(new) media in *creative technology*

from a *new media* perspective

Anton Eliëns

abstract In this note we will discuss the educational targets and learning goals for the *new media* track in *creative technology*. By way of introduction, it will also be explained what must be understood by educational targets, and how we can relate these to the learning goals or topics represented by a collection of courses. A set of courses will be proposed, but also an alternative approach, offering *media in context*, that is as an element of *creative applications* will be discussed, for which we will also indicate the relation to other theories and areas of science.

status: 18/2/08 – for discussion

introduction

Creating a curriculum for *creative technology*, and for that matter a *new media* track, is, indeed, a complex puzzle, for which potentially many solutions exist. The reader may wonder why also here the sub-title *from a new media perspective* is used. Briefly, this may be explained by stating that, one way or another, *media* may be regarded as an essential ingredient of any ICT-related study, and that, in addition, there are multiple ways of including *media* in the *creative technology* curriculum, even without offering an explicit *new media* track or specialisation.

In other reports[1] we have discussed the relation of *new media* to design, indicated the requirements for computing, sketched scenarios, and (moreover) gave an outline of the *creative technology* curriculum. In each of the reports, an indication of *educational targets*, for each of the various tracks or sub-disciplines, was given, suggesting the relevance of the proposed solution(s).

To give an indication what is meant by the arguably debatable categories of educational targets, a brief explanation is given below:

categories of educational targets

- *skills* – practical, hands-on, technology-oriented
- *knowledge* – ready-to-use, beyond skills, required insight
- *theory* – grounded in literature and scientific context
- *experience* – application of skills and knowledge in context

Although there may be no sharp dividing line between for example skills and knowledge, knowledge and theory, and skills and experience, when taking into account the scope within which skills are executed, or the depth or explicitness of theories involved, such a distinction becomes (hopefully) more clear.

Below we will, after clarifying the learning goals and educational targets of the *creative technology* curriculum, give an outline of how the *new media* track could fit within the curriculum, and what choices need to be made to finally realize the curriculum.

creative technology – learning goals and targets

In CreaTe – Proposal for a new curriculum[2] (p. 12), a number of components are mentioned that should be part of such a curriculum. These components include:

learning goals – *creative technology*

- computing – architecture, networks, programming
- technology – new media, smart technology
- creative applications – creativity (mental + artistic), psychology, research/design methods, communication
- business – marketing, planning, project management
- design – sketch, prototype, realize

[1] janus.cs.utwente.nl:8000/twiki/bin/view/CT/NewMedia08

[2] janus.cs.utwente.nl:8000/twiki/pub/CT/WebHome/CreaTeFinalReport_v1.0.pdf

An observation we may make is that for *creative applications* the list of learning goals is rather long and diverse, potentially involving many scientific and possibly extra-academic disciplines, dependent on what level, so to speak, we wish to present these aspects.

In principle, the components listed above can be taken to represent educational targets, that is what students of *creative technology* need to learn or obtain during their study:

educational targets – *creative technology*

- skills – computing, mathematics, simulation, technology
- knowledge – mathematics, computer & software architecture
- theory – systems engineering, media & communication, human factors
- experience – project(s), deployment in social context

Let it be clear, these targets are not a given per se, but could, and probably should be discussed, to obtain a concise description of what we aim for with *creative technology*. An additional (intended) benefit is that this way the requirements for each track in the curriculum can (in principle) be more concisely specified, and compared with the requirements for other tracks.

new media – targets and learning goals

In delineating the content and scope of the *new media* track, or even more plainly the *media* component in the *creative technology* curriculum, we may, with an eye to what is common nowadays for university-level curricula, arrive at the following educational targets:

educational targets – *new media*

- skill(s) – scripting, programming, interaction design
- knowledge – web, multimedia & game technology
- theory – understanding of media & communication theory
- experience – concept development & realization of (playful) application(s)

There is, obviously, ample freedom of what courses or topics to introduce, apart from basic web technology, to realize such targets. Within the *creative technology* curriculum, however, covering a substantial part of the following topics, at least for a *new media* track, seems mandatory.

learning goals – *new media*

- interactive video – in customizable format
- web technology – for developing information portal(s)
- animation – for simulations and (physical) systems
- virtual reality – for games and virtual environments
- game development – for entertainment and instruction
- rich internet application(s) – for multimedia (web) applications

