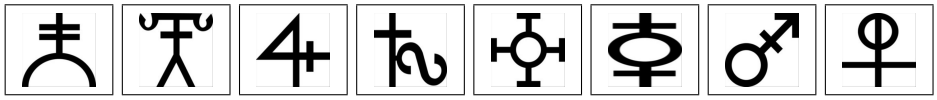
part i. digital convergence

more than the art of turning base metals into gold, alchemy is a system of cosmic symbolism
perfect solutions

1. digital culture
2. hypermedia information spaces



2

reading directives In these first chapters, we will explore the notion of multimedia, look at it from a historical perspective and discuss in somewhat more detail the issue of convergence, the mix and interchange of media that has become possible in the digital era. In the second chapter, we will give a precise definition of information spaces, and an overview of the history of hypermedia.

Essential sections are section 1.2, which characterizes digital convergence in a more precise way, and sections 2.1 and 2.2, which respectively characterize information spaces and hypermedia. Section 2.3 may safely be skipped by readers not interested in the philosophy of media and creation.

perspectives The topics treated in this part can be looked at from multiple perspectives. When you write a paper about any of these topics, as suggested in *projects* paragraph, you should be aware of from which perspective you tackle your subject.

In summary, we can in a non-exhaustive way, distinguish between the following perspectives:

perspectives – digital convergence

- *historical* – media development timeline
- *sociological* – communication relations
- *psychological* – experience limits
- *aesthetical* – dynamics of creation
- *technical* – divergence & competition
- *philosophical* – re-mediation
- *commercial* – what is the economic model?

As an example, the psychological perspective deals with an interesting issue, namely how much information can we digest and what are the limits to our perceptual system that determines whether the experience offered by a virtual reality interface is really effective.

essay topics The issues treated in these chapters may be used as topics for an essay. As a hint, here are a few titles:

- digital convergence and the future of mobile multimedia
- media @ home – the windows media center
- media art – merging technology and aesthetics

For a first essay, I would suggest a paper no longer than 5 pages. If there are technical details that you do not want to omit, then consider an appendix of 2 to 3 pages. For hints on how to approach writing a paper, see appendix 5.



the artwork

1. alchemy – an illustration from a book about alchemy, from which also the quote is taken, the quote is explained in the *afterthoughts*.
2. signs – ancient chemical symbols, Signs, p. 171, 172.
3. photographs – Jaap Stahlie[1], from portrait series.

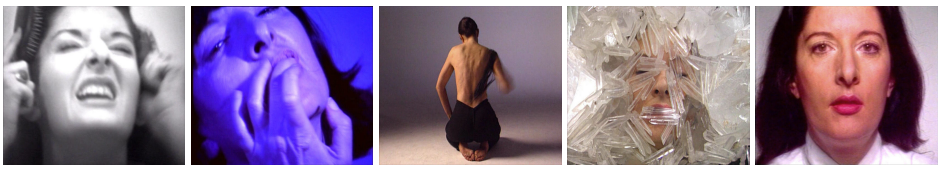
[1] www.jaapstahlie.com

1. digital culture

life is becoming digital

learning objectives *After reading this chapter you should be able to define the notion of multimedia, recount the history of digital entertainment, explain the concept of digital convergence, discuss the future of cyberspace, and speculate about the commercial viability of mobile multimedia.*

We live in the digital era, Negroponte (1995). We are surrounding ourselves with gadgets and we are consuming immense amounts of information, that is increasingly being delivered to us via the Internet. We play games, and we still watch (too much) television. Some of us watch televion on our PCs, and may be even looking forward to watch television on their mobile phone. This is multimedia. For others, the PC is still a programmable machine. Being able to program it might earn you a living. Understanding multimedia, however, might even provide you with a better living. In this chapter, we study what trends may currently be observed in the creation and delivery of multimedia information, and we explore what impact the digital revolution may have from a commercial perspective.



1

1.1 entertainment and experience

The question of *what is multimedia* is rather elusive. We may, nevertheless, look at how the phrase *multimedia* is used, and how the concept *multimedia* is related to other concepts. as in the concept graphs that may be obtained with the Visual Thesaurus[2], providing as input *multimedia*.

[2] www.visualthesaurus.com

We then see that the notion of multimedia is related to *systems*, in particular interactive and hypermedia systems, and indirectly also to the notion of *transmission*, which will even become more apparent when we inspect the graph for the concept of *medium*, depicted in figure X below.

However, although this gives us some indication of how to position *multimedia* in the larger area of computer applications, in particular when exploring the *systems* node, it does not so much tell us what multimedia is all about.

From the perspective of human cognition, we may look at how multimedia contributes to our understanding of ourselves and the world around us. Traditionally, three levels of cognitive functioning are distinguished, Bruner (1972), corresponding with three levels of meaning:

levels of meaning

- actionary level – action and movements
- sensory/iconic level – images and impressions
- symbolic level – language and mathematics

Multimedia is clearly (most strongly) related to the sensory/iconic level, although for games one could say there is also a strong relation with the actionary level, and to some extent (for both multimedia and games) with the symbolic level.

For a more serious and deep understanding of how multimedia artefacts provide meaning and what role they play in our daily life, or how that meaning is affected by social contexts, we need to take recourse to *semiotic theory*, which is now one step too far, buth which we will look at in chapter 12.

Antother perspective from which to understand the meaning of *multimedia*, is to look at the function of media in our society, or, in other words, how *multimedia* is situated in our cultural institutions.

Consider this quote from the preface of all of all MIT books in the *Leonardo* series:

cultural convergence

> *The cultural convergence of art, science, and technology provides ample opportunity for artists to challenge the very notion of how art is produced and to call into question its subject matter and its function in society.*

Although the quote is about *art*, it is essentially related to *multimedia*, to the extent that the quote refers to *media art*. The MIT Media Lab[3] is one of the worlds most famous institutes in the field of multimedia. The *Leonardo* series is a collection of authoritive books on multimedia and related topics, which includes Zielinski (2006), Grau (2003), Wilson (2002).

To understand the position of (computer supported) media in our society, we may observe following Zielinski (2006): there are two forces, political and technological, and there is, currently, a trend towards standardization and uniformity

standardization and uniformity

1. Telematic media were incorporated very quickly in the globalization strategies of transnational corporations and their political administrators and they became increasingly dependent on existing power structures.

[3] www.media.mit.edu/

2. At the other end of the scale, there were individuals, or comparatively small groups, who projected great hopes onto these networks as a testing ground for cultural, artistic and political models that would give greater prominence and weight to divergence and plurality.

This reflects what Zielinski (2006) calls the *advanced media paradox*, facilitating heterogeneity and immersion on the one hand, and striving for universalisation on the other hand, as demanded by the centers of technological and political power.

Leaving the socio-political arena, we may in some sense predict the tension between *convergence* and *divergence*, by looking at the meaning context of the concept of *convergence*, again using the Visual Thesaurus, where we find that not only notions such as *overlap* and *occurrence* are related to it, but also the complementary concept of *divergence*. However, instead of speculating on the meaning of words, it might be more worthwhile to look at what we may consider to be the recent history of multimedia, entertainment.

entertainment

In november 2000, a theme issue of the Scientific American appeared, featuring a number of articles discussing (digital) entertainment in the era of digital convergence. Let's start with a quote:

Scientific American (november 2000)

> *The barriers between TV, movies, music, videogames and the Internet are crumbling. Audiences are fetting new creative options. Here is what entertainment could become if the technological and legal hurdles can be cleared ...*

Moreover, the editors made some wildly speculative claims, such as *digitizing everything audio and video will disrupt the entertainment industry's social order*, and *the whole concept of holding a CD or movie in your hand will disappear once d-entertainment is widely available.* To some extent this seems already to be true, as for example the music industry can painfully testify to.

Underlying the importance of entertainment in the era of digital convergence is the premisse governing an entertainment economy, which may be stated as

there is no business without show business

Additionally, the authors of the introduction to the theme issue speculate that *the creation of content will be democratized*, due to the availability of low cost digital movie cameras and PC video editors. Producing a video movie is now possible for just a few thousend euro or dollars. However, given the aesthetic ignorance of the average individual making video movies, it seems doubtful that this will hold true for entertainment in general.

In that same issue of the Scientific American, Gloria Davenport, a pioneer in the field of multimedia, presents list of applications characterizing the evolution of digital entertainment, Davenport (2000):

evolution of digital entertainment

- 1953: Winky Dink (CBS) – interactive television, drawing exercise
- 1972: Pong (Atari) – ping-pong on computer screen
- 1977: Adventure – text-based interactive fiction
- 1983: Dragon's Liar – laser-disc technology 3D game
- 1989: SimCity – interactive simulation game
- 1989: Back to the Future – the Ride
- 1993: Doom – 3D action game
- 1995: The Spot – interactive web-based soap opera (Webisodic)
- 1999: IMAX3D – back to Atlantis (Las Vegas)
- 2000: Big Brother – TV + around the clock Web watch + voting
- 2001: FE Sites – fun enhanced web sites

It is interesting to note that *Big Brother*, which was originally created by a Dutch team, has become a huge success in many countries. Although the integration with the web was limited, it may be seen as the start of a number of television programs with web-based interaction facilities.

digital experience

The list compiled by Gloria Davenport suggests, a convergence towards an 'ultimate digital experience', Now, what does *digital experience* mean?

In a special issue of the Communications of the ACM, about the next 1000 years of computing, Ramesh Jain makes the following observation, Jain (2000):

> *The desire to share experiences will be the motivating factor in the development of exciting multimedia technology in the foreseeable future.*

Considering the variety of means we have at our disposal to communicate, as reflected in the list below, we may wonder whether our current technology really stands out as something special.

