



AUDIOVISUAL COMMUNICATIONS

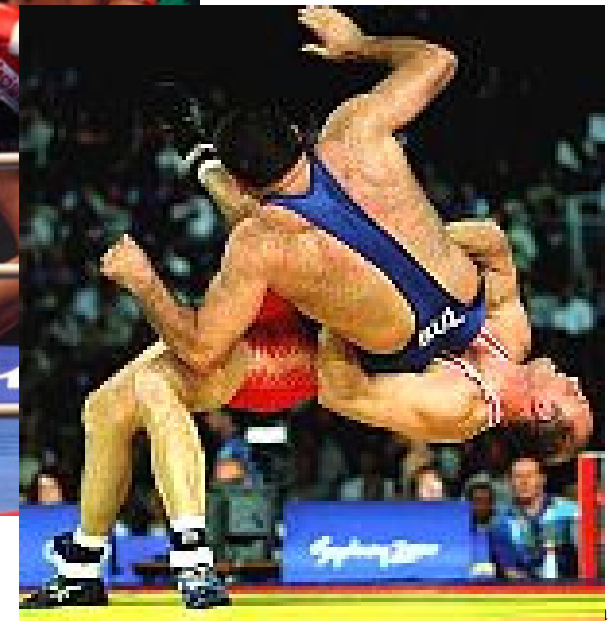
Fernando Pereira





Relation and Logistics

Professor-Students Interaction ...



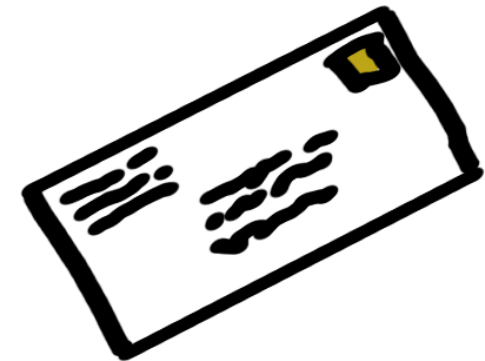


MEEC: Web Page and Mailing List

http://www.img.lx.it.pt/~fp/cav/Welcome_CAV.htm

To subscribe the course
mailing list send a message
to fp@lx.it.pt

Mailing list address:
CAV_MEEC@lx.it.pt



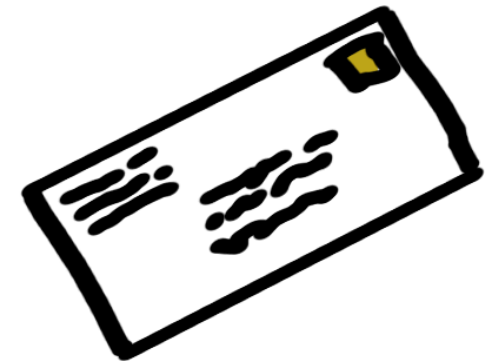


MERC: Web Page and Mailing List

http://www.img.lx.it.pt/~fp/cav/Welcome_CAV.htm

To subscribe the course
mailing list send a message
to fp@lx.it.pt

Mailing list address:
CAV_MERC@lx.it.pt





MEEC: Lectures Schedule

THEORETICAL LECTURES

- ★ **2 lectures of 90 minutes per week - Wednesday and Friday at 3.30 pm in Auditorium EA2**

PRACTICAL LECTURES (alternating with lab sessions)

- ★ **1 lecture of 90 min per week – Wednesday at 11 am and 5 pm and Friday at 11 am in Laboratório de Telecomunicações 4 (4º floor of Torre Norte)**

LABORATORY SESSIONS (alternating with practical lectures)

- ★ **1 lecture of 90 min per week – Wednesday and Friday at 11 am and 5 pm in Laboratório de Telecomunicações 4 (4º floor of Torre Norte)**



MERC: Lectures Schedule

THEORETICAL LECTURES

- ★ 2 lectures of 90 minutes per week – Monday at 3:00 pm and Tuesday at 1:30 pm in Auditorium A5

PRACTICAL LECTURES (alternating with lab sessions)

- ★ 1 lecture of 90 min per week – Monday at 4:30 pm in Room 0.15 or Tuesday at 3:00 pm in Room 1.2

LABORATORY SESSIONS (alternating with practical lectures)