In the list of topics, each of which could be presented in a course of its own, no explicit indication is given what must be considered pre-requisite knowledge. One option is to include in each course an introductory part in which the basic technology is presented, accompanied with exercises that allow the students to practice and gain experience. This is the way that, for example at art schools, the obstacle of teaching technology is generally dealt with. However, in an academic setting,it seems more worthwhile to profit from other disciplines, such as *computing* and *design*, to obtain the required skills and knowledge of, respectively, scripting/programming and modelling.

new media – course(s)

In specifying the requirements for the computing track in *creative technology* and giving a first proposal for how to organise the first year, admittedly from a *new media* perspective, the following list of courses were proposed, see below. It must be remarked beforehand, however, that the proposal for the first year, which only includes NM1 and NM2, for a total of 9 credits, was to a large extent motivated by feasibility, that is an equal distribution of courses over the sub-discplines of *creative technology* and, consequently, a delegation of the responsibility to teach *scripting* to *new media*, as part of NM1 (*web technology*). Another, implicit, assumption was that attention to contextual aspects of *new media*, related with creativity, communication

and business, was envisaged to take place in *creative application* projects, that must serve an integrative function in the program.

course(s)

course	credits	description
CS1	3	computer & network architecture(s)
CS2	6	programming fundamental(s) – C++/Java
CS3	6	advanced programming – idoms, APIs
NM1	3	web technology (1) – html, javascript. css
NM2	6	animation in 2D
NM3	6	web technology (2) – php, sql, web services
NM4	6	3D virtual environments – x3d/vrml
NM5	6	game development – C++/DirectX
CA1	3	*we create identity*
CA2	6	*living & working tomorrow* (advanced)
CA3	6	*have fun and play!*

As an exmmple CA1 (*we create identity*) planned in the first month, would allow students to create a common website, make interactive videos about topics of interest, and present themselves both as individuals and as a group, thus creating a *common identity*, using open source content management and social networking (web) technology. This way not only the students creativity is stimulated but, albeit in a somewhat implicit way, students also gain hands-on experience (skills) with current-day web technology. In later *creative application* courses, CA2 and CA3, other tracks, in particular *smart technology* and *design* could play a more prominent role.

As argued in the computing requirements report, it is likely that we wish to offer our students, next to scripting, in-depth skills and knowledge of programming, preferably in C++, which also seems required for the *smart technology* track, and may also be considered a pre-requisite for (serious) game development with more advanced technologies. As a remark, dividing the tasks of teaching basic skills and programming is beyond the scope of this note, even though it will ultimately determine in what form media technologies will be presented.

media in context – creative application(s)

It seems worthwhile to present a scenario of teaching media-related skills and knowledge (and even some theory) not in a topic-oriented way as indicated above, but embedded in a *creative application* project. The type of application could range from, say, a cultural heritage application [1], a social awareness system which by its definition would include smart technology [2], or a (more or less *serious*) game on a suitable rich media platform [3].

Irrespective of the type of application or the societal topic(s) addressed by the product, such a course/prpject would address the following learning goals:

learning goal(s)

- elementary web-based multimedia technology
- programming and tools for interactive animation and video
- first principles of information visualisation
- basic media and cummunication theory
- the design of an effective communication plan
- the business and societal context of media deployment

The advantage of such an approach, in which media technology is presented in the context of a *creative application* (of societal relevance), over a disciplinary approach to teaching *new media*, is that skills and knowledge are learned as a group, which allows students to tackle issues according to their interest, expertise and (individual) talent. The disadvantage, in return, is that it becomes more difficult to assess the contribution as well as the level of skill and knowledge of the individual student(s).

Very likely, for a first year, a middle-way approach is most desirable, where students work individually or in small groups in disciplinary courses for the various tracks, but are encouraged to work in large groups

on integrative *creative application* projects, which allows them to develop a more personal profile according to individual preference(s).

