

## aanvullingen report v1.0 / AE (14/8/08)

### 2.4 Benchmark courses

eind eerste alinea, ipv Below we discuss the profile of Creative Technology with respect to these courses. Voor sectie 2.4.1:

As we indicated in section 2.1, final qualifications for Creative Technology indicated **technology**, that is actual skills in engineering and computer science, as well as an understanding of both **business** and **human factors**, needed for viable deployment of new technologies and solutions. In addition we emphasized experience with **design** and **creativity**, with a deep understanding of human values to understand and express the **requirements** of products and services needed for *living and working tomorrow*.

However ambitious such a wishlist may seem, apart from the courses and initiatives discussed in more detail below, institutes such as Entertainment Technology Center ([www.etc.cmu.edu](http://www.etc.cmu.edu)) at Carnegie Mellon University, pioneered by Randy Pausch, achieved world-wide recognition and follow-up. As reported by Randy Pausch in his renowned **last lecture** ([www.youtube.com/watch?v=ji5\\_MqicxSo](http://www.youtube.com/watch?v=ji5_MqicxSo)), such initiatives, apparently throwing overboard traditional academic teaching methods in favor of artistically-inspired projects, initially meet with resistance, and require active support of institutional leaders with clear vision towards the future. Also for Creative Technology, it does indeed require some courage to introduce a curriculum that not only implies a paradigm-shift in methods of teaching but a broadening of the categories of students as well, by allowing students with a M/Society-profile, formerly not admitted to any of the traditional engineering disciplines.

Creative Technology is a bachelor study, since we strongly believe in the advantage of priming creativity, that is offering active explorative learning in the earliest possible phase of academic learning, instead of later in master or graduate degrees, when the most fruitful formative period has already passed. The courses and initiatives that we discuss below, and more extensively in the appendix, show many commonalities with the Creative Technology curriculum, and all emphasize a change of teaching methods that may to a stronger or lesser degree be characterized as: learner-centered environment, active appropriate practice, experiential learning, interpersonal communication and feedback, multi-disciplinary collaboration, student responsibility and self-motivated learning.

The unique challenge and opportunity for Creative Technology is, in comparison, that we can start with a bachelor degree, in a fresh environment, that is albeit within a traditional engineering setting, eager to change and incorporate a creative approach to the application of technology in a societal context, and, finally, that we are able to do so in a period that thought about **creativity** and **research** have matured to the extent that there is a nationally endorsed **strategic research agenda for the creative industry**.

#### 3.2.3 The general characteristics of the curriculum

aan het einde, voor 3.2.4. Mandatory Study Units, possibly adapt eind eerste alinea: In Part B.1 a description is given of each study unit, which provides an indication of the particular topics covered in these courses and the approach taken with the project and exploration-related units

### Overview of Study Units and Learning Goals

In part B, we have included a detailed description of the courses offered within Creative Technology, following a standard EWI format, indicating: a characterization of contents, (possible) pre-requisite courses, goals and attainment targets, the place in the curriculum, application area and motivating examples, as well as, teaching methods, and required facilities. Such a format is necessary, in particular for the actual realization of the curriculum, but however valuable the format, for an overall understanding of the contents of the Creative Technology curriculum and the relation between individual course units within the tracks that constitute Creative Technology, respectively **Mathematics**, **Computer Science**, **New Media**, **Smart Technology** and **Design** as well as the **Creative Applications** and **Creative Explorations**, we provide an overview of the respective tracks and courses below, with a brief indication of the contents of the courses, their possible relation to other courses and the educational approach, per track.

