radboud University [student member];
- E. (Evi) Sijben BSc, master's student Computing Science in the specialisation track Data Science at Radboud University [student member];
- B. (Baran) Erdogan, third-year bachelor's student Computer Science at University of Amsterdam [student member];
- M. (Martijn) Brehm, third-year bachelor's student Computer Science at University of Amsterdam [student member].

Preparation
On 21 March 2019, the panel chair was briefed by QANU on his role, the assessment framework, the working method, and the planning of site visits and reports. A preparatory panel meeting was organised on 9 May 2019. During this meeting, the panel members received instruction on the use of the assessment framework. The panel also discussed their working method and the planning of the site visits and reports.

The project coordinator and secretary composed a schedule for the site visit in consultation with the Faculty. Prior to the site visit, the Faculty selected representative partners for the various interviews. See Appendix 4 for the final schedule.

Before the site visit to the University of Twente, QANU received the self-evaluation reports of the programmes involved and sent these to the panel. A thesis selection was made by the panel's chair and secretary. The selection consisted of final master projects and their respective assessment forms, based on a provided list of graduates in the academic years 2017-2018 and 2018-2019. A variety of topics and a diversity of examiners were included in the selection. The secretary and panel chair assured that the distribution of grades in the selection matched the distribution of grades of all available projects and theses, and that both specializations in the master's programme were covered in the selection. After studying the self-evaluation report, theses and assessment forms, the panel members formulated their preliminary findings. The secretary collected all initial findings and questions and distributed these amongst all panel members.

At the start of the site visit, the panel discussed these initial findings, identified the key issues to be discussed during the sessions, and agreed on a division of tasks during the site visit.

Site visit
The site visit to the University of Twente took place on 9 and 10 December 2019. Before and during the site visit, the panel studied the additional documents provided by the programme. An overview of these materials can be found in Appendix 5. The panel conducted interviews with representatives of the programme: students and staff members, the programme management, alumni and the Board of Examiners. It also offered students and staff members an opportunity for confidential discussion during a consultation hour. Nobody made use of this opportunity.

The panel used the final part of the site visit to discuss its findings in an internal meeting. Afterwards, the panel chair publicly presented the panel's preliminary findings and general observations.

The visit was concluded with a development conversation, in which the panel and the three programmes discussed various development routes for the programmes. The result of this conversation is summarised in a separate report.

Consistency and calibration
In order to assure the consistency of assessment within the cluster, following measures were taken: the panel composition ensured regular attendance of (key) panel members, including the chair, and the project coordinator was present at the panel discussion leading to the preliminary findings of each programme at all site visits.

Report
After the site visit, the secretary wrote a draft report based on the panel's findings and submitted it to the project coordinator for peer assessment. Subsequently, the secretary sent the report to the panel. After processing the panel members' feedback, the project coordinator sent the draft report to the Faculty in order to have it checked for factual irregularities. The project coordinator discussed the ensuing comments with the panel's chair and changes were implemented accordingly. The report was then finalised and sent to the Faculty and University Board.

Definition of judgements standards
In accordance with the NVAO's Assessment framework for limited programme assessments, the panel used the following definitions for the assessment of the standards:

Generic quality
The quality that, from an international perspective, may reasonably be expected from a higher education Associate Degree, Bachelor's or Master's programme.

Meets the standard
The programme meets the generic quality standard.

Partially meets the standard
The programme meets the generic quality standard to a significant extent, but improvements are required in order to fully meet the standard.

Does not meet the standard
The programme does not meet the generic quality standard.

The panel used the following definitions for the assessment of the programme as a whole:

Positive
The programme meets all the standards.

Conditionally positive
The programme meets standard 1 and partially meets a maximum of two standards, with the imposition of conditions being recommended by the panel.

Negative
In the following situations:
- The programme fails to meet one or more standards;
- The programme partially meets standard 1;
- The programme partially meets one or two standards, without the imposition of conditions being recommended by the panel;
- The programme partially meets three or more standards.

SUMMARY JUDGEMENT

The master's programme Interaction Technology has a unique and societally relevant profile with technology at the core, and dares to reinvent itself as the technologies that form its contents evolve. Students have the opportunity to develop themselves according to their individual preferences, including international exchange through the EIT Digital double degree programme. Although the panel approves of the resulting profile, it thinks that the programme could benefit from strengthening its vision and positioning, in particular with regard to the design field, the field of computer science, and the bachelor's programme Creative Technology. The intended learning outcomes (ILOs) reflect the six pillars that the programme defined as the core of the programme: Technology, Understanding humans and context, Storytelling, Design, Research and Impact, innovation and entrepreneurship. They are aligned with the 4TU Meijers Criteria, anchoring the programme's academic orientation at master's level. The panel applauds the recent establishment of a professional advisory board that can help the programme further develop its profile and fine-tune its ILOs.