An example structure of such an integrative project, with a *new media* flavor, indeed, is given below:

course structure

- week 1 – introduction of platform and design issues [2]
- week 1 – concept design of (media) application(s) [6]
- week 2 – essentials of animation and visualisation [6]
- week 2 – basic media and communication theory [4]
- week 3 – information presentation in (flex RIA) platform
- week 3 – student presentations of design and storyboards
- week 4 – business and societal context of the creative industry [5]
- week 4 – delivery and presentation of final application(s)

Not included in this outline, are checkpoints for tutor and peer review, which are essental instruments for feedback and progress control. Also, in my experience, it is worthwhile to create an element of (external) visibility, for example by involving an (external) commercial or institutional partner, which acts as *opdrachtgever*.

As for issues of theory and technology, it must be mentioned that such projects may form an excellent starting point for literature study or technical exploration, since they do provide the motivation needed for more in-depth studies, that may otherwise be hard to achieve.

conclusion(s)

In this brief report we have given an outline of the disciplinary courses needed for a *new media* track in *creative technology*. Also we have sketched a partially alternative scenario which allows for teaching *media* skills and knowledge in the context of a *creative application* project, where the goals is determined by content and (societal) relevance, yet the means require sufficient yechnical expertise, that must be acquired on the way.

In summary, however, it seems best to include a sufficient amount of disciplinary (*new media*) courses, where students can explore their technical skills and creative talent in a more independent and individual way. From a *new media* perspective, I am tempted to say, such courses form an essential preparation for more demanding projects, where apart from technical skills and knowledge, also interpersonal communication and group behavior play a role. Nevertheless, as integrative units, *creative application* projects must be considered essential in the *creative technology* curriculum, to prepare students for one of the possible roles in the *creative industry*, *product design*, *communication*, *entertainment*, or (serious) *game development*.

reference(s)

1. Eliëns A., Wang Y. van Riel C. and Scholte T. (2007), 3D Digital Dossiers – a new way of presenting cultural heritage on the Web, In Proc. Web3D 2007, ACM SIGGRAPH, pp. 157-160
2. Eliëns A. and Vyas D., Panorama – explorations in the aesthetics of social awareness, In Proc. GAME-ON 07, Nov 20-22, University of Bologna, Marco Roccetti (ed.), p. 71-75, EUROSIS-ETI Publication, ISBN 9789077381373
3. Eliëns A., van de Watering M., Huurdeman H., Bhikharie S.V., Lemmers H., Vellinga P. , Clima Futura @ VU – communicating (unconvenient) science, In Proc. GAME-ON 07, Nov 20-22, University of Bologna, Marco Roccetti (ed.), pp. 125-129, EUROSIS-ETI Publication, ISBN 9789077381373
4. Kress G. and van Leeuwen T. (1996), Reading Images: The Grammar of Visual Design, Routledge
5. Geert Lovink and Ned Rossiter (eds), MyCreativity Reader, A Critique of Creative Industries, Institute of Network Cultures, Amsterdam 2007
6. A. Eliëns, topical media & game development – media.eliens.net

creative technology – target(s)

educational targets – *computing*

- skills – programming in various languages, able to learn new languages quickly
- knowledge – networks, web-applications, programming languages, operating systems
- theory – integration of languages, computer & software architecture, algorithmic complexity
- experience – application development, (technical) requirements analysis

educational targets – *new media*

- skill(s) – scripting, programming, interaction design
- knowledge – web, multimedia & game technology
- theory – understanding of media & communication theory
- experience – concept development & realization of (playful) application(s)

educational targets – *sensor technology*

- skill(s) – modeling, construction
- knowledge – mechanics, ubiquitous computing, smart systems
- theory – human perception, privacy, security
- experience – deployment of (multi) sensor systems

educational targets – *mathematics*

- skill(s) – problem solving
- knowledge – algebra(s), graph theory
- theory – dynamic systems, logic
- experience – modeling complex systems

educational targets – *design*

- skill(s) – drawing, modelling
- knowledge – design methodology
- theory – human factors
- experience – design & prototyping

educational targets – *creative technology*

- skills – computing, mathematics, simulation, technology
- knowledge – mathematics, computer & software architecture
- theory – systems engineering, media & communication, human factors
- experience – project(s), deployment in social context

scenario(s) – creative technology / new media

scenario(s) – *creative industry*

The *creative industry* is a somewhat wide notion, originally introduced by the Blair government to re-vitalise dormant industrial areas. After the success of Silicon Valley, and New York's Silican Alley, the model was adopted by among others Amsterdam and Berlin.