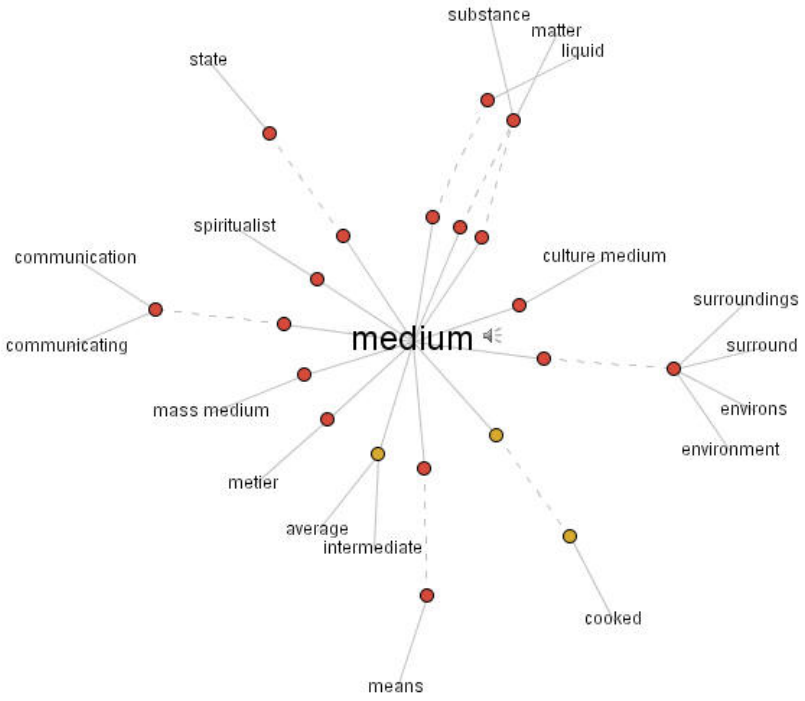
communication technology

- *oral* – communicate symbolic experiences
- *writing* – record symbolic experiences
- *paper* – portability
- *print* – mass distribution
- *telegraph* – remote narrow communication
- *telephone* – remote analog communication
- *radio* – analog broadcasting of sound
- *television* – analog A/V broadcasting
- *recording media* – analog recording
- *digital processing* – machine enhancement
- *internet* – multimedia communication

According to Ramesh Jam, internet-based multimedia communication differs from earlier communication technology in that it somehow frees the message from the medium. Reflecting on Marshall McLuhan phrase – *the medium is the message* – he observes that:

the medium was the message when only one medium could be used to communicate messages.

Now, that the Internet allows the synthesis and rendering of information and experiences using whatever is the most appropriate media to convey the message, the message is, as Jain phrases it, just the message, and the medium is just the medium. In other words, the medium itself does not seem to constrain what message can be conveyed. Looking at the documentary *Fahrenheit 9/11* though, we may seriously doubt whether this is true. Although it is possible to gain knowledge about the alliances that underly politics, even in the age of the internet, the television campaigns seem to be more dominant in affecting the general publics opionion about global politics than anything else, due to the conventional formats of presentation and editing.

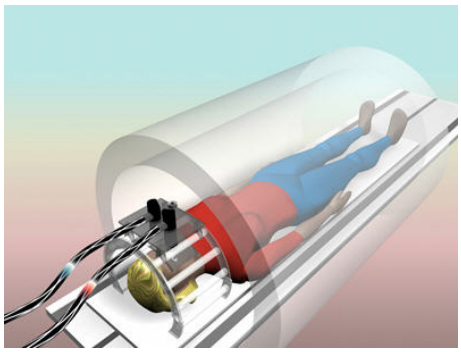


2

Let's once more look at a graph, above, indicating the concept relations for the notion of *medium*. What strikes me as important are the relations with the distinct concepts of *substance*, *communication*, *environment*, and *intermediate*. In

some respects the notion of *medium*, underlying the plural use of it in *multimedia* is comparable to the notion of *ether*, which was once seen as a vehicle for the transport of broadcasted information. But I also like to stress the 'substantial' aspect of multimedia, as a material for design and creation, similar to paint.

The basic issue here is what is a medium and how does it affect, or even shape our experience(s). Following Ramesh Jain, we may speculate that the range of sensory information offered by multimedia applications may become much richer than is currently the case, and we may then predict that there will be a tremendous progress in presentation technology, multisensory presentation technology! Clearly, from a technological perspective there seems to be no limit, except those imposed by our own phantasy. However, it should be equally obvious that compelling experiences rely on carefully staged presentations, and as such require an entirely new discipline of design.



VR for pain relief

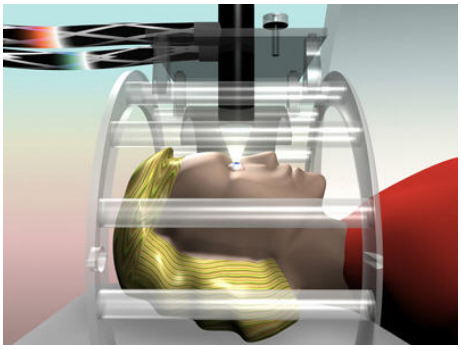


image delivery system

3

example(s) – *VR for pain relief*

The research project fMRI Research on Virtual Reality Analgesia[4] at the Human Interaction Laboratory (Washington) has explored the use of VR to reduce the agonay of taking MRI scans. The U.W Radiology Digital Imaging Science Centers wide field of view magnet-friendly virtual reality image delivery system makes it possible for volunteers and patients to have the illusion of going into virtual reality during fMRI brain scans. As explained on the website, the image on the left above, shows a woman in virtual reality during an fMRI brain scan, looking into a custom magnet-friendly virtual reality goggles. VR images from projectors in another room are carried to the participant in the form of light (photons, no electrons) via optic fiber image guides. The participant has the illusion of going inside the virtual world, allowing researchers to measure what happens to her brain when she reports reductions in pain during VR. The white cage-like structure around the womans head, in the image on the right, shows fMRI receiver coils used by the

[4] www.hitl.washington.edu/research/magnet

fMRI brain scanner to collect the information about changing patterns of brain activity.

Another project investigating the use of VR techniques for pain distraction can be found at the site of the Virtual Environments[5] of the Georgia Institute of Technology, Atlanta.

research directions– *the face of cyberspace*

The notion of *cyberspace* was introduced in William Gibson's novel *Neuromancer*, that appeared in the early 1980's, signifying a vast amount of (digital) data that could be accessed only through a virtual reality interface that was controlled by neuro-sensors. Accessing data in *cyberspace* was not altogether without danger, since data protection mechanisms (including firewalls, as we call them nowadays) were implemented using neuro-feedback. Although the vision expressed in *Neuromancer* is (in our days) still futuristic, we are confronted with a vast amount of information and we need powerful search engines and visualisation techniques not to get lost. So what is the reality of *cyberspace* today?

> *... cyberspace is a construct in terms of an electronic system.*

as observed by Vivian Sobschack, 1996, quoted from Briggs and Burke (2001), p. 321. On reflection, our (electronic) world of today might be more horrendous than the world depicted in *Neuromancer*. In effect,

cyberspace

> *television, video cassettes, video tape-recorder/players, video games, and personal computers all form an encompassing electronic system whose various forms interface to constitute an alternative and absolute world that uniquely incorporates the spectator/user in a spatially decentered, weakly temporalized and quasi-disembodied state.*

All these gadgets make us dizzy, stoned with information and fried by electromagnetic radiation. However, the reality of everyday computer use is (fortunately?) less exciting than the images in *Neuromancer* suggest. User interfaces are usually tiresome and not at all appealing. So except for the fanatic, the average user does easily get bored. Would this change when virtual reality techniques are applied pervasively? What is virtual reality?

virtual reality

> *virtual reality (is) when and where the computer disappears and you become the 'ghost in the machine' ...*

In other words, virtual reality is a technology that provokes immersion, sensuous immersion, supported by rich media and powerful 3D graphics. In our age of information, we may wonder how all that information should be presented. Rephrasing the question, we may ask what are the limits of the digital experience, or more importantly, what should be the norm: 3D virtual environments, plain text, or some form of XP?

[5] www.gvu.gatech.edu/virtual

1.2 technological developments

Let's see if we are able to give a more precise characterization of *digital convergence*. In their introduction to the theme issue of the Scientific American, Forman and SaintJohn locate the beginning of digital convergence, historically, at the 1939 New York World Fair, and more in particular the RCA Pavillion, which should be considered as the formal debut of television broadcast. They observe that

history

> *the receiver at the RCA Pavillon was way ahead of its time, it was a combination of television - radio - recorder - playback - facsimile - projector ...*

Moreover, they remark that this *in hindsight suggests that we humans have a fundamental desire to merge all media in one entity.*

By way of definition we may state, following Forman and SaintJohn, that digital convergence is:

digital convergence

> the union of audio, video and data communication into a single source, received on a single device, delivered by a single connection

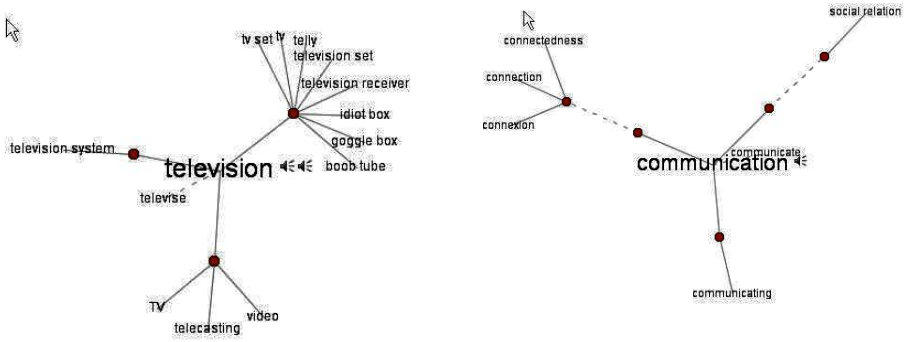
And, as they say, *predicted for decades, convergence is finally emerging, albeit in a haphazard fashion.*

Taking a somewhat closer look, we may discern subsidiary convergences with respect to content, platform and distribution:

subsidiary convergences

- *content* – audio, video, data
- *platform* – PC, TV, internet, game machine
- *distribution* – how it gets to your platform

Here, Forman and SaintJohn continue by speculating that if compatibility standards and data protection schemas can be worked out, all d-entertainment will converge into a single source *that can shine into your life on any screen, whereever you are ...* However, observe that the number of competing standards and architectures is enormous, and that apart from the technical issues involved it is not entirely clear what business model should underly such convergence. In computer shops, there PCs with TV receivers are sold in the range of 1000-2000 euro. This does not include the screen. They come with either the XP Home or Windows Media Center. One of the first in this line of machines, in the higher prices range, was the Sony W1.