The programme offers students a wide selection of courses to compose their own curriculum in Interaction Technology. The coherence and alignment with the ILOs of each individual curriculum are safeguarded through a minimum of required EC in each of the programme's six pillars. Due to the amount of choice and these requirements, some students struggle to compose an ideal curriculum that fits within two years. The panel recommends the programme to investigate how this can be addressed. It also recommends to review the use of terminology to further define its unique profile, moving away from its computer science origin. The double degree specialization Human Computer Interaction & Design (HCID) is adequately embedded in the programme, with sufficient quality control on the elements executed at partner universities.

The programme is offered in an international, multidisciplinary context, and is strongly associated with the research interests of the various groups from the multiple faculties involved in the programme. The project-based teaching methods fit the profile of the programme, and are well-provided with labs and equipment. The panel recommends to further invest in the Interaction Technology community, which it considers an opportunity to further develop the identity of the programme. The use of English as the language of instruction in the programmes fits the international character of the programme and its teaching staff, and prepares students for the international job market. The high student numbers within the faculty cause a high workload for the teaching staff. The faculty has taken measures to expand the teaching staff in due time, which the panel supports. The panel is positive about the quality of the teaching staff of the programmes, the professionalization of teachers through University Teaching Qualifications and the regular meetings in which alignment of courses is discussed between the interfaculty teaching staff.

The programme has a valid, transparent and reliable system of assessment in place. The assessment methods are varied and fit the learning goals of the programme. The course assessment plans provide a clear overview of the course goals and the intended learning outcomes. The Examination Board of the programme fulfils its formal tasks and has a proactive role with regard to assessment quality. The final projects are assessed through a solid procedure that involves an assessment committee of at least three examiners. The assessment form is of sufficient quality, although the programme should closely monitor that all assessment committees provide sufficient qualitative feedback. The programme has solid procedures in place to safeguard the quality of HCID theses conducted at partner universities of the EIT Digital consortium. The panel recommends including a written record to the assessment dossier of the additional quality check on these theses.

The panel concludes that the final projects of the programme are of the required quality, and convincingly show that the intended learning outcomes are achieved. The panel praises the programme for the high number of scientific publications resulting from the final projects. Graduates of the programme easily find a job in fields that align well with the profile of the programme, with a relatively high number of them continuing in academia.

The panel assesses the standards from the *Assessment framework for limited programme assessments* in the following way:

Master's programme Interaction Technology

Standard 1: Intended learning outcomes	meets the standard
Standard 2: Teaching-learning environment	meets the standard
Standard 3: Student assessment	meets the standard
Standard 4: Achieved learning outcomes	meets the standard
General conclusion	positive

The chair, em. Prof. dr. T. (Theo) D'Hondt, and the secretary, P.A. (Peter) Hildering MSc, of the panel hereby declare that all panel members have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 24 April 2020

DESCRIPTION OF THE STANDARDS FROM THE ASSESSMENT FRAMEWORK FOR LIMITED FRAMEWORK ASSESSMENTS

Standard 1: Intended learning outcomes
The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings

Profile
The master's programme Interaction Technology (I-Tech) is offered by the Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) of the University of Twente. The programme aims to combine the fields of computer science, electrical engineering and several social sciences to study how people interact with digital technologies such as virtual reality, speech and language interfaces, the internet of things and social robots. This includes research, design, development and evaluation of user-friendly digital technologies. Students are expected to obtain a scientific mind set as well as specialist technical knowledge so that they are able to understand and use modern hardware and computational technologies. The programme aims to prepare for a career in an interdisciplinary and intercultural environment in either research or industry. As a 'new engineer', graduates should be able to bridge disciplines by understanding technology as well as its users.

The programme has evolved from the former master's programme Human Media Interaction. The name Interaction Technology was adopted in 2018 to represent the gradual shift of the programme towards a broader focus on interaction of people with a wide range of virtual systems and technologies rather than multimedia products alone. As part of this redesign, the programme has identified six pillars that represent the domains that every I-Tech professional will encounter during his or her career: 1) Technology, 2) Understanding humans and context, 3) Storytelling, 4) Design, 5) Research and 6) Impact, innovation and entrepreneurship. Students are free to compose their own study programme as long as each of these six pillars is adequately covered (see Standard 2). This allows for a dynamic programme that is tailored to the individual preferences and goals of each student. Next to the regular Interaction Technology curriculum, students can also opt for a double degree programme Human Computer Interaction and Design (HCID) offered in the context of EIT Digital, where they spend one year in Twente, and one year at one of the EIT Digital partner institutions in either Sweden, Italy, Finland, France, Germany or Spain, and receive diplomas from both institutions. The first year at each institution is designed to be equivalent, whereas the second year constitutes of a specialization and the master's thesis. Students in the HCID double degree programme make up approximately 40% of the student population.

The panel has studied the profile of the master's programme Interaction Technology and was positively surprised by the dynamical character of the programme. The programme puts technologies at the core, and dares to reinvent itself as the technologies that form its contents evolve. Students have a lot of options to compose their own curriculum, and as a result have the opportunity to develop themselves according to their individual preferences. The interdisciplinary profile of the programme that focuses on the interaction with users and modern (computational) technologies is unique and relevant for society. Furthermore, the focus on human interaction with technology aligns exceptionally well with the 'High Tech Human Touch' profile of the University of Twente. The double degree programme offered through EIT Digital offers students an opportunity for exchange and international experience, in line with the recommendation of the previous accreditation committee to offer students more opportunities to go abroad. Finally, the panel noted that the programme has a very favourable gender balance as compared to other programmes in the Computer Science cluster: which has grown towards a 50-50 balance in recent years.