In the *creative industries*, our students might take any of the following roles:

scenario(s) – *creative industry*

- *entrepreneur* – creating business
- *creative genius* – generating idea(s)
- *content author* – to produce material(s)
- *technical developer* – to write script(s) & program(s)

Despite the wide range of possible roles, whatever role is taken, however, our graduates will distinguish themselves by their level of technical expertise.

scenario(s) – *product design*
In an evergrowing cosumer market, *product design* will be an area of active development. Dependent on the context of deployment, healthcare, entertainment, or home or office furniture, our students may be active in any of the following roles:

scenario(s) – *product design*

- *visual design* – to give aesthetic appeal
- *concept development* – to accomodate human needs
- *usability & deployment* – making it fit for it's role
- *evangelist* – to promote the (benefits of the) idea

Despite the wide range of possible roles, whatever role is taken, however, our graduates will distinguish themselves by their level of technical expertise.

scenario(s) – *communication*
Tradional communication models, in broadcasting and advertisemt, are gradually being replaced by multimedia strategies, involving the internet and crossmedia in an essential way. In such media endeavors we may find our students active in one of the following roles or departments:

scenario(s) – *communication*

- *web developer* – setting up portal(s)
- *crossmedia architect* – relating all media
- *production agency* – to coordinate delivery
- *strategic planning* – defining targets and goals

Despite the wide range of possible roles, whatever role is taken, however, our graduates will distinguish themselves by their level of technical expertise.

scenario(s) – *entertainment*
Entertainment is an everlasting source of revenue for innovative enterprises. In our society the technical opportunities for entertainment are abundant, both in an urban and private setting. Our students may work in the area of entertainment in one of the following roles or fields:

scenario(s) – *entertaiment*

- *concept design* – defining new artefacts
- *technical infrastructure* – for realization
- *business plan* – to coordinate the enterprise
- *production manager* – mediating between parties

Despite the wide range of possible roles, whatever role is taken, however, our graduates will distinguish themselves by their level of technical expertise.

scenario(s) – *game development*
Games are increasingly beong recognized as valuable tools in an educational environment, and coprporate learning. With the growing attention for *serious games*, it becomes likely that we will find our students active in *game development*, in either one of the following roles or activities:

scenario(s) – *game development*

- theme(s) & storyline(s) – *setting the context*
- style & visual(s) – *creating the appeal*
- asset development – *to embody the game*
- interaction & experience design – *to promote involvement*

Despite the wide range of possible roles, whatever role is taken, however, our graduates will distinguish themselves by their level of technical expertise.

curriculum *creative technology*

from a *new media* perspective

Anton Eliëns

abstract In this brief report an outline is given of how a first year curriculum of *creative technology* may look like, proceeding from the assumption that equal attential is given to the constituting subdisciplines of *creative technology*, that is *computer science*, *new media*, *smart technology*, *mathematics* and *industrial design*, and that a substantial part of the curriculum is devoted to integrative *creative applications*.

status: 18/2/08 – for discussion

introduction

Summarizing, we may formulate the educational targets of the *creative technology* curriculim as follows:

educational targets – *creative technology*

- skills – computing, mathematics, simulation, technology
- knowledge – mathematics, computer & software architecture
- theory – systems engineering, media & communication, human factors
- experience – project(s), deployment in social context

The scope of the curriculum is also determined by the contribution of what may be regarded the constituting (sub) disciplines of *creative technology*:

CS – computer science
NM – new media
ST – smart technology
MA – mathematics
DE – design

CA – creative applications

with *creative applications* as an essential integrative element in the curriculum.

creative technology – foundation(s)

When each of the sub-disciplines takes an equal share in the first year, which is meant to lay the foundations for further specialisations, it seems fair to devoted 9 credits to each, leaving a total of 15 credits for *creative applications*. An indication of how the elements for each track could be is given below.

course	credits	description
CS1	3	computer & network architecture(s)
CS2	6	programming fundamental(s) – C++/Java
NM1	3	web technology (1) – html, javascript. css
NM2	6	animation in 2D
ST1	3	smart technology (1) – smart systems
ST2	3	smart technology (2) – sensor design & instrumentation
MA1	6	mathematics essentials with matlab
MA2	3	the (he)art of mathematics
DE1	6	drawing & modeling
DE2	3	human factors in design
CA1	3	*we create identity*
CA2	6	*living & working tomorrow*
CA3	6	*have fun and play!*