4

TV or PC

It is fair to say that no device has changed the way we live so dramatically as television. Television, for one, has altered the way we furnish our living rooms, not to speak about the time we waste watching the thing. Comparing the graphs for *television* and *communication*, we immediately see that their underlying concepts are very different. And more specifically, the association of television with a phrase such as idiot box may raise doubt whether the promise of convergence, which does include communication as an essential feature, will ever become a reality.

Now, we may wonder what interactive television and enhanced televison have to offer us. Looking back, we may observe that it takes some time for the new possibilities to catch on. For example, interactive television was introduced in 1970, but apparently people did not want to communicate with the broadcaster. As another example of enhanced televison, take Big Brother. Although many people watched Big Brother when it first appeared on television, the willingness of the audience to react other than by phone was (apparently) somewhat disappointing. Perhaps, in the Netherlands this was due to the fact that only a fraction of the PC owners was, at that time, permanently online.

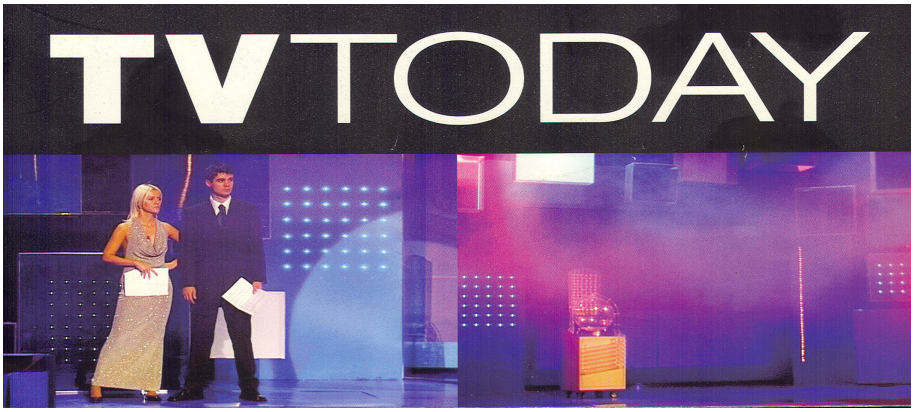
In spite of the failed experiments, Forman and SaintJohn state, somewhat optimistically, that *the convergence of digital content, broadcast distribution and display platforms create the* big *convergence of d-entertainment and information with feedback supporting human interactivity.*

Before looking at *digital television* more closely, let's summarize what digital convergence involves:

convergence

- *content* – 2D/3D graphics, data, video, audio
- *distribution* – broadcast, wireless, DVD, internet, satelite, cable
- *platform* – PC, television, game machine, wireless data pad, mobile phone

This summary indicates the technical opportunities, and the possible functinal extensions that may enhance our use of television, computer, game console and mobile phone. As concerns digital television, we may come up with some immediate advantages, such as enhanced resolution, a multiplication of channels, and (more relevant to the issue of convergence) interactive television.



exposition on the history of TV in Institute for Time-based Arts/Montevideo[6]

5

To get you failiar with some common acronyms, when speaking about (digital) television, we must make a further distinction between:

- HDTV – high definition television
- SDTV – standard definition television
- ITV – interactive television

As further discussed in chapter 3, we have (standard) codecs for d-TV, in particular MPEG-2, for recording digital video, and MPEG-4, for high-quality streaming video on the internet, both from the Motion Picture Expert Group, that enable the effective delivery of digital video, possibly in combination with other content.

Unfortunately, experts disagree on what might become the most suitable appliance or platform to consume all those digital goodies. Here is a list of possible choices:

a *killer* d-TV appliance ...

- DVD player/recorder – 400.000 sold in 2 years, 2h of MPEG-2 video
- personal television – TiVo, Replay-TV (MPEG-2 cache)
- game machine – Sony PS 2, X-Box

Will we prefer to watch stored video, instead of live televison broadcasts? Will the Internet be able to compete with traditional television broadcasting. Will DelayTV or Replay-TV, which allows you to watch previous broadcasts at a time that suits you become popular? Will an extended game machine or PC replace your television? Currently,we must observe that streaming media (still) have rather poor resolution.

Leaving game machines aside, will it then be the TV or PC that will become our platform of choice? Forman and SaintJohn observe:

TV or PC

> *The roadblock to the Entertainment PC could be the PC itself. Even a cheap TV doesn't crash or freeze. The best computers still do.*

However, they conclude that it might make sense to adopt a programmable PC that can support competing TV standards, rather than construct a stack of TV peripherals. Nevertheless, there are a number of problems that occur when we (collectively) choose for the PC as our platform for d-entertainment. Should we have thin clients, for example based on the Sun/Java platform or so-called fat clients based on some version of Microsoft windows> How do we handle the fact that the current internet protocols are not robust, and how can we provide what is known as *quality of service*? Should we adopt any of the proprietary architectures and codecs, such as RealVideo, QuickTime, Windows media, or should we adhere to an open standard such as MPEG-4?

Evidently, the situation becomes even more complex when we just consider the range of alternatives for connectivity, that is for possible ways of distributing contents:

distribution

- *telephone network* – from 0.5 - 2 Mbps to 60 Mpbs (2.5km)
- *broadcast TV* – 6 MHz / 19 Mbps (4 channels MPEG HDTV)
- *cable TV* – hybrid fiber-optic coaxial cable 6 Mbps
- *fixed wireless* – 2 Mbps (radiotowers + rooftop antenna), phones/handhelds
- *satellite* – downloads to 100kbps, modem for uploads ...

Most probably, convergence with respect to distribution will not result in one single way of being connected, but rather a range of options from which one will be selected transparently, dependent on content and availability.

Let's stay optimistic, and ask ourselves the following question:

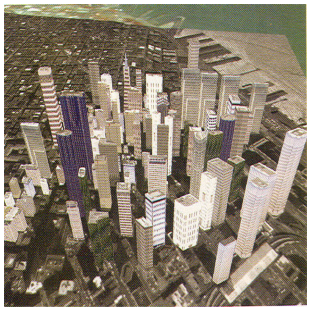
what will we do with convergence once we have it?

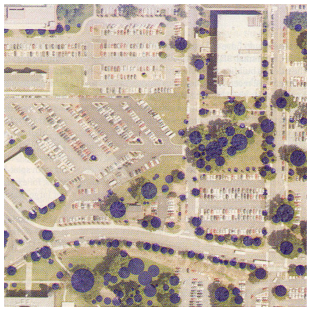
One possible scenario, not too unlikely after all, is to deploy it for installing computing devices everywhere, to allow for, to name a few, smart houses, smart clothes, or, in other words, to create a smart world. I wonder what a smart world will look like. In the end we will have to wait and see, but whatever will emerge

we will watch

That is to say, it is not likely that we will have a world without television. Television as we are used to it seems to be the dominant paradigm for d-entertainment, for both the near and distant future.


Berkeley mesh


San Francisco view


augmented terrain map

6

example(s) – *visible world*

Just imagine that every visible place on earth would be accessible in a virtual world. Researchers of the Georgia Institute of Technology[7], Atlanta, have developed software for the semi-automated construction of detailed interactive urban environments, that takes data from multiple sources, including geo-corrected imagery from aerial photography and satelites and ground-based close-ups, Rosenblum and Macedonia (2002).

The challenge here is to collect data from multiple sources and convert this into models, and perhaps even more difficult, to make the models visible so that they can be navigated in an interactive fashion. Recently, the Georgia group teamed up with a group from Berkeley to develop more complex models (images on the left), and together they are working on automating the extraction of information from aerial pictures (image on the right), in particular the detection of groups of trees, and height estimation.

There are many applications for such technology, including urban planning, emergency response, tourism and entertainment, military operations, traffic management, construction and maintenance, mobile services, citizen-government relations, and (not in the least) games.

The next step might be to connect the cameras, that are already there in many of these places, to the model, to observe what happens there in real life. But, somehow, this vision becomes frightening.

However, if you want to give it a try yourself, and populate the virtual globe with your own creations, go download the viewer and editing tool from *Google Earth*:

Google Earth

- Earth – earth.google.com
- SketchUp – sketchup.google.com/download.html

and read the tutorials!