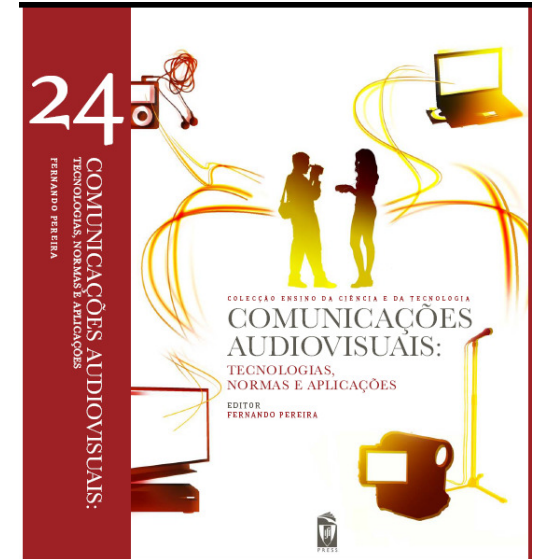
- ★ 1 lecture of 90 min per week – Monday at 4:30 pm or Tuesday at 3:00 pm in Room 1.28



CAV Studying Material

Studying material made available consists in:

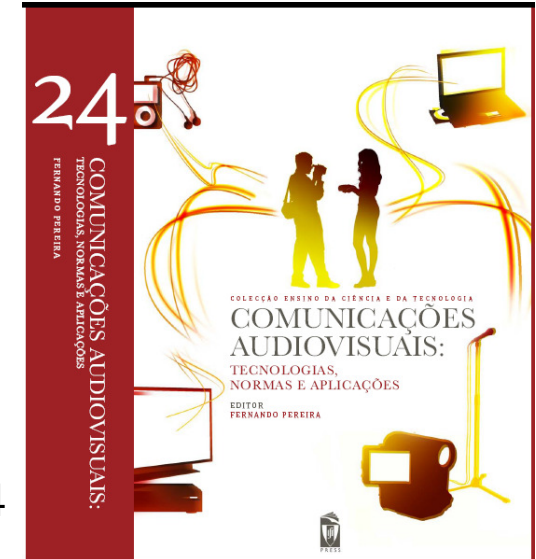
- ★ **Book “Comunicações Audiovisuais: Tecnologias, Normas e Aplicações”, IST Press, 2009 (details at the CAV Web Page)**
- ★ **Slides from theoretical lectures (available at CAV Web Page)**
- ★ **Additional supporting texts for each topic (available at the CAV Web Page)**
- ★ **Collection of exercises with the corresponding solutions (available at CAV Web Page)**
- ★ **Laboratory guides (available at CAV Web Page)**
- ★ **Exams from previous years with solutions (available at CAV Web Page)**





Book ... *Ma Non Troppo* ...

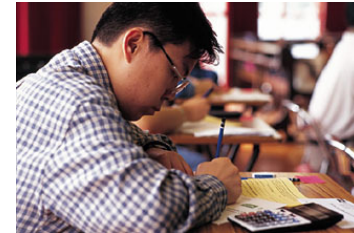
- ★ Introduction Cap. 1
- ★ Analogue TV Sec. 3.1, 3.4, Cap. 4
- ★ From Analogue to Digital Cap. 5
- ★ Facsimile Sec. 8.1, 8.2
- ★ Digital Images Sec. 8.3, 8.4, 10.4
- ★ Videotelephony and Videoconference Sec. 9.1, 9.2, 9.3, 9.6 (brief), 11.3-5 (brief)
- ★ Digital Video Storage Sec. 3.3, Sec. 7.1-7.5, Sec. 9.4, 11.6
- ★ Digital Television Sec. 9.5, 10.1, 10.3, 11.7
- ★ Advanced Multimedia Coding Sec. 9.7 e 11.8 (brief), 9.8



Note: The book authors gave up on any royalties to reduce the price of the book.



Evaluation Method



The CAV evaluation method includes three components, notably:

1. **FINAL WRITTEN EXAM** held after the end of the lecturing period (weight **70%**) – **24th June and 20th July, 9 am**;
2. **SCIENTIFIC DIVULGATION PAPER** (in groups of at most 3) about a selected topic, to provide until **28th May** (weight **30%**);
3. **LABORATORY PARTICIPATION** (in groups of 2) to be checked through the filling of a form during the laboratory session.

The final mark is computed by:

$$\text{Final_Mark} = \text{round} [(0.7 \times \text{Exam} + 0.3 \times \text{Paper}) \times \text{Lab}]$$

where Lab is 1 if the student participated in, at least, 3 out of the 4 lab sessions, and 0.95 otherwise.



Evaluation Method: Some Rules ...

★ EXAM:

- The minimum mark for the exam is 9.5.