Naturally, each of the tracks or sub-disciplines may take responsibility for the details of the courses.

first year – curriculum
As a first proposal for distributing the courses over the period of the first year, we may think of:

period	course(s)	
1	CA1/CS1	introduction
2	MA1	mathematical skills
3	NM1/ST1	introduction specialisation(s)
4	DE1	industrial design
5	CA2	*living & working tomorrow*
6	NM2/ST2	specialisation(s)
7	NM2/ST2	continued
8	MA2/DE2	mathematics & design
9	CS2	programming fundamentals
10	CA3	*have fun and play!*

This proposal stems from the wish to have a proper alteration between technical/disciplinary courses and introductory/explorative courses. It also does explicitly not exclude mutual connections between the various tracks, that is topics and subjects that are dealt with commonly, from different perspectives.

follow up – new media & smart technology
In later years, students will choose for a specialisation in aither the *new media* or *smart technology* track. However, from a *new media* perspective, it should be clear that both in the computing track as well as the creative applications track, a close relation with smart technology might be desirable.

Additional courses in *computing* and *new media* will include:

course	credits	description
CS3	6	advanced programming – idoms, APIs
NM3	3	web technology (2) – php, web services
NM4	6	3D virtual environments – x3d/vrml
CA2	6	*living & working tomorrow* (advanced)

Given the domain of *creative technology* we envision an advanced project *living & working tomorrow*, in close cooperation with *smart technology*.

conclusion(s)
We have sketched a proposal for the first year *creative technology* curriculum, based on an equal share of tracks and sub-disciplines, as a reference for discussing courses and topics in the first year. It must be emphasised, again, that the integrative courses/projects *creative applications* are essential, not only to train the individual students in applying their skills and knowledge, but equally important to promote a collective identity of *creative technology* students in collaborative projects.

design in *creative technology*

from a *new media* perspective

Anton Eliëns

abstract In this report we look at how the *design* track may complement the *new media* track, not only in the area of skills, such as hand drawing, but also, perhaps more importantly, in the area of *human factors*. Additional benefots may come, more over from modelling, that is building VR models inspired by drawing using appropriate digital content/modeling tools.

status: 11/2/08 – for discussion

introduction

Although there are by tradition significant differences between the computing disciplines (from which the intitiative for *creative technology* was taken) and industrial design, joining efforts in establishing the new curriculum *creative technology* may be worthwhile, not only because of potential overlap and shared interests, but also because of the fact that the tow approaches may complement eachother in a fruitful way.

For a brief summary of educational targets for *creative technology*, we may somewhat tentatively present a list as below:

educational targets – *creative technology*

- skills – computing, mathematics, simulation, technology
- knowledge – mathematics, computer & software architecture
- theory – systems engineering, media & communication, human factors
- experience – project(s), deployment in social context

Although this summary gives no information wrt. the educational approach, many of the topics would alos be included in a curriculum *industrial design*. As a matter of fact, the curriculum *industrial design* already has experience with an educational approach that me be characterized as project-based and *just-in-time* (theoretical) learning [1].

new media – targets and learning goals

No doubt, the level of technical expertise, that is computing skills, required of students *creative technology*, and in particular students of the *new media* track, will be more demanding than for *industrial design* students.

In summary, educational targets for *new media* may be listed as below:

educational targets – *new media*

- skill(s) – scripting, programming, interaction design
- knowledge – web, multimedia & game technology
- theory – understanding of media & communication theory
- experience – concept development & realization of (playful) application(s)

Actual learning goals, or topics of study in the *new media* track encompass:

learning goals – *new media*

- interactive video – in customizable format
- web technology – for developing information portal(s)
- animation – for simulations and (physical) systems
- virtual reality – for games and virtual environments
- game development – for entertainment and instruction
- rich internet application(s) – for multimedia (web) applications

Apart from *virtual reality*, which also has a place in industrial design, these topics are of subsidiary relevance for industrial design students, but may become more important when the context of deployment of design artefacts is taken into account.