[7] www.gvu.gatech.edu/datavis/research

research directions– *technological determinism*

Although there are many technical issues involved in (digital) multimedia, as exemplified in the issues that play a role in digital convergence, a technical perspective alone does not suffice. Each technological innovation has its consequences on our social life. Conversely, each trend in society might result in the adoption or development of new technology. Looking at the history of the media, we may observe that media become *materials* in our social processes. Or, as phrased in Briggs and Burke (2001):

media as materials

> *each medium of communication tended to create a dangerous monopoly of knowledge*

For example (Briggs and Burke (2001), p. 8) for Christians, images where both a means of conveying information and a means of persuasion, that is part of the rethorics of institutionalized religion.

Looking at our age, and the media that have come into existence in the previous century (radio, television, ...), Briggs and Burke (2001) observe that:

technological determinism

> *technological determinism was not the answer, ... more attempts were to be made to provide answers about the social consequences of television than had ever been asked about radio.*

In effect, underlying all developments in the media (including the computer) we may assume a basic need for information. A rather problematic need, for that matter:

information

> *Information became a major concern anywhere during the late 1960 and 1970s where there was simultaneous talk both of 'lack of information' and 'information saturation'.* Briggs and Burke (2001), p. 555

Nowadays, we regard information as a commodity. Train schedules, movies, roadmaps, touristic information, stock prices, we expect it all to be there, preferably online, at no cost. No information, no life. Information drives the economy. Upwards and downwards!

1.3 multimedia applications

In many stores there is a multimedia section. In some stores you will see B-movies being announced as *multimedia topper*. In other stores, the multimedia sections has a large offering of computer peripherals, ranging from DVD-RW drives to webcams and TV on PC hardware. Elsewhere you may buy authoring packages to organize your cell-phone photos, your family photo and video album, to create your personal archive on DVD. All this might make you wonder whether

multimedia is serious business. See figure (a) and (b), illustrating our personal *memex*, as explained below.

But more seriously, what is the commercial impact multimedia and in particular digital convergence may have? And, perhaps equally important, why should we be interested in this from, I must say, an academic perspective?

In this last section of the introductory chapter, we will look at some popular press items related to new media, mixed media (in particular the merge of TV and internet) and mobile multimedia. We will then briefly reflect on what significance these issues have from our academic perspective.

7

new media

As you may be read in the newspapers in the beginning of this century, large investments have been made (by both cable and telephone companies) to improve the technological infrastructure for the new media. Simultaneously, joint ventures have arisen between content developers and providers, as with the Dutch Endemol company.

Now, what does the popular press have to say about all these developments. Here is one comment, from a Dutch newspaper:

Peter Greven 23/3/2001 (Volkskrant)

> new media sucks – people like new technology. they don't like new media.

The translation from Dutch is, admittedly, mine. It says, in other words, that people like to receive the old stuff on new gadgets, but that they are not willing to pay for any new sort of services. For example, when considering the smart video recorder, that uses a disk cache for storing MPEG coded versions of broadcasts, just think of other gadgets and services that didn't make it or that are encountering problems in being accepted. Some famous examples from the past are the videofoon, videotext, cd-i, and DCC.

Perhaps the reason for these failures is the *trial-and-error* method,, also referred to as the spaghetti method, that is being followed in developing new media. As characterized by Jan van Dijk, of a dutch university in the east of the Netherlands (Twente), the spaghetti method consists of throwing a plate against

the wall, and see what will stick to the wall. In other words, just throw your product on the market and see whether it will stick. Perhaps that is not the right method to be followed. But can you think of a better one?

In many cases 'the market', that is the people using a service, do not behave as expected. For example in Sweden, the upload of material far exceeded download, which is contrary to the assumptions underlying ADSL.

TV meets the Web

At first sight it seems promising to develop mixed media. As an example, a dutch agency announced services to support the integration of TV and the Web, promising the integration of

www.tvmeetstheweb.com

> *streaming media (audio and video), interactive gaming, virtual reality and 3D animation, interactive TV programming, interactive advertising, video on-demand, webcasting and multimedia*

In 2000 they issued a report sketching the European broadband landscape. Quoting from this report: *The advent of broadband Internet access, which has been available in the US for some time but is only now beginning to make inroads into Europe, makes a whole range of new services possible. As download speeds have increased and more bandwidth has become available, the possibility of delivering screen-based content such as films, television programs and music has moved a step closer to mass market usage.* With respect to the adoption of cable or DSL in Europe, they observe that despite the fact that cable companies have gained firm ground, there is an even larger number of conventional telephone lines, around 180 million. In contrast, there are only 15 million cable subscribers, giving DSL a large potential audience. Matthijs Leendertse, co-author of the report, observes: *Gaining competitive advantage and future revenue in Europe's broadband landscape will depend heavily on a company's ability to offer integrated services: access (fixed and wireless) and content. It is virtually impossible at this point for one single company to offer these services on a pan-European level. This means that companies need to find partners to fill the gaps in their offerings.* Let me assure you, at the moment you will be reading this the battle is still going on!

mobile multimedia

Let's look at another potential hype. In 2000, Webnoize published a report (by Matt Bailey), entitled *Wireless Entertainment: What Is It Worth?*, which introduces the *wireless web*, and predicts that *young media junkies* will demand music videos and animations, and listen to wirelessly streamed music.

The intent of the report is to investigate whether investments in the mobile entertainment are justified. The report examines how providers of music and video services can benefit from the wireless delivery of multimedia. Using survey evidence, pricing information from new wireless networks and interviews with

industry visionaries, the report analyzes supply and demand to build an economic and business model for mobile multimedia.

Apart from the need to invent some business model, there are a number of strategic questions to be answered in order to estimate the risk of making investments in this direction. Following Bailey, we may list questions such as:

strategic questions

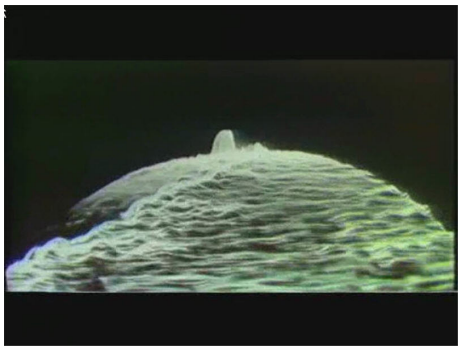
- how quickly will wireless connectivity speeds improve?
- what is the demand for services that deliver music and video to wireless devices?
- how can suppliers of multimedia services monetize demand for wireless access?
- how much will it cost to stream multimedia content to wireless devices now and in 2006?
- are consumers willing to compromise quality for lower cost?

And more. If you are interested whether anyone is willing to take such risks and invest in mobile multimedia, just look at what players were involved.

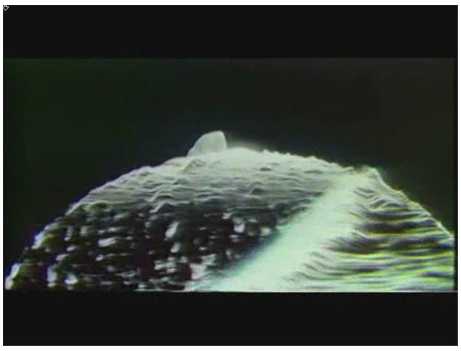
the players

> *Alltel, AT&T Wireless, AtomShockwave, Cingular Wireless, Clear Channel, HitHive, Ifilm, Infinity, KDDI, Liquid Audio, LMIV, Mannesmann, MP3.com, MTV, NetCom, Myplay, Nortel Networks, NTT DoCoMo, Omnitel, Sprint, Telefonica, Telstra, Vitaminic, Verizon Wireless, Virgin Megastores, Vodafone, Voicestream.*

Now make up your mind, and ask yourself the question whether multimedia is worth your (intellectual) investment.



Vasulka Objects (1)



Vasulka Objects (2)

8

the academic perspective

Being sensitive to hype is only too human. So also academics may be fascinated by new trends. and get distracted by rumors on the market. Breaking loose from this fascination, we may ask ourselves what are the real issues, and what makes multimedia interesting. Let me start with answering the latter question first. As

an academic subject, multimedia is interesting because it offers such an intriguing mix of subjects, including multimedia technology, exploratory design and scientific validation. Commercially, it is safe to say that the volume of entertainment related multimedia content, including games, music and infotainment is substantial, and hence its economic interest is indisputable. But what are the real issues?

One of the examples of multimedia applications I will present in the last chapter is an application in the domain of cultural heritage. For this domain we have developed so-called *digital dossiers* containing a representation of the work(s) of a particular artist as well as information that characterizes the work in its historic and cultural context, needed for the re-exposition or installation of the work. Problems facing the developer of a digital dossier cover the interaction of the user with the dossier, the presentation of both textual and multimedia information, and facilities for search and navigation. And there are technical issues, such as which codecs to select for the videos and how to manage the content included in the dossier. Developing a dossier is not as one might naively think the creation of content only, but rather involves designing the functionality of the application as well.

Generalizing from the domain of cultural heritage to the area of infotainment and multimedia information systems, where an integrated presentation of textual and multimedia information must be achieved, we may boldly state that designing the functionality of the application is the most crucial issue, and as such of primary academic interest. All other topics, including multimedia technology, compression algorithms, software engineering, multimedia platform support and information retrieval techniques, may be regarded in some loose sense to be subservient to the issue of design.

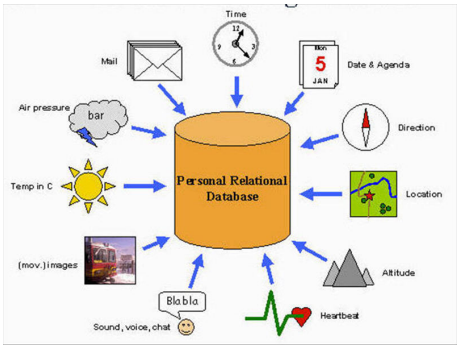
digital art As the illustrations in the text testify, another personal motivation for being involved in multimedia comes from the area of digital art. And, with students I observe a similar interest in the potential digital content authoring offers as a vehicle for personal expression.

