NM4: virtual environments

6700040 / project-based course, semester 3, 6 ects (proposed: 8 ects with contents of web 2.0 mashup(s)

Æliens

course description – nm4: virtual environments

The course description(s) are taken from the accreditation report Creative Technology (version 2.0).

content(s) The course introduces virtual environments, more in particular 3D virtual environments, such as deployed for online games and communities, as well as for scientific data visualisation. The course will focus on open standards for web 3D, that is X3D and VRML, and also discuss extensions to flex / as3 for developing 3D immersive applications, such as Papervision3D.

Recommended literature: X3D: Extensible 3D Graphics for Web Authors by Don Brutzman, Leonard Daly, The Morgan Kaufmann Series in Interactive 3D Technology, 2007
Online reference(s):

- www.x3dbook.com/slidesets
- www.web3d.org
- blog.papervision3d.org

Remark: It will be investigated whether and under what conditions it is possible to use the Utwente VR facility, the TXChange-Cell for the course:

- www.txchange.nl

prerequisites: MA1, CS1, CS2, NM1, NM2

goals & attainment target(s)
The course aims at providing

- awareness of technologies for networked 3D virtual environment
- familiarity with 3D display technology, shaders and visual effects
- fluency with scripting dynamic behavior in 3D virtual worlds
- full literacy with building interactive X3D/VRML applications

Students are expected to have a sufficient degree of crafmanship, and will be stimulated to create visually appealing

place in curriculum: NM4 is an introductory course in virtual environments for NM students. It builds on NM2, where animation was introduced in a 2D context. It must be regarded as a prerequisite for NM5, in which game development is the topic, and as the technical background for CA3: Hybrid World(s).

application area & motivating example(s) Online Virtual Communities have a long history, and recently became popular by online role playing games such as World of War Craft and Second Life. Also (web) 3D has gained a respected place in online product demos and infotainment.

teaching method(s) The course will be organised around lectures, which will introduce basic examples and which will provide an in-depth explanation of the technologies. The assignments will consist of a series of basic exercises and a final exercise In which the students are required to develop a moderately complex interactive 3D application.

Regular feedback will be given in classroom sessions where students present their work as well as via online comments or email. Grading will be based on basic assignments, the final assignment project with documentation, as well as an essay in which a topic of choice, either technical or in relation to graphics programming and visual effects, is discussed in more depth.

special facilities: computer lab & presentation facilities

course outline(s) – nm4: virtual environments

In this part a more detailed discussion will be provided of **topics**, **learning goals**, **materials** used, and the actual **structure of the course**, as well as a sketch of the **assignments** given. Also **references** to releveant literature is provided, including **online resources**. At the end, **advice for students** following the course will be given, as well as **hints for the instructor(s)**.

course topic(s)

Following an **example-based approach**, an important part of the course should consist of **case studies** and small examples demonstrating **solutions** to issues in **VR design**

- web-based VR – VRML/X3D
- authoring issues – model(s), scenegraph(s) & event(s)
- VR experience design – case studies
- augmented/mixed reality – issues & toolkit(s) (Artoolkit[1]/ARiSE[2])
- immersive environment(s) – narrative(s) vs game play
- game engine(s) – (physical) model(s) & realism

Of particular interest are the developments in **augmented & mixed reality**. At the time of writing, a great number of toolkits seem to be available, some using **VRML/X3D**, while others use more traditional C++/OpenGL platform dependent technologies. Since **game engine(s)** become increasingly more powerful, the distiction between **VR and game(s)** is blurring, dependent on how (physical) models are used to achieve realism.

learning terget(s)

Basic skills involve the use of authoring languages and tools. Detailed knowledge of the **platform of choice** is required to produce **effective VR**s.