smart technology – additional requirements

An essential part/track of *creative technology* is constitued by what may be called *ubiquitous computing*, or smart technology. The educational targets related to this track may be summarized as:

educational targets – *smart technology*

- skill(s) – modeling, construction
- knowledge – mechanics, ubiquitous computing, smart systems
- theory – human perception, privacy, security
- experience – deployment of (multi) sensor systems

Nevertheless, as the focus of *creative technology* may be characterized as the creation of *computer augmented* (entertainment) *artefacts* [2], smart technology should also clearly be positioned in a *design* context.

the design curriculum – focus on human factors

Looking at educational targets for *design*, admittedly from a *creative technology* and *new media* perspective, we may arrive at:

educational targets – *design*

- skill(s) – drawing, modelling
- knowledge – design methodology
- theory – human factors
- experience – design & prototyping

Elements in the curriculum *design* would typically encompass:

learning goals – *design*

- sketch, drawing
- vr & cad modeling
- physical prototypes
- concept development

We may observe that in addition to elementary skills of drawing and modeling, an important contribution may come from the attention to human factors that is essential in the design of artefacts related to human experience.

conclusions – creating computer-augmented artefact(s)

Returning to the *creative technology* curriculim as a whole, we may list the following topics or educational goals:

learning goals – *creative technology*

- computing – architecture, networks, programming
- technology – new media, smart technology
- creative applications – creativity (mental + artistic), psychology, research/design methods, communication
- business – marketing, planning, project management
- design – sketch, prototype, realize

Evidently, design is an intrinsic element of *creative technology*, and, taking into account the observations made above, additional benefits may come from

- experience with a project-based educational approach
- clear attention to human factors in a design context
- practical experience with teaching drawing and modelling skills

reference(s)

1. Create the Future – An environment for excellence in teaching future-oriented Industrial Design Engineering, available in online version
2. Facets of Fun – On the Design of Computer Augmented Entertainment Artefacts, available in online version

computing requirements *creative technology*

from a *new media* perspective

Anton Eliëns, with Angelika Mader

abstract In this report we look at the requirements for the *computer science* or *computing* track in the *creative technology* curriculum. We will propose computing courses, that may be taken as a reference when developing the final curriculum.

status: 18/2/08 (discussion)

introduction

Although the *creative technology* curriculum is at this stage still in development, with contributions of a variety of tracks or sub-disciplines, an outline of the educational goals of *creative technology* will look like:

educational targets – *creative technology*

- skills – computing, mathematics, simulation, technology
- knowledge – mathematics, computer & software architecture
- theory – systems engineering, media & communication, human factors
- experience – project(s), deployment in social context

Correspondingly, the topics treated in the curriculum, or the elements of which the curriculum will consist will encompass:

learning goals – *creative technology*

- computing – architecture, networks, programming
- technology – new media, smart technology
- creative applications – creativity (mental + artistic), psychology, research/design methods, communication
- business – marketing, planning, project management
- design – sketch, prototype, realize

Taking these elements as a guideline will help us in determining what role the *computing* track will play in setting up the curriculum.

background - the role of computing

From a more general perspective, the area of computing, or in other words, the discipline of *computer science* should set as educational goals:

educational targets – *computing*

- skills – programming in various languages, able to learn new languages quickly
- knowledge – networks, web-applications, programming languages, operating systems
- theory – integration of languages, computer & software architecture, algorithmic complexity
- experience – application development, (technical) requirements analysis

More specifically, the *computer science* track in *creative technology* should cover, at a yet to be determined level of depth, the following topics and subjects:

learning goals – *computing*

- network – internet, organisations, graphs
- computer – elements, programming, algorithms
- operating system – assembly, compilers, multi-programming
- language – formal/natural, imperative, functional, logical, C++/Java
- hardware – memory, chaching, graphical programming support
- database – representation, storage, query (optimazation)
- web – client/server, web-services, data-driven application(s) – standard(s)

- media – scripting (ECMA+), event handlers/models

The level or depth at which these tpoics should be treated is determined by the requirements of the two specialisations envisioned for *creative technology*, respectively *new media* and *smart technology*.

new media – targets and learning goals

The eucational targets for the *new media* curriculum, may be summarized as fowllows:

educational targets – *new media*

- skill(s) – scripting, programming, interaction design
- knowledge – web, multimedia & game technology
- theory – understanding of media & communication theory
- experience – concept development & realization of (playful) application(s)