★ DIVULGATION PAPER:

- The minimum mark for the divulgation paper is 9.5.
- The divulgation paper should preferably be written in groups of 2 or 3 students.
- The divulgation paper mark is individual even if the paper is a group work.
- The evaluation of the divulgation paper may include a self-assessment component.
- The evaluation of the divulgation paper may include a presentation and/or discussion if found necessary.

★ FINAL MARK:

- The students with a final mark higher than 17 may have to make an oral exam to confirm the mark; not making this oral exam, if requested, implies getting a mark of 17.



About the Divuligation Paper

- ★ **The divulgation paper consists in a tutorial text about a relevant topic related to audiovisual communications.**
- ★ **This paper has the target to stimulate in the students the contact with bibliographical research and also with relevant companies and industry.**
- ★ **The paper will be produced in two versions:**
 - 1. Paper version** which shall not have more than **8 PAGES** using the template made available at the CAV Web Page.
 - 2. HTML version** with a similar content of the paper version but exploiting HTML capabilities typical of Web content, e.g. including video and audio material and interactivity.

For 2009/2010, the deadline for the divulgation paper is 28 May 2010 (Friday).



Example Topics for the Divuligation Paper

- ★ Acquisition and visualization of images
- ★ Videotelephony and videoconference
- ★ Digital Video Broadcasting
- ★ Digital Video Disc
- ★ TV Anytime
- ★ Interactive television
- ★ Internet video
- ★ Television in Portugal
- ★ Video on demand
- ★ Automatic music retrieval
- ★ GSM speech coding
- ★ Audio coding
- ★ MP3
- ★ Multimedia content protection
- ★ MP3 versus AAC
- ★ iPod
- ★ iPhone
- ★ Mobile multimedia
- ★ IPTV
- ★ Digital terrestrial television
- ★ Cable TV in Portugal: comparing services
- ★ Digital TV: the competing alternatives
- ★ Video surveillance
- ★ Satellite video
- ★ Video coding: the format war
- ★ Audio coding: the format war
- ★ High definition video
- ★ Digital TV in Portugal: comparing services
- ★ Mobile video in Portugal: comparing services



Evaluation Method: Paper Self-Assessment

- ★ By the paper deadline date, each student (not each paper) will provide to a previously identified student representative, his/her 'guess' for his/her paper. The professor will not have access to these 'guesses'.
- ★ The professor will score the papers in a 0-20 scale.
- ★ The students which 'guess' is the same as the professor's mark will get a bonus of 1 point in the paper mark.
- ★ The students which 'guess' is ± 1 point regarding the professor's mark will get a bonus of 0.5 point in the paper mark.





MEEC: Presenting and Assigning the Divulcation Paper



**Starting next
Wednesday and
Friday, at 11:00 am
in LT4 !**





MERC: Assigning the Divuligation Paper Topics



**Starting Tuesday
(tomorrow), at
3:00 pm in Room
0.23 !**





MEEC: Lab Registration



Send message to fp@lx.it.pt choosing between Wednesday (11:00 am and 5 pm) and Friday (11:30 am) with 2 names and numbers/group.

Assignment by order of arrival !





MERC: Lab Registration



Send message to fp@lx.it.pt choosing between Monday, 4:30 pm and Tuesday, 3:00 pm with 2 names and numbers/group.

Assignment by order of arrival !





The Context

Audiovisual Communications

Transference of image, audio and video information through space, time, or space and time simultaneously.