During the site visit, the panel discussed with the programme management, students and teaching staff how the programme relates to the various disciplines it associates its focus with. The programme originated from computer science, but has shifted more towards design and innovation as the technology it studied embedded more and more into society. The panel notes that this shift has happened organically, and as a result, the current profile of the programme is mostly a product of evolution rather than intentional design. Although the panel approves of the resulting profile, it thinks that the programme could benefit from strengthening its vision and positioning. For instance, the programme still defines itself in terms of the ACM Curriculum for Computer Science programmes, which has become less obvious as the programme has become more interdisciplinary (see below). Also, the programme increasingly focuses on design and innovation, but does not fully embrace the associated terminology and conventions, for instance in course names (see Standard 2). Finally, the programme should define its position with regard to the bachelor's programme Creative Technology within the same faculty. This programme is the main supplier of students to the master's programme Interaction Technology and students see this as a natural continuation. However, the bachelor's programme Creative Technology was not specifically designed to prepare for this master's programme (which was originally intended to follow after the bachelor's programme Technical Computer Science) and their curricula are not aligned. According to the panel, the programme should decide whether such an alignment is desirable, and in any case how they relate to one another.

Intended learning outcomes
The intended learning outcomes (ILOs) of the master's programme consist of 9 core competences that students should obtain at the end of the programme. They describe the core knowledge and skills that allow graduates to research, develop and evaluate the interaction of people with digital technologies. To show that these ILOs qualify students as academic masters according to international standards, the programme presented the panel with an overview in which the ILOs are linked to the ACQA framework (Meijers criteria) for master's programmes. The ACM Framework that serves as domain-specific framework of reference was formulated for broad curriculum undergraduate programmes, but serves as a source of inspiration for master's programmes with regard to the general competences. To demonstrate the alignment of its ILOs with these international requirements of the field, the programme showed an overview in which the ILOs are linked to the ACM Computer Science Curriculum 2013 (Appendix 1).

The panel studied the ILOs of the master's programme Interaction Technology and concluded that they form a convincing and well-structured overview of the six pillars of the programme translated into the knowledge and skills levels to be acquired by the students. The use of the Meijers criteria in designing the ILOs guarantees that they meet the required degree level and academic orientation, as well as cover the general engineering skills required by the academic and professional field. The panel noted that the ILOs only partly cover the eleven competences of computer science as formulated by ACM, which is not surprising considering that this master's programme is not a core computer science programme. The programme acknowledges this partial disconnection and has recently established a Professional Advisory Board to address this matter, as recommended by the previous accreditation committee. This Board is installed to better align the programme with the field of technology, media and arts, rather than computer science alone. It consists of both academic members and representatives from the professional field, most prominently the creative industry. The board plans to meet annually to discuss developments in the field and possible implications of these for the ILOs and curriculum. The panel thinks that the establishment of a Professional Advisory Board is a good decision that will help the programme further develop its profile and the fine-tuning of its ILOs.

Considerations
The master's programme Interaction Technology has a unique and societally relevant profile with technology at the core, and dares to reinvent itself as the technologies that form its contents evolve. Students have the opportunity to develop themselves according to their individual preferences, including international exchange through the EIT Digital double degree programme. Although the panel approves of the resulting profile, it thinks that the programme could benefit from strengthening

its vision and positioning, in particular with regard to the design field, the field of computer science, and the bachelor's programme Creative Technology. The intended learning outcomes reflect the six pillars that the programme defined as the core of the programme. They are aligned with the 4TU Meijers Criteria, anchoring the programme's academic orientation at master's level. The panel applauds the recent establishment of a professional advisory board that can help the programme further develop its profile and fine-tune its ILOs.

Conclusion
Master's programme Interaction Technology: the panel assesses Standard 1 as 'meets the standard'.

Standard 2: Teaching-learning environment
The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings

Curriculum
The Interaction Technology curriculum consists of a mandatory introductory course (Foundations of Interaction Technology, 5 EC), a body of elective courses that students can choose to compose their personal curriculum (50 EC), a free elective space (25 EC), a research topics course (10 EC) and a final master's project (30 EC). Each individual study programme needs to cover all six pillars for a minimum number of EC per pillar. The Technology pillar requires 20 EC, Understanding Humans and Context and Research 10 EC each, and the remaining three each require a minimum of 5 EC. Each elective course is assigned to one (5 EC) or two pillars (2.5 EC each). The assignment to pillars of the free elective space, the research topics and the final master's project is decided upon by the programme mentor, one of the staff members with the specific task to help students compose a coherent individual curriculum. The open structure of the curriculum combined with requirements per pillar are intended to give students the opportunity to specialize in a direction of choice, while still covering all basics of the programme.