In the standard EWI course format, **goals and attainment targets** are indicated using (one of the phrases) *awareness*, *familiarity*, *fluency* and *full literacy*. For better understanding these phrases, the reader may find support in the keywords characterizing these, below:

1. *awareness* – theoretical knowledge / hear say
2. *familiarity* – experience and (limited) knowledge
3. *fluency* – basic skill/knowledge, sufficient for elementary application
4. *full literacy* – application of skill/knowledge in problem context

The twelve final qualifications, given in section 2.1, listing the Creative Technology students' set of skills and competences, ranging over the domains of **technology**, **requirements**, **human factors**, **design**, **creativity** and **business**, must in a more pragmatic way be translated to the *learning goals and attainment targets* for each course. However, falling to some extent outside the scope of academic learning goals and attainment targets are qualifications related to **attitude**, **experience** and **creativity**. These aspects, which we consider vital for Creative Technology students, are difficult to measure and assess, since, as for example in Creative Applications, they are intrinsically part of the dynamics of the (group) process. Another problem that presents itself with regard to the assessment of skills and competences related to the goals and attainment targets of, in particular the technical and mathematical, courses is that, given the wider admission profile of Creative Technology students, it may not be realistic to use the same yardstick for all students, since ultimately the quality and value of a student (also for the intended job market) is not only dependent on the possession of individual skills and competences, but to a greater extent perhaps on the performance of the student in collaborative group projects, where it is obviously more important to communicate than to have *knowledge and skills* as such. This aspect of Creative Technology clearly creates a tension in formulating learning goals and attainment targets for the more traditional disciplines of mathematics, computer science and engineering. In contrast, project-based work in *New Media*, *Design* and *Smart Technology* courses gives more freedom to adapt assessment to the individual student's profile.

In general, we observe that, for the more traditional courses, we strive for minimally a level of familiarity that allows for solving technical problems, possibly in cooperation with fellow students, but with sufficient understanding of the underlying principles to be qualified as *engineer*, that is someone who is able to construct technical artefacts. On the other hand, we expect our students to display initiative and to strive for excellence when it comes to applying mathematical insight and technical knowledge in *creative applications* and *projects*.

**Creative Applications** form the core of Creative Technology, as they allow for student initiative, a high degree of autonomy, problem finding and cooperation, yet within a structure that facilitates feedback and promotes a high level of achievement.

- CA1: We Create Identity
- CA2: Living and Working tomorrow
- CA3: Have Fun and Play!
- CA4: Ambient Screens
- CA5: Hybrid Worlds

In CA1, which requires the use of media and tools, the emphasis is on expression and creating group coherence, as well as to identify topics of interest, as potential targets for future learning, and not in the least establishing relationships and contacts between students. CA2 allows for work in smaller groups over a longer period of time, primarily focused on identifying and solving problems in the domain of Smart Technology. CA3 is meant to gain public exposure and participate in a local event with some amazing mix of New Media and Smart Technology. In year 2, the Creative Applications, CA4 and CA5, allow for further exploring the use of sensor and media technologies, in for example scenario-based games or in more serious domains, such as transport logistics, deploying the *Internet of Things*.

**Creative Explorations** are meant to provide in the need to get acquainted with ideas from, for example, the history of art and science, and current day practice in the convergence of art, science and technology.

- CE1: Creative Exploration of Structures
- CE2: Explorations in Art, Science and Technology

CE1 is intended to guide the student in finding inspiration in mathematics, giving insight in both foundational aspects as well as in structures and algorithms that may, for example, be used in generative art. For CE2 it is intended to invite guest speakers who may introduce exciting topics in the intersection of art, science and technology, preferably with demonstrations of their work, to serve as inspiration and model for our students.

**Mathematics** is an essential ingredient of the Creative Technology curriculum. The mathematical courses will introduce basic concepts and terminology, and bring about familiarity with essential mathematical notions, with special focus on issues relevant for the New Media and Smart Technology tracks. Self-guided explorations, using Matlab, will be encouraged.