One of the artists of which I included material in this book is Woody Vasulka, who was a pioneer in the early days of video and computer art. In an interview, held in 1985 with Rene Coelho, the founder of Montevideo[8], Vasulka explained his fascination with the scan processor and later the video computer by stating that it allowed him to *invent the image*. Still, howver, as he said, in some sense traditional painting acted as a visual reference system by which to judge the images produced with the new technology. Later in the interview, he observed that after some time he became bored with the images produced this way, and he started to feel the need to include more narrative in his work. His wife, Steina Vasulka, with whom he founded the Kitchen, a gathering place for new media artists in New York in the 1970s, remarked that in the early phase she was struck by the fact that *the material was so friendly*, that is how easy it was to express your ideas.

These words suffice to emphasize the importance of the motivation you might

[8] www.montevideo.nl

get out of the material, to be susceptible to as Brancusi phrases it *the rethorics of the material*, even when you are an academic.



(a) personal events

(b) gadgets

9

example(s) – *personal memex*

Just imagine that your would store all your photographs, SMS messages, emails, and in addition to that record your physiological condition, using body-wearable sensors. These data can then be uploaded to your PC, and later to a mass storage server, so that they can be used in your medical dossier, to improve your performance in your favorite sport, or to augment your memory when recollecting stories about your holidays or travels. Impossible? Not at all, Disk space will be cheap. Your body may act as a network to connect the body wearable devices, and, after all, most of the gadgets do already exist! Besides, the idea is not new. See section 2.2 for early visions of the *memex*.

research directions– *the information society*

There is no doubt about it, we live in an information society. But do we know what an information society is?

In Briggs and Burke (2001) (p. 187), the functions of the media are summarized as

functions of media

information, education, entertainment

So, perhaps, we could better state that we live in a *media society*. So far, in the latter part of the previous century, television has dominated our lives, and observe that (following Ernie Kovack, cited from Briggs and Burke (2001)):

medium

> television is a medium 'because it is neither rare nor well done'

Back to the main issues, what is an *information society*? According to Briggs and Burke (2001):

information society

> *the new term 'information society' gave form to a cluster of hitherto more loosely related aspects of communication – knowledge, news, literature, entertainment, all exchanged through different media and different media materials – paper, ink, canvas, paint, celluloid, cinema, radio, television and computers. From the 1960s onwards, all messages, public and private, verbal and visual, began to be considered as 'data', information that could be transmitted, collected, recorded, whatever their point of origin, most effective through electronic technology.*

So, from the varieties of perspectives we have discerned, including technological perspectives, societal perspectives and psychological perspectives, we must investigate the problem of communication:

communication

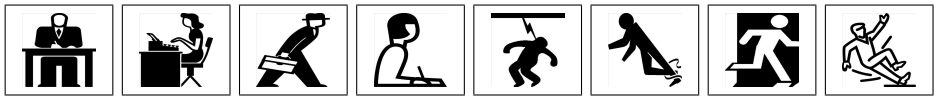
- *what* – content
- *who* – control
- *whom* – audience (how many)

That is, simply, who says what to whom in what channel with what effect?! The remainder of the book will, however, will treat these issues mainly from a technological perspective. In the chapters that follow, we will enquire after the technological assumptions that make an information society possible.

1.4 development(s) – convergence in second life

第二生命

...



10

questions

digital convergence

1. Sketch the developments in *multimedia*. What do you expect to be the commercial impact of multimedia in the (near) future?

concepts

2. Explain what is meant by *digital convergence*.

3. Which kinds of *(digital) convergence* do we have?
4. Discuss the relation between the *medium* and the *message*.

technology

5. Give a brief sketch of the development of *digital entertainment*.
6. Characterize: HDTV, SDTV, ITV.
7. Discuss convergence with respect to *platforms*.
8. Discuss convergence with respect to *delivery*.

projects & further reading As a project, consider the development of a Java-based mobile game using J2ME, see Morrison (2005), or a web-based game using Visual Basic .NET, see Santos Lobao and Hatton (2003).

You may further explore multiplatform game development, and find arguments to choose for either Java-based or managed code based implementations.

For further reading, I advice to have a look at the special issues of the Scientific American, American, and the CACM on the next 1000 years of computing, CACM (2001), and, for getting an idea where this all leads to, Schneidermann's *Leonardo's laptop*, Shneiderman (2003).

the artwork

1. photographs of art works by Marina Abramovic, *Art must be beautiful*, *Blue period*, *Dissolution*, *Dozing consciousness*, *In between*, with (pending) permission from Montevideo[9]. See also section 10.2.
2. *medium*, according to the Visual Thesaurus[10].
3. fMRI Research on Virtual Reality Analgesia[11], see section 1.1.
4. *television* and *communication*, according to the Visual Thesaurus.
5. TV Today, exhibition at Montevideo, februari 2005.
6. visible world – taken from Rosenblum and Macedonia (2002), see section 1.2.
7. personal event database and personal gadgets, from Freeband[12] project.
8. *Thomas Lips 1975*, *Thomas Lips 1993*, from Marina Abramovic, with permission from Montevideo.
9. *scanlines* from Woody Vasulka[13], 197x, with permission from the artist.
10. signs – people, van Rooijen (2003), p. 254, 256.

The work of Marina Abramovic has a strong *existential* flavor. It has also served as the material for a case study in developing a digital artist dossiers, the *abramovic dossier*, discussed in section 10.2. The work of Woody Vasulka is of a more *experimental* character, and shows the joy of discovering the possibilities of the, at the time, new electronic and digital tools and materials.

[9] www.montevideo/nl
[10] www.visualthesaurus.com
[11] www.hitl.washington.edu/research/magnet
[12] www.freeband.nl
[13] www.vasulka.org

2. hypermedia information spaces

everything must be intertwinkled

learning objectives

After reading this chapter you should be able to define information spaces in a precise manner, position the hypertextual capabilities of the web in a historical perspective, explain the difference between multimedia and hypermedia, and argue why computational support for narrative structure in multimedia applications is desirable.

However entertaining it might be presented to you, underlying every multimedia presentation there is an information space. That is to say, irrespective of the medium, there is a message. And being confronted with a message, we might want to inquire for more information. In this chapter, we will define the notion of information space more precisely. We will extend this definition to include information hyperspaces, by looking at the history of hypertext and hypermedia. Finally, we will discuss visualisation as a means to present (abstract) information in a more intuitive way, and we will reflect on what is involved in creating compelling multimedia.

1

2.1 information and data

Current day *multimedia information systems* distinguish themselves from older day information systems not only by what information they contain, that includes multimedia objects such as images and sounds, but also by a much more extensive repertoire of query mechanisms, visual interfaces and rich presentation facilities. See Chang and Costabile (1997).

Preceding the advent of multimedia information systems, which include networked multimedia systems as discussed in section 6.3, we have seen advances in

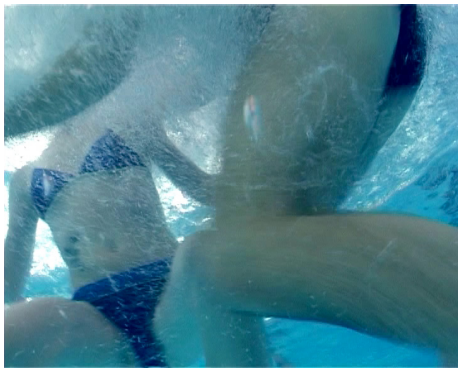
multimedia information systems

- *storage technology – multimedia databases*
- *wideband communication – distribution accross networks*
- *parallel computing – voice, image and video processing*
- *graphic co-processors – visual information with high image quality*

Now, the class of *multimedia information systems* is, admittedly, a large one and includes applications and application areas such as:

geographical information systems, office automation, distance learning, health care, computer aided design, scientific visualization, and information visualization.

Nevertheless, irrespective of what technology is used for storage and retrieval, multimedia information systems or multimedia databases impose specific requirements, with respect to: the size of data, synchronisation issues, query mechanisms and real-time processing.
Partly, these requirements concern the efficiency of storage and retrieval and partly they concern aspects of usability, that is the way information is presented to the user. In particular, we can think of a great number of query mechanisms that our multimedia information system of choice is expected to support: free text search, SQL-like querying, icon-based techniques, querying based on ER-diagrams, content-based querying, sound-based querying, query by example, and virtual reality techniques.




logical information spaces

But before thinking about the optimal architecture of multimedia information systems or the way the information is presented to the user, let's consider in what way a multimedia (information) system or presentation may be considered an *information space*.

As a tentative definition, let's assume that

> *an information space is a representation of the information stored in a system or database that is used to present that information to a user.*

This may sound too abstract for most of you, so let's have a look at this defininition in more detail.

First of all, observe that when we speak of representation, and when we choose for example a visual representation, then the representation chosen might be either the users conceptualization of the database, or a system generated visualization. In principle the same holds for a text-based representation, but this is far less interesting because the options in choosing a representation and presenting it to the user are much more limited.

Unfortunately, the phrase *representation* is also somewhat vague. To be more precise, we must distinguish between a *visual information space* (for presentation), a *logical information space* (in which we can reason about abstract information objects) and a *physical information space* (where our concrete multimedia objects are stored).