The mandatory Foundations of Interaction Technology course at the start of the programme gives students an overview of the field, and helps them decide in which direction they want to specialize. The elective courses can be chosen from a list of 60+ courses, which are for the majority offered by the research departments associated with the programme, like Human Media Interaction, Design Production and Management, Robotics and Mechatronics and Data Science. Next to the elective courses offered within the programme, students have a free elective space of 25 EC which they can either use for more elective courses, courses outside the programme or the university, an internship or a *capita selecta* course proposed by the students themselves. Students finish their programme with a final project, preceded by the Research Topics course. In this course, students choose a suitable topic, define a research question and the research methods, and develop a work plan for their project. The project itself is the execution of a 30 EC independent research and/or design project, resulting in a written thesis and an oral presentation.

Double degree students in the HCID specialization in principle follow the same curriculum, but have more restrictions in their choice of courses due to the narrower focus of the track on human-computer interaction. A body of 40 EC courses in the first year is mandatory, and they can choose their electives from a restricted list. Students follow one year in Twente and one year at one of the partner universities, that offer equivalent curricula that are regularly aligned between universities. Each of the participating universities is accredited through the European Standards & Guidelines. In addition, EIT Digital has its own system of quality assurance for each joint programme.

The panel has studied the curriculum and the course list, as well as materials from a number of courses, and discussed these with the programme management, students and teaching staff. It concludes that the programme offers an extensive list of courses, providing students with many

opportunities to shape the programme according to their own preferences. At the same time, the requirements for each of the pillars guarantees that each student covers all ILOs of the programme in a coherent way. The fact that the Technology pillar has the strongest requirements fits the technology-focused profile of the programme, whereas the Research pillar and the Research Topics course provide a major research component to the programme safeguarding its character as an academic master's programme. Furthermore, the courses are strongly connected to the research topics studied within the associated research departments. As a result, courses are up-to-date and incorporate recent trends and research results. The panel learnt from students that the abundance of choice and the requirements in choosing options can be sometimes overwhelming for students, and they sometimes struggle to compose a coherent curriculum. This observation will be further discussed under Feasibility below. The HCID specialization offers a coherent curriculum using the courses offered by the programme. The programme has sufficient control of the quality of the EIT Digital programme through the alignment of curricula between the partner universities, as well as EIT Digital's own quality assurance system to which the programme contributes.

From the list of courses and their descriptions and discussions with students and staff, the panel noted that the names of some courses are ambiguous. Several courses named 'Advanced Courses' are broadening courses rather than deepening courses, the associated computer science field is often central in the name, and the term 'design' is used in a very broad sense, ranging from engineering to creative design. In general, the panel thinks that the naming of courses still reflects the computer science origin of the programme, whereas the programme has gradually evolved away from this foundation. The panel recommends reviewing the course names and make adaptations where necessary to reflect the specific identity of the programme, using the conventions from similar design and innovation programmes.

Teaching methods, facilities and community
As the interaction of people with technology is central to the programme, projects and practical work in which this interaction is studied are a central teaching method alongside lectures and tutorials. Students are treated as apprentices, and students and staff are envisioned to form a learning community where students are active contributors to the exchange of ideas. This also means that students are often invited to staff lectures and social events, and vice versa. Students make use of three laboratories for their practical work: the Designlab, the SmartXP space and the HMI lab. The Designlab is a multidisciplinary collaborative workplace that students from different creative programmes jointly use for prototyping; it offers devices such as laser cutters and a 3D printer. SmartXP is a shared space for I-Tech students and the bachelor's programme Creative Technology where they can work and mingle. The HMI lab is the research lab of the Human Media Interaction research group. It may also be used by students for project work and offers virtual and augmented reality hardware and robots.

The panel is positive about the project-centred teaching methods of the programme, which fit the profile of the programme. Students appreciate the opportunity to perform their projects in a research environment, and exchange ideas with the teaching staff. The programme-specific facilities are fitting to the project-centred teaching methods, and are valued by students. The Designlab, which the panel visited during the site visit, offers students a multidisciplinary creative environment and sufficient equipment and space for project work.

Although the programme works on creating a community feeling with staff and students, some students indicated to the panel that they feel the need for further community building within the programme. They reported segregation in the programme due to the large inflow from the bachelor's programme Creative Technology on the one hand, and the very diverse inflow on the other hand. As the programme is fully flexible apart from the introductory course, students feel that they do not get enough chances to get acquainted and mingle with the pre-existing community of Creative Technology students. The panel recommends the programme to keep investing in the creation of an Interaction Technology community. This will add to the sense of community amongst students, and is also an opportunity to further develop the Interaction Technology profile and identity. The panel

thinks that with the current facilities and the attention invested in forming an engaging community of learners, the programme already has the tools at its disposal to make this desired connection a success.

Feasibility
The panel has studied an overview of the study success of the programme, and discussed the feasibility of the programme with students, teaching staff and programme management. This overview shows that approximately 30% of the students finish the programme within two years, and 75% within three years. The programme management and students reported to the panel that although the courses are considered to be feasible, many students struggle with composing a coherent curriculum. The many options for courses in combination with the restrictions imposed on this choice through the six pillars of the programme make it hard for students to choose a curriculum that fits within two years. Many students therefore choose to take longer because their ideal curriculum has too many courses in a specific quartile, or because they are overwhelmed by the amount of choice and only realize what their ideal curriculum would look like later in the programme. This is reflected in the success rate of the programme, with most students taking between two and three years to finish their programme.