- skill(s) – authoring, design
- knowledge – VR technologies, spatial organisation
- theory – user interface issues
- experience(s) – construction of moderately complex VR
- attitude – experimentation, aesthetics

However, not only technical issues are important, but also issues of **design**, **creativty** and **aesthetics**.

lesson material(s)

The course *virtual environments* is (partially) based on my course *multimedia authoring* which uses, apart from flex/as3 extensions for 3D, **VRML/X3D**.

virtual environments – web3D/VR

- canonical example(s) – *vr*
- (online) reference material(s) – resource(s)
- challenging target(s) – demo(s)

Obviously, the material for this course needs to be extended with, among others, material related to **augmented reality**, dependent on the role such technologies might play in our *creative technology* curriculum.

course structure

The course does require active participation of the student(s), not only in exploring the technolgy by making the assignments, but also by presenting **solutions and problems** in class.

session(s)

1. introduction of VR applications
2. basic assignment(s) – product demo(s)

[1] www.hitl.washington.edu/artoolkit
[2] www.iais.fraunhofer.de/3336.html?&L=1

3. VR technologies – input(s) & display(s)
4. experience design – user interface issues
5. student presentation of concept final assignment(s)
6. VR cases studies – visit to (TXChange)
7. mixed/augmented reality in game(s)
8. presentation of final assignment(s)

To the extent possible, the course will take a technology-agnostic approach, favoring **concept(s)** over implementation(s) or language(s). Neverteheless, at some point a choice for one or more technologies will be made, dependent on available **resources**, as well as **(programming) skills** of the students.

assignment(s)
There will a small number of assignemts, to be made by the students individually. The goal of these assignments is to provide a structure that assists the students in exploring the technology. Basic assignemnts (may) include:

basic(s) – *virtual environments*

1. product(s) – model a simple product
2. interaction(s) – extending the product demo
3. animation(s) – as a result of (user) interaction(s)

For the final assignment(s) of the course, students are allowed to work indidually, or in groups of two or three (maximally) students. Work done in groups must be proportionally more challenging and complex. Students can make a choice out of (among possibly others):

final(s) – *virtual envronments*

- simulation(s) – of natural or artificial system
- scenario-driven narrative(s) – to promote collaboration
- augmented reality game – using augmented/mixed reality technology

In effect, students will be encouraged to follow their own ideas, in for example implementing a game. For the final assignments, an effort will be made to develop interesting challenges in cooperation with the TXChange facility.

reference(s)
An excellent starting point for a course in VR is provided by the X3D book of Don Bruntzman, who one of the leading figures in the Web3D Consortium.

1. X3D: Extensible 3D Graphics for Web Authors (The Morgan Kaufmann Series in Interactive 3D Technology) by Don Brutzman, Leonard Daly
2. A. Eliëns, topical media & game development – media.eliens.net

A wealth of material and references can be found at my **topical media & game development** site, including tutorials and examples.

online resource(s)
The online resources (will eventually) include references to technologies and tools, that may be used by the student(s) to develop **VR applications** for their (final) assignment(s).

- vr – www.vrjuggler.org
- consortium – web3d.org
- txchange – www.t-xchange.nl
- slides – www.x3dbook.com/slidesets
- tools – x3dgraphics.com/tools
- artoolkit – www.hitl.washington.edu/artoolkit
- arise – www.arise-project.org

Additional information will also be gathered during the course, by letting students take an active part in exploring VR technologies.

advice for the student(s)

VR technologies can be surprisingly complex. So, in order to achieve interesting results, you'd better **team up** with other students, whose skills are complentary to yours. When developing a VR or augmented reality application, keep **focus** on the **user(s) experience**, and do **not** get (too much) distracted by technical issues, however interesting these may seem. Get familiar with issues in **narrative theory** and the **semiotic(s) of realism**, and actively seek feedback by inviting your friends and collegues to **try your application(s)**.

hint(s) for the instructor(s)

The *virtual environments* course provides an excellent opportunity to let students create more challenging applications, than in previous courses, including **augmented reality game(s)** and **scenario-driven narrative(s)** in a more-or-less realistic setting. Active alignment with related courses in **mathematics** and **design** is necessary for optimal results.

The original choice for VRML/X3D is motivated by the wish to have a **light-weight platform** for experimentation. Also when applications are developed for the **T-XChange** (contact dr. Johan de Heer), an approach that allows for fast experiemntation should be encouraged, in order to allow for fast iterations in **prototyping the (final) application(s)**.

afterthought(s)