Summarizing we have:

- *physical information space* – images, animations, video, voice, ...
- *logical information space* – abstract database objects
- *presentational information space* – to present information to the user

Our visual information space, our presentation space, as you may prefer to call it, might reflect the logical information space in a symbolic manner by using diagrams, icons, text and possibly visualzations, or, going one step further, it may also mimic the logical information space by using virtual reality, as discussed in chapter 8.

Now we can give a more precise definition of the notion of information space, in particular *logical information spaces*:

> *a logical information space is a multidimensional space where each point represents an object from the physical information space (read database).*

First of all, observe that when we speak of dimensions we might also speak of attributes that can take either continuous, numerical, discrete or logical values. So, concretely, these attributes may be directly or indirectly related to information stored in the database, and hence we can give a more precise definition of the notion of (multimedia) information objects, queries and *cues* (in the logical information space):

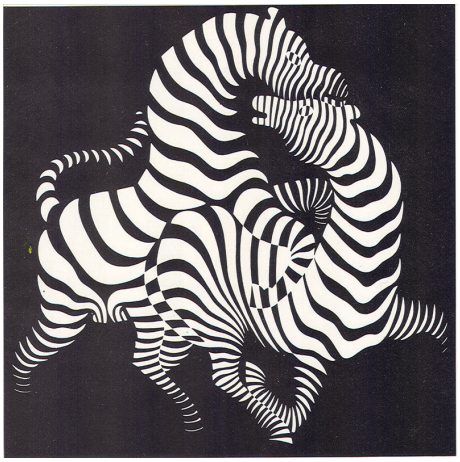
- *information object* – a point in the (logical) information space
- *query* – an arbitrary region in this information space
- *clue* – a region with *directional information*, to facilitate browsing

The notion of *clue* is actually quite interesting, since both examples and queries may be regarded as clues, that facilitate browsing through the contents of an information space. As an example, just think of the situation that, when looking for another notebook, you want something that is similar to the the thing you've previously seen, but that has an additional video output slot that may be connected to your TV.

Also, clues are needed to allow for *query by example*. In this case you need to help the user to define a query in the logical information space, so that the system can construct an *optimal query* to search for the desired object(s) in the physical information space.

When we regard *the information retrieval problem* to be the construction of the *optimal query* with respect to the examples and clues presented by the user, then we may characterize the *optimal query* as the one that will retrieve the largest number of relevant database objects within the smallest possible region in the (logical) information space.

extensions Given the stratification, that is levels or layers, of information systems discussed above, we can think of improvements or extensions on each level. At the physical layer, for example networked multimedia, in a client/server architecture, see 6.3. At the logical layer, as an information hyper space,consisting of chunks and hyperlinks, as explained in section 2.2. And at the presentation layer a virtual reality interface, representing for example the physical location of student records, somewhere at a virtual campus [x], as further explored in chapter 8. Each of these improvements or extensions can be regarded as a technological or scientific adventure in it's own right.



example(s) – *e-flux*

Do you recognize this?

> When we visit a contemporary art exhibition, we find ourselves before the works, which are often quite difficult to interpret, and we observe them without understanding the process that generated them. Between a chopped-up cow immersed in formaldehyde and a replica of the Pope blindsided by a meteorite, it's legitimate to ask questions.

To provide a counter-force the exhibiton Project Room[14] *challenges the usual exhibition routine and decides to not exhibit executed art works but rather offers ten self-interviewing videos by as many artists, who speak openly about a piece they are working on, or a visionary project they want to realize, or about their creative process.*

In other words, this is about works of art with no physical manifestion. It is an interesting issue whether this would still count as a *work of art*. And for multimedia, is there multimedia without a physical manifestation, with sensorily impressing the user/client. Do you remember the children story, the *New Clothes of the Emperor*?

research directions– *universal interchange*

Technology changes rapidly. Just think about the development of the PC in the last two decades of the previous century. And applications change rapidly too. At the time of writing the web does barely exist for ten years. Information spaces, on the other hand, from a sufficiently abstract perspective at least, should be rather stable over time. So the question is, *how can we encode information content in an application-independent way?* As a remark, application-independence implies technology-independence. The answer is, simply, XML. The next question then should be, what is XML and why is it more suitable for encoding information then any of the other formats, such as for example relational tables.

The first question is not so difficult. There are many sources from where an answer may be obtained. Perhaps too many. A good place to start is the XML FAQ (Frequently Asked Questions) at the Web Consortium site:

www.w3.org/XML/1999/XML-in-10-points

> *XML is a set of rules (you may also think of them as guidelines or conventions) for designing text formats that let you structure your data.*

More specifically, XML may be characterized as follows:

XML in 10 points

1. XML is for structuring data
2. XML looks a bit like HTML
3. XML is text, but isn't meant to be read
4. XML is verbose by design

[14] www.e-flux.com

5. XML is a family of technologies
6. XML is new, but not that new
7. XML leads HTML to XHTML
8. XML is the basis for RDF and the Semantic Web
9. XML is license-free, platform-independent and well-supported

Perhaps not all of these points make sense to you at this stage. So let me first indicate that XML has in fact quite a long history. XML is the successor of SGML (the Structured Generalized Markup Language) that was developed in the 1980s to encode documents (such as airplane manuals) in an application-independent manner. SGML is not a language itself, but a descritpion of how to create a content description language, using tags and attributes (as in HTML). In fact, HTML is an application of SGML, using tags with attributes both for formatting and hyperlinks. In other words, SGML is a meta language. And so is XML. Since everything got messy on the web, XML was proposed (as a subset of SGML) to make a clear distinction between content and presentation. Presentation aspects should be taken care of by stylesheets (see below) whereas the content was to be described using and XML-based language.

Now, why is XML a suitable format for encoding data? That question is a bit harder to answer. One of the reasons to use XML might be that it comes with a powerful set of related technologies (including facilities to write stylesheets):

related technologies

- Xlink – hyperlinks
- XPointer – anchors and fragments
- XSL – advanced stylesheets
- XSLT – transformation language
- DOM – object model for application programmer interface
- schemas – to specify the structure of XML documents

These technologies (that are, by the way, still in development) provide the support needed by applications to do something useful with the XML-encoded information. By itself, XML does not provide anything but a way to encode data in a meaningful manner. Meaning, however, comes by virtue of applications that make use of the (well-structured) data.

In summary, XML and its related technologies provide the means to

XML

- separate data from presentation
- transmit data between applications

Actually, the fact that XML was useful also for arbitrary data interchange became fully apperent when XML was available. To get an impression of what XML is used for nowadays, look at www.xml.org.

This leaves us with the question of why XML is to be preferred over other candidate technolgies, such as relational databases and SQL. According to Kay (2001) , the answer to that question is simply that XML provides a richer data

structure to encode information. In the multimedia domain we see that XML is widely adopted as an encoding format, see section **??**. For an example you might want to have a look at MusicXML, an interchange format for notation, analysis, retrieval, and performance applications, that is able to deal with common Western musical notation as used from the 17th century onwards. In appendix **??** we will explore how XML might be useful for your own multimedia application by treating some simple examples.

4

2.2 hypermedia

Given an information space we may turn it into an information hyperspace, that is, following Chang and Costabile (1997),

information hyperspace

> the logical information space may further be structured in a *logical information hyperspace*, where the clues become hyperlinks that provide directional information, and the information space can be navigated by the user following directional clues.

In other words, information is chunked, and each chunk is illustrated or made accessible by an example (hypernode).

Now, what exactly does *information hyperspace* mean? To answer this question, let's briefly look at the history of hypertext and hypermedia.

history

- 1945 – Vannevar Bush (Memex) – as we may think, Bush (1995)
- 1963 – Douglas Engelbart (Augment) – boosting the human intellect Engelbart (1963)
- 1980 – Ted Nelson (Xanadu) – everything is intertwinkled, Nelson (1980)

Vannevar Bush' seminal paper *As we may think* may be regarded as the origin of what is known as *hypertext* with which, even if you don't know the phrase, every one of you is familiar, since it is (albeit in a rather simple way) realized in the web.

The phrase *hypertext* was invented by Ted Nelson (not patented, as far as I know), who looked for a less constraining way to organize information then was common in the educational system he grew up with. But before that, Douglas Engelbarth, who incidently invented the mouse, developed the Augment system to, as he said, *boost the human intellect*. What for, you may ask. Let me quote the series of flashes that Engelbarth went through, according to *Dust or Magic* Hughes (2000):

- *flash 1*: we are in trouble (human mankind)
- *flash 2*: we need to boost mankind's ability to deal with complex urgent problems
- *flash 3*: aha, graphic vision surges forth of me ...
- *flash 4*: hypermedia – to augment the human intellect
- *flash 5*: augment (multimedia) workstation – portal into an information space

classification of hypermedia

Perhaps it is good to know that Vannevar Bush wrote his article when working for an information agency in the second world war period. From that perspective, we can easily see that hypermedia (combining hypertext and multimedia) were thought of an instruments of intelligence.

Basically, hypermedia systems must be able to deal with:

hypermedia systems

- components – *text, graphics, audio, video*
- links – *relations between components*
- presentation – *structured display*

Far from being a definition, this characterization gives some insight in what functionality hypermedia systems must support. Recall that dealing with complex information is what hypermedia is all about.

Is this a natural way to deal with information? Just think about how you are taught to deal with information and how you actually go about with it. Speaking about Ted Nelson, Hughes (2000) observed that *he realized that this intertwingularity was totally at odds with the education system he spent so long in and had been so uncomfortable with.* Quoting Ted Nelson himself from his book *Literary Machines*:

> *A curriculum promotes a false simplification of any subject, cutting the subject's many interconnections and leaving a skeleton of sequence which is only a charicature of its richness and intrinsic fascination.*

Judge for yourself. Would you prefer to have an 'immersive' course in multimedia rather than a more or less ordered collection of abstractions?