The panel concludes that the programme in itself is feasible, but recommends the programme to further investigate the process of curriculum choice by students in order to minimize the chance of study delay due to practical reasons. It understands the limitations of the programme has in offering courses more than once per year, but recommends the programme to consider other measures such as extended guidance of students in composing their curriculum, adapting the placement of courses in the quartile schedule or a different approach to the pillar requirements to allow for more flexibility.

Language and internationalization
The programme is offered in English, and has a very international teaching staff and student population. The use of the English language is in line with the university-wide policy to offer all programmes in English, and prepares students to work in an international environment, where English is the norm in the academic and professional field. In addition, the use of English allows the programme to use the latest insights in the field, which are usually only available in English, and to involve the large non-Dutch fraction of the teaching staff in education. The international context of the programme is further enhanced due to the exchange of students in the double degree HCID specialization. To guarantee a sufficient command of English, the programme has implemented a (university-wide) policy that each teacher should at least have a C1-level command of English. Furthermore, international students are offered opportunities to learn about Dutch culture and the Dutch language through courses offered by the university. According to the panel, the considerations of the programme to use English as instructional language is appropriate considering the very international orientation of the field, as well as the international teaching staff within the faculty. The use of English is well-implemented within the programme, with adequate language requirements and support for the teaching staff to safeguard their command of English.

Teaching staff
The teaching staff of the programme is an interdisciplinary team that originates from many different research groups. These are not only research groups native to the EEMCS faculty, but also originate in the faculties Behavioural and Management Sciences (BMS) and Engineering Technology (ET). The teaching staff meets monthly in the departmental council, that discusses the form and content of the course programme, as well as the relation between courses. Obtaining a University Teaching Qualification (UTQ) as well as having at least C1-level command of English is a prerequisite for every new teacher.The majority of teachers currently has a UTQ or is in the process of obtaining one. Students indicated to the panel that they are positive about their teachers, which they consider to be enthusiastic, approachable and knowledgeable in their field. The panel is positive about the quality and professionalization of the teaching staff of the programme. The frequent meetings of the teaching staff add to the alignment of courses in an interfaculty programme. As active researchers, the

teaching staff connect the courses to their own research, providing students with the opportunity to stay up-to-date on current research.

Although the student intake of Interaction Technology is relatively stable, the programme still feels the consequences from the high increase in student numbers at the faculties involved, most prominently EEMCS. Teachers are involved in multiple programmes, and the courses are open for students from other master's programmes. The teaching staff indicate that this puts a strain on their workload, which is noted by students as well. The faculty is dealing with this demand by hiring new staff, both academic staff and teaching-only staff. Hiring is currently underway, and is expected by the programme to remedy the current situation. The panel is positive about the high priority that the faculty gives to the issue of staff workload. It agrees with the measures taken, and encourages the faculty to continue hiring new teaching staff to keep up with the high student numbers.

Considerations
The programme offers students a wide selection of courses to compose their own curriculum in Interaction Technology. The coherence and alignment with the ILOs of each individual curriculum are safeguarded through a minimum of required EC in each of the programme's six pillars. Due to the amount of choice and these requirements, some students struggle to compose an ideal curriculum that fits within two years. The panel recommends the programme to investigate how this can be addressed. It also recommends to review the use of terminology to further define its unique profile, moving away from its computer science origin. The double degree specialization HCID is adequately embedded in the programme, with sufficient quality control on the elements executed at partner universities.

The programme is offered in an international, multidisciplinary context, and is strongly associated with the research interests of the various groups from the multiple faculties involved in the programme. The project-based teaching methods fit the profile of the programme, and are well-provided with labs and equipment. The panel recommends to further invest in the Interaction Technology community, which it considers an opportunity to further develop the identity of the programme. The use of English as the language of instruction in the programmes fits the international character of the programme and its teaching staff, and prepares students for the international job market. The high student numbers within the faculty cause a high workload for the teaching staff. The faculty has taken measures to expand the teaching staff in due time, which the panel supports. The panel is positive about the quality of the teaching staff of the programmes, the professionalization of teachers through UTQs and the regular meetings in which alignment of courses is discussed between the interfaculty teaching staff.

Conclusion
Master's programme Interaction Technology: the panel assesses Standard 2 as 'meets the standard'.

Standard 3: Student assessment
The programme has an adequate system of student assessment in place.

Findings

Assessment system
The programme adheres to the assessment system and exam regulations decided upon at the faculty level. The assessment policy prescribes a course assessment plan in which the course learning objectives, their relationship with the programme learning goals and the individual tests within the module or course are presented. The plan also describes what assessment methods will be used, and what the rules and regulations are with regard to the tests, such as their contribution to the final grade and the responsible lecturer. As the programme views its students as apprentices, emphasis is placed on individual, formative assessment during the courses, with feedback on project work, portfolios feedback or presentations.