- MA1: Motion and Modeling
- MA2: Signals and Systems
- MA3: Statistics and Probability
- MA4: Strategies and Protocols
- MA5: Queues and Logistics

MA1 is both relevant for ST2 (Dynamical Systems) and NM2 (Interactive Visualization). It treats, among others, basic Newtonian motion laws, that may be used for both steering vehicles (ST2) and physics-driven animations (NM2). The MA2 course provides material necessary for the realization of Smart Technology applications, and MA3 is needed for, for example, empirical usability studies. MA4 and MA5 are envisaged as mathematical pre-requisites for scenario-based game-play and navigation in virtual/hybrid environments.

**Computer Science** is equally essential for Creative Technology, as both Smart Technology and New Media are computationally intensive and demand strongly developed programming skills. The CS courses will pre-dominantly be of a disciplinary nature, with a strong emphasis on basic principles and concepts, leaving further explorations to projects within the New Media and Smart Technology tracks.

- CS1: Elements of Computer Science
- CS2: Programming for Creative Technology
- CS3: Programming and Structure
- CS4: Data-driven Applications

In CS1 a so-called *techno-drama* approach is chosen, as an innovative way to introduce computing concepts. CS2 deals with basic programming skills in C++ and may be considered to be pre-requisite for scripting skills needed in NM1 and NM2, as well as for the technical work involved in the implementation of sensor systems. CS3 brings about advanced programming skills and CS4 prepares for the realization of data-driven applications, both in the area of web-based New Media (NM4) as well as Smart Technology systems (ST6).

**New Media** is one of the specialization tracks of Creative Technology, focusing on (serious) game development, virtual environments and rich-media web applications. The track essentially requires both programming skills and sufficient mathematical insight, for game development as well as interesting visual effects.

- NM1: Web Technology
- NM2: Interactive Visualization
- NM3: Web2.0 Mashups
- NM4: Virtual Environments
- NM5: Game Development

Both the courses NM1 and NM2 prepare for CA3 in year 1, providing the student with the skills and knowledge needed to develop rich-media applications in a web context. Apart from basic assignments, the courses allow for projects related to the individual students' interests and skills. The NM3 course is strongly related to CS4, allowing the student to develop data-driven web applications and mashups. Both NM4 and NM5 prepare for the second year Creative Applications, which essentially contain elements of virtual environments and game development.

**Smart Technology** is the other specialization track and, given the tradition of engineering and design in EWI and UTwente, a distinguishing element of Creative Technology. Topics covered include sensor systems, mechatronics, as well as issues of control and regulation.

- ST1: Smart Environments
- ST2: Dynamical Systems
- ST3: Control Systems
- ST4: Wireless Communication Systems
- ST5: Introduction to Electronics
- ST6: Sensors

The ST1 course is pre-requisite for CA2 (Living and Working Tomorrow), as it prepares the student for the actual deployment of sensor technology. In ST2 the focus is on conceptual and mathematical issues in dynamic systems, as a preparation for follow-up courses and projects Smart Technology in year 2. ST3 provides skills and knowledge needed for CA5 (Hybrid Worlds), and ST4 and ST5 provide further material needed to complete bachelor projects within the Smart Technology track.

**Design** may be regarded as an auxiliary track of Creative Technology, that is nevertheless essential for all students regardless of their choice of specialization track. The design courses not only provide the skills necessary for modeling and concept design, but also teach the student about human factors and, not the least important, how to present their work effectively.

- DE1: Sketching for CreaTe
- DE2: Graphical design
- DE3: Designing in context
- DE4: Human Factors
- DE5: 3D modelling
- DE6: Advanced graphic design
- DE7: Digital content creation tools

The DE1 course is not only useful for learning skills of sketching, but is regarded to be beneficial for the general creativity of the students as well. DE2 complements the more technical approach of NM1, and is needed to help students to create an appealing online portfolio of their work. The DE3 as well as the DE4 courses teach the student, respectively, aspects of creativity and how to deal with human factors in design, obviously relevant for both New Media and Smart Technology tracks. The DE5 course is useful for students designing tangible (smart) artefacts, and clearly, together with DE6 and DE7, essential for students specializing in virtual environments and game development.