Elements of which the *new media* curriculum will consist, at least for the students taking *new media* as a specialisation, include:

learning goals – *new media*

- interactive video – in customizable format
- web technology – for developing information portal(s)
- animation – for simulations and (physical) systems
- virtual reality – for games and virtual environments
- game development – for entertainment and instruction
- rich internet application(s) – for multimedia (web) applications

Since *new media*, which includes the area of (serious) game development, requires a wide range of skills and knowledge, including programming as well as digital content creation, it is unlikely that all students will or need to be trained in computer science uniformly.

smart technology – additional requirements

For the specialisation of *smart technology* we may, perhaps somewhat naivelty, come up with the following list of educational goals:

educational targets – *smart technology*

- skill(s) – modeling, construction
- knowledge – mechanics, ubiquitous computing, smart systems
- theory – human perception, privacy, security
- experience – deployment of (multi) sensor systems

Minimally, the topics in *smart technology* will include:

learning goals – *smart technology*

- modeling, control systems,
- smart technology engineering
- instrumentation – software development

In particular for instrumentation the *smart technology* curriculum will very likely require more advanced, that is specialized, programming skills than the *new media* curriculum.

the computing curriculum – first proposal

In the *new media* curriculum, which is at the time of writing, still in development, the following courses will likely be included:

course(s)

course	credits	description
NM1	3	web technology (1) – html, javascript. css
NM2	6	animation in 2D
NM3	6	web technology (2) – php, sql, web services
NM4	6	3D virtual environments – x3d/vrml
NM5	6	game development – C++/DirectX

Taking the *new media* curriculum, sketched above, as a point of departure, we arrive at the following (mandatory) courses for the *computer science* curriculum:

course(s)

course	credits	description
CS1	3	computer & network architecture(s)
CS2	6	programming fundamental(s) – C++/Java
CS3	6	advanced programming – idoms, APIs

In the proposal above we have, with an eye on practical feasibility, allowed for including *acripting* in the courses for *new media*, thus alleviating the requirements for the *computing* courses.

As to the actual realization of the courses, see the references below, it might be worthwhile to look for a cooperation that allows for dividing laber between the staff alloted to the various tracks, and, more in particular, that allows for a distribution of the work according to personal style and preference for respectively an inspirational, example-based approach, and a more technical bottom-up approach.

As indicated in reference (8), we should be beware of making a choice based on *ease of education*. More explicitly, with regard to both system aspects and performance a choice for C++ as a first (real) programming language, as opposed to scripting languages, seems to be preferred over a choice for Java, despite the pitfalls in teaching a complex language like C++.

relation to other tracks

When we look at the other tracks within the *creative technology* curriculum, we may list as educational targets for *mathematics*:

educational targets – *mathematics*

- skill(s) – problem solving
- knowledge – algebra(s), graph theory
- theory – dynamic systems, logic
- experience – modeling complex systems

and, as educational targets for the track *design*, that is to be developed in collaboration with the *industrial design* department:

educational targets – *design*

- skill(s) – drawing, modelling
- knowledge – design methodology
- theory – human factors
- experience – design & prototyping

For the *mathematics* track we may remark that the track itself does not require computing skills as such. However, it is very likely that the *mathematics* track will inspire and inform the *new media* track, and to some extent even the *computing* track.

The *design* track might benefit from computing skills, but it seems most likely that these will be covered within the *sacripting* part of *new media*

conclusions

In this note we have sketched the requirements for the *computer science* or *cimputing* track within *creative technology*, and we have proposed a collection of courses to meet these requirements.

We again emphasize that in the realization of the courses, and the distribution of thw workload among the staff, we should strive for mutual contributions to profit from individual style and expertise.

reference(s)

online: create.eliens.net [resource(s)]

1. Teaching Software Engineering through Game Design
2. Toy Projects Considered Harmful

3. The Rethinking CS101 Project
4. Creating a Science of Games (CACM)
5. Software Engineering Issues in Interactive Installation Art
6. Programming by Example – A Creative Programming Environment, Remixed
7. Supporting Creative Thinking through Opportunistic Software Development
8. Computer Science Education: Where Are the Software Engineers of Tomorrow?