The panel studied the assessment policy of the programme and a number of course assessment plans. It concluded that the programme uses varied assessment methods that fit the learning goals of the programme. These include written exams, assignments, project work, multimedia products and research papers. There is an adequate system of quality assurance of assessment in place. For instance, each written exam is reviewed beforehand by a colleague, adding to the validity of the exams. In the case of group projects, the supervisor monitors whether each student has made a proper contribution to the process, and if not, can impose an additional individual oral exam.

Assessment final projects
The programme has an individual research or design project that covers most of the programme's ILOs. Exceptions are the Storytelling and the Impact, Innovation and Entrepreneurship pillars, which final attainment level is assessed in the associated courses. Each final project results in a written thesis and a presentation of the results. This project is assessed by a committee of at least three examiners, which originate from at least two different research groups. Externally conducted final projects are allowed, as long as they always have two supervisors: an academic supervisor from within the department who is responsible for the project's academic quality, and an external daily supervisor who is responsible for the project's relevance for the external party. The committee of examiners attends the project presentation and decides upon the grade in consensus afterwards. The grade and motivation are documented in an assessment form, separated into five subgrades. The panel was impressed by the solid assessment procedure with a thesis committee consisting of multiple examiners. In the case of a thesis conducted at one of the partners in the EIT Digital HCID specialization, the programme takes several quality control measures. Each thesis proposal needs to be approved by both universities. Furthermore, the programme checks with the student half-way into the project to make sure that he or she is on the right track. Finally, an examiner from Twente performs a check on basic quality before the thesis is accepted for graduation. Due to the major differences in grading cultures between universities, Twente has recently decided to no longer adopt grades from partner universities, but marks external HCID theses simply with 'pass' (V).

The panel studied the 15 assessment forms of final projects. For the theses conducted at Twente, it was positive on the quality of the assessment, and it generally agreed with the grades. On some assessment forms, the amount of qualitative feedback was limited. The panel recommends monitoring the correct use of the form by all assessment committees, and to make the use of the comment field mandatory for each subgrade. The panel saw a variety of local assessment methods for the assessment of external HCID theses, depending on the university involved. The panel approves of the extra quality check that the programme performs on these theses to safeguard that each double degree thesis meets the requirements for a master's degree. It recommends including a written record describing the details of this quality check to the assessment dossier for quality assurance purposes.

Examination Board
The programme is covered by the faculty-wide Examination Board EEMCS. There is a sub-committee for Interaction Technology that is responsible for the programme-specific affairs of the programme. The Examination Board consists of the chairs of all sub-committees as members, and an independent overall chair, external member and secretary. The Board performs programme-independent tasks such as establishing policies for test quality, rules and guidelines and plagiarism and fraud prevention policies, whereas the sub-committee evaluates the quality of assessment within the programme and advises on test plans. The sub-committee meets with the programme management twice a year to discuss assessment of the previous semester, and the quality of the final projects. It is supported by an assessment committee that evaluates the assessment within the programme under mandate.

The panel interviewed the Examination Board, including representatives of the sub-committee Interaction Technology, and studied a number of its annual reports. It concludes that the Board fulfils its formal tasks in safeguarding the quality of assessment within the programme, including the quality of final projects and the prevention of fraud and plagiarism. It is well-informed on the assessment

within the programme and proactively discusses improvements for assessment quality with the programme management.

Considerations
The programme has a valid, transparent and reliable system of assessment in place. The assessment methods are varied and fit the learning goals of the programme. The course assessment plans provide a clear overview of the course goals and the intended learning outcomes. The Examination Board of the programme fulfils its formal tasks and has a proactive role with regard to assessment quality. The final projects are assessed through a solid procedure that involves an assessment committee of at least three examiners. The assessment form is of sufficient quality, although the programme should closely monitor that all assessment committees provide sufficient qualitative feedback. The programme has solid procedures in place to safeguard the quality of HCID theses conducted at partner universities of the EIT Digital consortium. The panel recommends including a written record to the assessment dossier of the additional quality check on these theses.

Conclusion
Master's programme Interaction Technology: the panel assesses Standard 3 as 'meets the standard'.

Standard 4: Achieved learning outcomes
The programme demonstrates that the intended learning outcomes are achieved.

Findings

Quality final projects
Prior to the site visit, the panel studied 15 final projects of the master's programme, distributed over students from the regular degree programme and HCID double degree students. The panel is positive about the quality of all projects. The theses show a wide variety of multidisciplinary topics relating to the interaction of people with technology, fitting the profile of the programme. Topics include amongst others a learning robot for primary schools, a digital tagging game, interfaces in virtual reality and emotional influence tactics in virtual negotiations. Students show creativity as well as adequate research skills at an academic master's level. The quality of students' achievements is further demonstrated by the high number of peer-reviewed publications (eight in the past two years) resulting from final projects.

Alumni
According to alumni research conducted by the programme, 85% of the programme's graduates find a relevant job within six months upon graduation. 28% of graduates continue in academia, which is high compared to master's programmes in computer science. The rest of the graduates mainly end up in ICT (43%), often on the topic of user experience, which fits the focus of the programme.