True enough, the visions of the pioneers of hypermedia where overwhelming. Nevertheless, the concept of hypermedia, that is non-linear media with machine-supported links, or *'text' as a network*, found an application in a large variety of systems, see McKnight et al. (1991).

classification of hypermedia systems

- macro-literary systems – *publishing, reading, criticism*
- problem exploration tools – *authoring, outlining, programming*
- browsing systems – *teaching, references, information*
- general hypermedia technology – *authoring, browsing, collaboration*
- embedded hypermedia – *CASE, decision support, catalogs*

An example of a hypermedia system that has extensively been used in education, for example biology and chemistry classes, is the Brown University Intermedia system of which supports so-called *information webs*, consisting of *documents* and *links*, that could both be retrieved by specifying attribute, allowing in this way for respectively both filtered content and conditional navigation. An interesting aspect of this system is that the user may create *maps*, that is structures containing documents and links, which form a personalized version of the web of information for a specific user, superimposed on the information space offered by the system.

5

Dexter Hypertext Reference Model

After many years of developing ideas and exploring implementations, one group of experts in the field came together and developed what is commonly known as the *Dexter Hypertext Reference Model*, named after the location, actually a pub, where the meetings were held. The Dexter model offers an abstract description of *hypertext*. It made a distinction between *components*, *anchors* within components

and *links* between components, attached to anchors. The model was meant as a reference standard against which existing and future hypertext systems could be compared.

Components have the following attributes:

component

- content – *text, graphics, video, program*
- attributes – *semantic description*
- anchors – *(bi-directional) links to other documents*
- presentation – *display characteristics*

The Dexter Hypertext Model has been criticised from the beginning. Among others, because *compound documents*, that is documents having subcomponents, where not adequately dealt with. And also because it did not accomodate multimedia (such as video) content very well. In practice, however, the Dexter model has proven to be even somewhat overambitious in some respects. For example, the web does (currently) not support bi-directional links in a straightforward manner.

Amsterdam Hypermedia Model

When looking for alternatives, a Dutch multimedia research group at CWI proposed to extend the Dexter model with their own multimedia model (CMIF), an extension for which they coined the name *Amsterdam Hypermedia Model*.

Let's look at the (CMIF) multimedia model first:

(CMIF) multimedia model

- data block – *atomic component*
- channel – *abstract output device*
- synchronization arc – *specifying timing constraints*
- event – *actual presentation*

What strikes as an immediate difference with respect to the hypertext model is the availability of *channels*, that allow for presenting information simultaneously, and so-called *synchronization arcs*, that allow the author to specify timing constraints. Also, events are introduced in the model to deal with user interactions.

With respect to authoring, the model supports a declarative approach to specifying sequential and parallel compounds, that is in what order specific things must be presented and what may ocuur simultaneously. Again, channels may be employed to offer a choice in the presentation, for example a dutch or english account of a trip in Amsterdam, dependent on the preferences of the (human) viewer.

The Amsterdam Hypermedia Model (AHM) extends the Dexter Hypertext Reference Model in a rather straigthforward way with channels and synchronization arcs.

Amsterdam Hypermedia Model

- contents – *data block*
- attributes – *semantic information*

- anchors – *(id, value)*
- presentation – *channel, duration, ...*

Obviously, the difference between Dexter and AHM is primarily the more precise definition of *presentation characteristics*, by introducing *channels* as in the (CMIF) multimedia model. Another (major) difference lies in the characterization of compounds. Each compound has one or more children, or subcomponents. Subcomponents may act as the source or destination of synchronization arcs. Each component obtains a start-time, that may result from parallel or sequential composition and synchronisation arcs.

Another interesting concept introduced by the Amsterdam Hypermedia Model is the notion of *context*. What happens when you click on a link? Does everything change or are only some parts affected? Then, when you return, does your video fragment start anew or does it take up where you left it? Such and other issues are clarified in the Amsterdam Hypermedia Model, of which we have omitted many details here.

It is perhaps interesting to know that the Amsterdam Hypermedia Model has served as a reference for the SMIL standard discussed in section 3.2. If you want to know more about the Amsterdam Hypermedia Model, you may consult Ossenbruggen (2001) or Hardman et al. (1994).

6

example(s) – *hush*

In the *hush*[15] we explore a variety of hypermedia applications. In fact already in 1994 we developed a SGML-based browser with *applets* in Tcl/Tk, Applications and SGMLWEB. Somehow, we did a lot with music with optimistic titels such as *Bringing music to the We*, Ossenbruggen & Eliens (1994) and more pessimistic ones such as *Jamming (on) the Web*, Eliens *et al.* (1997). The acronym *hush* stands for *hyper utility shell*. Many of the projects with *hush* were student projects, in which we studied operational support for hypermedia applications. Although we used SGML for markup, we did not have any specific document model, as in CMIF. An overview and rationale of *hush* is given in Eliens (2000). A significant part of the *hush* software is being reused in the ViP system, that is discussed in section 4.3, albeit with an entirely different presentation technology.

[15] www,cs,vu.nl/∼eliens/online/hush

research directions– *computational models*

Today, hypermedia functionality is to some extent embedded in almost all applications. However, to realize the full potential of hypermedia, and in effect the networked multimedia computer, there are still many (research) issues to be resolved. To get an impression of the issues involved, have a look at the famous seven hypermedia research issues formulated by Halasz.

research issues

- *search and query* – for better access
- *composition* – for imposing structure
- *virtual structures* – on top of existing structures
- *computation* – for flexibility and interaction
- *versioning* – to store modification histories
- *collaborative work* – sharing objects with multiple users
- *extensibility and tailorability* – to adapt to individual preferences

See Ossenbruggen (2001), section 2.3 for a more extensive description. Although the research issues listed above were formulated quite early in the history of hypermedia, as a reflection on the requirements for second-generation hypermedia systems, they remain valid even today. Without going into any detail with respect to the individual research issues, I rather wish to pose the grand encompassing research issue for the networked multimedia computer: *What is the proper computational model underlying hypermedia or, more generally, for applications that exploit the networked multimedia computer in its full potential*? Some directions that are relevant to this issue will be given in section **??** which deals with the multimedia semantic web.

2.3 multimedia authoring

It is tempting to identify a presentation with the information space it presents. This is what users often do, and perhaps should do. When that happens, the presentation is effective. But you must remember that the actual presentation is just one of the many possible ways to engage a user in exploring an information space. Making the choice of what to present to the user is what we understand by *(multimedia) authoring*.

Authoring is what we will discuss in this section. Not by giving detailed guidelines on how to produce a presentation (although you may look at the online assignment for some hints in this respect), but rather by collecting wisdom from a variety of sources.

7

visualization

Let's start with our explorations by looking at the problem of *visualisation* with a quote from David Gelernter, taken from Shneiderman (1997):

visualization

> *Grasping the whole is a gigantic theme, intellectual history's most important. Ant vision is humanity's usual fate; but seeing the whole is every thinking person's aspiration.* David Gelernter, Mirror Worlds 1992

Now, consider, there are many ways in which the underlying information space may be structured, or speaking as a computer scientist, what data types may be used to represent the (abstract) information.

data types

- *1-D linear data* – text, source code, word index
- *2-D map data* – floor plan, office layout
- *3-D world* – molecules, schematics, ...
- *temporal data* – 1 D (start, finish)
- *multi-dimensional data* – n-dimensional (information) space
- *tree data* – hierarchical
- *network data* – graph structure

The *visualisation problem* then is to find a suitable way to present these structures to the user. Basicall, following Shneiderman (1997), there are two paradigms to present this information:

- *interactive* – overview first, zoom and filter, then details on demand
- *storytelling* – as a paradigm for information presentation

Storytelling may be very compelling, and does not force the user to interact. On the other hand, storytelling may lead to information consumerism alike to television enslavement.

An interaction paradigm that combines 'storytelling' with opportunities for interaction, as for example in the *blendo* approach discussed in section 3.2, would seem to be most favorable. Interaction then may result in either changing the direction of the story, or in the display of additional information or even transactions with a third party (for example to buy some goodies).

persuasive technology

Whatever your target audience, whatever your medium, whatever your message, you have to be convincing if not compelling.

In the tradition of *rethorics*, which is the ancient craft of convincing others, a new line of research has arisen under the name of *persuasive technology*. In the words of my collegue, Claire Dormann, persuasion is:

persuasion

- a communication process in which the communicator seeks to elicit a desired response from his receiver
- a conscious attempt by one individual to change the attitudes, beliefs or behaviours of another individual or group individual through the transmission of some messages.

In other words, *the purpose of persuasion is to accomplish one of the following goals: to induce the audience to take some action, to educate the audience (persuade them to accept to accept information or data), or to provide the audience with an experience.* In the area of multimedia, one may think of many applications. Quoting Claire Dormann, *in* interactive media*, the field of application of persuasive technology ranges from E-commerce, social marketing (like an anti-AIDS campaign) to museum exhibits. Also E-commerce provides an obvious example. To convince people to buy more, more persuasive messages and technologies are developed through the use of humorous and emotional communication, agents (such as price finders) or 3D representations of products and shops. For health campaigns (or any campaign of your choice) one can imagine 3D information spaces with agents presenting different point of views and where users are given different roles to play. In a museum you might want to highlight key points through innovative and fun interactive exhibits.* Although the subject of *persuasive technology* is far less technology-oriented than the name suggests, multimedia (in a broad sense) form an excellent platform to explore *persuasion*. As concerns multimedia authoring, set yourself a goal, do the assignment, explore your capabilities, convey that message, and make the best of it.