Considerations
The panel concludes that the final projects of the programme are of the required quality, and convincingly show that the intended learning outcomes are achieved. The panel praises the programme for the high number of scientific publications resulting from the final projects. Graduates of the programme easily find a job in fields that align well with the profile of the programme, with a relatively high number of them continuing in academia.

Conclusion
Master's programme Interaction Technology: the panel assesses Standard 4 as 'meets the standard'.

GENERAL CONCLUSION

The panel assesses all standards of the NVAO's Framework for a limited programme assessment 2018 for the programme as 'meets the standard'. According to the decision rules of the framework, the panel assesses positively on the programme.

Conclusion
The panel assesses the *Master's programme Interaction Technology*: as 'positive'.

APPENDICES

APPENDIX 1: DOMAIN-SPECIFIC FRAMEWORK OF REFERENCE

The I-Tech programme is roughly based on the ACM 2013 curriculum framework. This framework is used by many computer science programmes across the world. The Dutch universities have agreed to use it for bachelor as well as master computer science programmes. And although I-Tech is not a computer science programme in the narrow sense of the word, computer science is evolving from a field of classical subjects such as algorithmic, networks and programming, to a field that also deals with the interaction of people with digital technologies. Therefore, this ACM 2013 curriculum framework is an appropriate basis for the I-Tech programme. This extensive document is available at: https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf

The Association for Computing Machinery (ACM) is an internationally recognised institute that produces resources with the intention of helping computer science and similar fields advance scientifically as well as professionally. Besides giving detailed lists of subject matter to be covered in an undergraduate programme, it describes a computer science graduate in 11 characteristics.

At a broad level, the expected characteristics of computer science graduates include the following:

1. Technical understanding of computer science
2. Familiarity with common themes and principles
3. Appreciation of the interplay between theory and practice
4. System-level perspective
5. Problem solving skills
6. Project experience
7. Commitment to life-long learning
8. Commitment to professional responsibility
9. Communication and organizational skills
10. Awareness of the broad applicability of computing
11. Appreciation of domain-specific knowledge

For a more detailed coverage, please refer to chapter 3, page 23 on the above link.

APPENDIX 2: INTENDED LEARNING OUTCOMES

The I-Tech programme has the following subject specific scientific attainment targets:

a) Graduates have a thorough knowledge and understanding of each of the sub-fields listed below:

a. methodology of user-oriented design, including the drafting of user requirements and user studies
b. usability engineering
c. intelligent interaction employing techniques taken from artificial intelligence

b) Graduates can design sophisticated applications involving interactive systems that are geared to the needs of users, using state-of-the-art techniques and methods. They are able to design such applications both independently and as part of a team.

c) Graduates have knowledge of and understand various aspects of the user context of interactive systems and can, based on this, communicate effectively and efficiently with users during the various phases of the development process.

d) Graduates have knowledge of and understand basic questions and research methods into human behaviour relevant to the multimodal system they develop and grasp the relevance of these fields of study to the design of interactive systems.

e) Graduates can draft, transfer, document and communicate to technical designers specifications on the basis of a knowledge and understanding of the technical aspects of interactive systems.

f) Graduates can draft, transfer, document and communicate functional specifications and technical aspects of interactive systems to end-users or clients (by storytelling and using expressive media).

g) Graduates can assess systems for Human Technology Interaction according to their technical and operational aspects, incorporating a thorough knowledge and understanding of qualitative, quantitative and numerical methods.

h) Graduates understand how interactive systems influence technological and business requirements.

i) I-Tech graduates have specialist knowledge of the three Human Technology Interaction subfields (listed under a). Furthermore, I-Tech graduates have practical experience conducting, reporting about and applying the results of scientific research in developing innovative interactive systems by using Interaction Technology techniques and methods.

APPENDIX 3: OVERVIEW OF THE CURRICULUM

Interaction Technology (I-Tech) first year 2019-2020

Take 15 EC in each block. Foundations of Interaction Technology is mandatory upon starting the master (either in semester 1 or 2). Pillars: T = Technology (take min. 20 EC in total), UHC = Understanding Human Context (min. 10 EC), R = Research (min. 10 EC), D = Design (min. 5 EC), IIE = Impact, Innovation Entrepreneurship (min. 5 EC), S = Storytelling (min. 5 EC).
Courses belonging to two pillars count half for each, so 2,5 per pillar they belong to. Advanced courses and projects can belong to different pillars depending on the project (TBD, to be decided) and can only be done after finishing the corresponding introductory course.

All courses are 5 EC unless stated otherwise.

Block 1A (Q1)	**Block 1B (Q2)**
• T: Basic Machine Learning • T: Multi-Agent Systems • T: Control System Design for Mechatronic Systems • T&UHC: Foundations of Interaction Technology • T&UHC: Natural Language Processing • UHC: Philosophy of Technology • R: Concepts, Measures and Methods • D: Create the Future (10 EC) • IIE: Brand Management • S: Documentary Practice • TBD: Advanced Affective Computing • TBD: I-Tech Project (block 1A and 1B, together 10 EC)	• T: Data Science • T: Engineering System Dynamics • T: Foundations of Information Retrieval • T: Deep Learning - From Theory to Practice • T&UHC: Speech Processing UHC&D: Multisensory Design • R: Empirical Methods for Designers • D: Human Centred Design • IIE: Computer Ethics • IIE: Basics of Impact, Innovation & Entrepreneurship • S: Storytelling Through Oral Presentation • TBD: Advanced Machine Learning • TBD: Advanced Project in Natural Language Processing • TBD: I-Tech Project (block 1A and 1B, together 10 EC)
Block 2A (Q3)	**Block 2B (Q4)**
• T: Data Science • T: Image Processing and Computer Vision • T: Ubiquitous Computing • T&UHC: Foundations of Interaction Technology • T&UHC: Brain Computer Interfacing • T&UHC: Conversational Agents • T&D: Social Robot Design • R: Trends in Human Robot Interaction Research • R: Human Computer Interaction • D: Mastering Tinkering • IIE: Global Strategy and Business Development • IIE: Strategic Technology Management and Innovation • IIE: Entrepreneurial Finance • S: Storytelling Through Sound • TBD: I-Tech Project (block 2A and 2B, together 10 EC) • TBD: Advanced Project in Information Retrieval • TBD: Advanced Speech Processing	• T: Virtual Reality • T: Modern Robotics • T: Tele-Interaction in Robotics • T&UHC: Affective Computing • D&S: Designing Interactive Experiences • D: Design and Behaviour Change • D: Embodied Interaction • S: Art, Mathematics and Technology • TBD: I-Tech Project (block 2A and 2B, together 10 EC)1 • TBD: Advanced Conversational Agents • TBD: Advanced Brain Computer Interfaces • TBD: Advanced Human Robot Interaction • TBD: Advanced Computer Vision and Pattern Recognition • TBD: REDI: Research Exp. in Databases and Information Retrieval

Interaction Technology (I-Tech) second year 2019-2020

Block 1A (Q1)	Block 1B (Q2)	Block 2A (Q3)	Block 2B (Q4)
Internship (20 EC) Research Topics I-Tech (10 EC)		Final Project I-Tech (30 EC)	

Research Topics and Final Project are mandatory. Internship is optional. Instead of an internship, 20 EC of courses can be followed. See the first year for the available courses. Note that internship, Research Topics and Final Project can be done at any time after finishing all other courses; the above is just the "ideal" schedule when starting in semester 1 and doing the master in exactly two years.

For the full curriculum overview including short course descriptions, please refer to https://www.utwente.nl/en/itech/Education%20I-Tech/new-students/itech-vakken-20181113.pdf.

APPENDIX 4: PROGRAMME OF THE SITE VISIT

DAG 0 ZONDAG 8 DECEMBER

17.30 19.00 Voorbereidend overleg panel

DAG 1 MAANDAG 9 DECEMBER 2019

09.00 09.15 Ontvangst
09.15 09.45 Voorbereidend overleg panel
09.45 10.30 **Interview opleidingsmanagement CS**
10.30 10.45 Pauze
10.45 11.30 **Interview studenten bachelor CS**
11.30 11.45 **Presentatie bachelorprojecten**
11.45 12.15 **Rondleiding Designlab**
12.15 13.15 Lunch
13.15 14.00 **Interview docenten bachelor CS**
14.00 14.15 Pauze
14.15 15.00 **Interview studenten master CS**
15.00 15.15 Pauze
15.15 16.00 **Interview docenten master CS**
16.00 16.15 Pauze
16.15 16.45 **Examencommissie**
16.45 17.00 Pauze
17.00 17.30 **Ontwikkelgesprek CS**
17.30 18.30 Intern overleg

DAG 2 DINSDAG 10 DECEMBER 2019

08.30 09.00 Aankomst, intern overleg panel
09.00 09.45 **Interview management ITech**
09.45 10.00 Pauze
10.00 10.45 **Interview studenten ITech**
10.45 11.00 **Presentatie studenten ITech**
11.00 11.15 Pauze
11.15 12.00 **Interview docenten ITech**
12.00 12.45 Lunch
12.45 13.30 **Eindgesprek met formeel verantwoordelijken**
13.30 15.00 Opstellen oordelen
15.00 15.15 **Mondelinge rapportage voorlopig oordeel**
15.15 15.30 Pauze
15.30 16.00 **Ontwikkelgesprek ITech**
16.00 16.15 Afronding

APPENDIX 5: THESES AND DOCUMENTS STUDIED BY THE PANEL

Prior to the site visit, the panel studied 15 theses of the master's programme Interaction Technology. Information on the selected theses is available from QANU upon request.

During the site visit, the panel studied, among other things, the following documents (partly as hard copies, partly via the institute's electronic learning environment):

- Overview programme content (study guide, electronic learning environment and a selection of course materials, including course assessment plans)
- Education and Exam Regulation
- Teaching staff overview
- Annual reports Boards of Examiners
- Annual reports Programme Committee
- Assessment plan
- Panel reports of the 2013 Programme Assessments