(re)mediation

What can you hope to achieve when working with the new media? Think about it. Are the new media really new? Does anyone want to produce something that nobody has ever seen or heard before? Probably not. But it takes some philosophy to get that sufficiently clear.

In Bolter and Grusin (2000), the new media are analyzed from the perspective of remediation, that is the mutual influence of media on eachother in a historical perspective. In any medium, according to Bolter and Grusin (2000), there are two forces at work:

(re)mediation

- *immediacy* – a tendency towards transparent immersion, and
- *hypermediacy* – the presence of referential context

Put in other words, immediacy occurs when the medium itself is forgotten, so to speak, as is (ideally) the case in realistic painting, dramatic movies, and (perhaps in its most extreme form) in virtual reality. Hypermediacy may be observed when either the medium itself becomes the subject of our attention as in some genres of modern painting, experimental literature and film making, or when there is an explicit reference to other related sources of information or areas of experience, as in conceptual art, many web sites, and also in CNN news, where apart from live reports of ongoing action, running banners with a variety of information keep the viewers up to date of other news facts.

Now, the notion of *remediation* comes into play when we observe that every medium draws on the history of other media, or even its own history, to achieve a proper level of immediacy, or 'natural immersion'. For example, Hollywoord movies are only realistic to the extent that we understand the dramatic intent of cuts, close-ups and storylines, as they have been developed by the industry during the development of the medium. As another example, the realism of virtual reality can only be understood when we appreciate linear perspective (which arose out of realistic Renaissance painting) and dynamic scenes from a first person perspective (for which we have been prepared by action movies and TV).

Even if you may argue about the examples, let it be clear that each (new) medium refers, at least implicitly, to another medium, or to itself in a previous historic phase. So, what does this mean for new media, like TV or virtual reality?

Let's start with virtual reality. Bolter and Grusin (2000) comment on a statement of Arthur C. Clarke

> *Virtual Reality won't merely replace TV. It will eat it alive.*

by saying that ... *he is right in the sense that virtual reality remediates television (and film) by the strategy of incorporation. This strategy does not mean that virtual reality can obliterate the earlier visual point-of-view technologies, rather it ensures that these technologies remain as least as reference points by which the immediacy of virtual reality is measured.*

So, they observe "paradoxically, then, remediation is as important for the logic of transparency as it is for hypermediacy". Following Bolter and Grusin (2000), we can characterize the notions of immediacy and hypermediacy somewhat more precisely.

immediacy

- epistemological: transparency, the absence of mediation
- psychological: the medium has disappeared, presence, immersion

hypermediacy

- epistemological: opacity, presence of the medium and mediation
- psychological: experience of the medium is an experience of the real

Now, sharpen your philosophical teeth at the following statement, taken from remediation, p. 224:

> *Convergence is the mutual remediation of at least three important technologies – telephone, televison and computer – each of which is a hybrid of technical, social and economic practice, and each of which offers its own path to immediacy.*
>
> *The telephone offers the immediacy of voice or the interchange of voices in real-time.*
>
> *Television is a point-of-view technology that promises immediacy through its insistent real-time monitoring of the world.*
>
> *The computer's promise of immediacy comes through the combination of three-dimensional graphics, automatic (programmed) action, and an interactivity that television can not match.*
>
> *As they come together, each of these is trying to absorb the others and promote its own version of immediacy.*

Let us once more come back to virtual reality and its possible relevance in our information age, Bolter and Grusin (2000), p. 225:: *in the claim that new media should not be merely archival but immersive, the rhetoric of virtual reality finally enters in, with its promise of the immediacy of experience through transparency.* . So, with respect to the new media, we may indeed conclude: *what is in fact new is the particular way in which each innovation rearranges and reconstitutes the meaning of earlier elements. What is new about media is therefore also old and familiar: that they promise the new by remediating what has gone before. The true novelty would be a new medium that did not refer to the other media at all. For our culture, such mediation without remediation seems to be impossible.*

example(s) – *mobius*

Rurger van Dijk, a former student of mine, has implemented an interactive story in *flash*. The story is a romance, told with images displaying scenes from the life of the players, a young man and a young women. The user can choose perspectives, either the man's or woman's, and watch the story from that point of view. The story is both non-linear and circular. The scenes can be connected in various way, and order is not compulsory. This work has been submitted to both the org.uk[16]>submerge[17] contest and the siggraph[18] educational track.

research directions– *narrative structure*

Where do we go from here? What is the multimedia computer, if not a new medium? To close this section on multimedia authoring, let us reconsider in what way the networked multimedia computer differs from other media, by taking up the theme of convergence again. The networked multimedia computer seems to remediate all other media. Or, in the words of Murray (1997):

convergence

[16] www.rockonflash.com/demos/RockOnFlashLogoDemo/asdoc/RockOnFlashLogo/org/uk.html
[17] www.rockonflash.com/demos/RockOnFlashLogoDemo/asdoc/RockOnFlashLogo/org/uk.html
[18] www.siggraph.org/education/siggraph_2005_cfp.htm

> *... merging previously disparate technologies of communication and representation into a single medium.*
>
> *The networked computer acts like a telephone in offering one-to-one real-time communication, like a television in broadcasting moving pictures, like an auditorium in bringing groups together for lectures and discussion, like a library in offering vast amounts of textual information for reference, like a museum in its ordered presentation of visual information, like a billboard, a radio, a gameboard and even like a manuscript in its revival of scrolling text.*

In Murray (1997), an analysis is given of a great variety of computer entertainment applications, varying from shoot-em-up games to collaborative interactive role playing. Murray (1997) identifies four essential properties that make these applications stand out against the entertainment offered by other media, which include books and TV. Two key properties determine the interactive nature of computer entertainment applications:

interactive

- *procedural* – 'programmed media' ...
- *participatory* – offering agency

All applications examined in Murray (1997) may be regarded as 'programmed media', for which interactivity is determined by 'procedural rules'. With *agency* is meant that the user can make active choices and thus influence the course of affairs, or at least determine the sequence in which the material is experienced.

8

Another common characteristic of the applications examined is what Murray (1997) calls *immersiveness*. Immersiveness is determined by two other key properties:

immersive

- *spatial* – explorable in (state) space
- *encyclopedic* – with (partial) information closure

All applications are based on some spatial metaphor. Actually, many games operate in 'levels' that can be accessedonly after demonstrating a certain degree of mastery. Networked computer applications allow for incorporating an almost

unlimited amount of information. Some of the information might be open-ended, with storylines that remain unfinished. Closure, then, is achieved simply by exhaustive exploration or diminishing attention.

multimedia authoring Coming back to the question what the 'new medium', that is the networked multimedia computer, has to offer from the perspective of multimedia authoring, two aspects come to the foreground:

multimedia authoring

- narrative format
- procedural authorship

The narrative format is incredibly rich, offering all possibilities of the multimedia computer, including 3D graphics, real-time sound, text. In short, everything up to virtual reality. But perhaps the most distinguishing feature of the new medium is that true authorship requires both artistic capabilities as well as an awareness of the computational power of the medium. That is to say, authorship also means to formulate generic computational rules for telling a story while allowing for interactive interventions by the user. Or, as phrased in Murray (1997), the new *cyberbard* must create prototypical stories and formulaic characters that, in some way, lead their own life and tell their stories following their innate (read: programmed) rules. In section **??** and appendix **??**, we will present a framework that may be used as a testbed for developing programmed narrative structures with embodied agents as the main characters.

2.4 development(s) – semantic mashups

9

questions

information spaces

1. (*) What factors play a role in the development of *multimedia information systems*? What research issues are there? When do you expect the major problems to be solved?

concepts

2. Define the notion of *information spaces*?
3. Indicate how multimedia objects may be placed (and queried for) in an *information (hyper) space*?
4. Characterize the notion of *hypermedia*.

technology

5. Discuss which developments make a large scale application of multimedia information systems possible.
6. Give a characterization of an object, a query and a clue in an *information space*.
7. Describe the *Dexter Hypertext Reference Model*.
8. Give a description of the *Amsterdam Hypermedia Model*.

projects & further reading As a project, I suggest the development of a virtual tour in a city, museum or other interesting locatoion.

You may further explore the implementation of traversal within a context, taking into account the history of navigation when backtracking to a particular point, issues in hyperlinking and interaction in multimedia applications, and computational support for narratives.

For further reading I advice you to take a look at the history of hypermedia and the web, using online material from the W3C[19], or the history of media as accounted for in Briggs and Burke (2001) and Bolter and Grusin (2000).

the artwork

1. book covers – Desing, Eco (1994), Avantgarde, Kunst, Betsky (2004)
2. Federico Campanale[20] – Oxygen, fragments from video installation, 2004
3. Vasarely – Diehl 1973.
4. Vasarely – Diehl 1973.
5. Vasarely – Diehl 1973.
6. Federico Campanale – Oxygen, more fragments.
7. student work – from *introduction multimedia* 2000.
8. Rutger van Dijk – *mobius*, interactive story, opening screen, see section 2.3.
9. edgecodes – screenshots, see section 2.3
10. signs – people, van Rooijen (2003), p. 244, 245.

The work of Vasarely has served as an example for many contemporary digital artists. It is playful, mat may be characterized also as *formalist*. The highly aesthetic video work of Federico Campanale who, as he told me was strongly influenced by vasarely in his early years, shows a similar combination of formalism and playfulness. The interactive story by Rutger van Dijk has a rather different atmosphere, it is highly romantic, with slick graphics. The musea sites are included to point to the existence of (an increasing number) of virtual tours.

[19] www.w3c.org
[20] www.blue-frame.com