facebook

flickr

You Tube
Broadcast Yourself

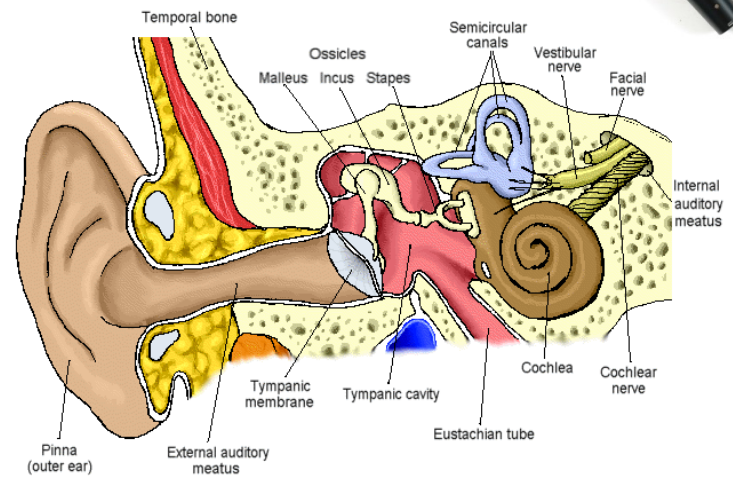
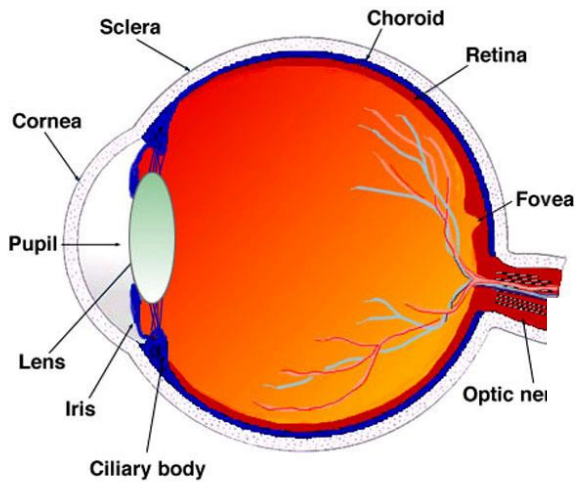
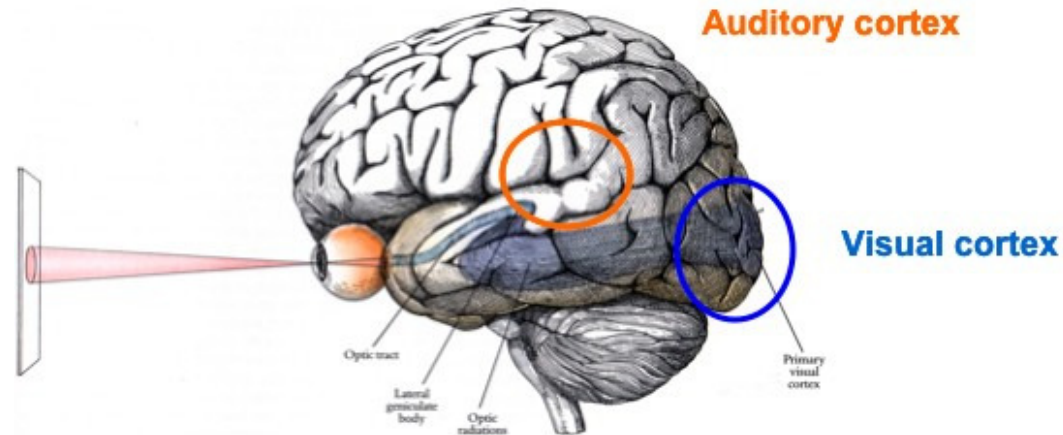
The Importance of the User ...



We All Communicate ...

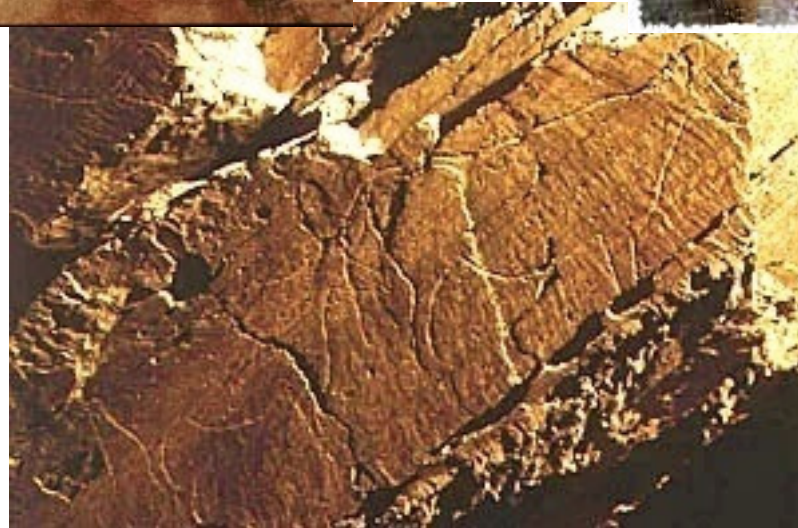


Sensations, Perceptions and Emotions ...





Communicating Since a Long Time Ago ...



And After Telecommunicating ...



You Tube
Broadcast Yourself



What do the Users Want ?

- ★ Information
- ★ Entertainment
- ★ Communication
- ★ Games
- ★ Education
- ★ Shopping
- ★ ...



How can Clients be Convinced ?

- ★ Satisfaction of personal needs
- ★ Added value, new capabilities
- ★ Interoperability
- ★ Quality and robustness
- ★ Content variety
- ★ (Low) cost of equipment and usage
- ★ Easy usage

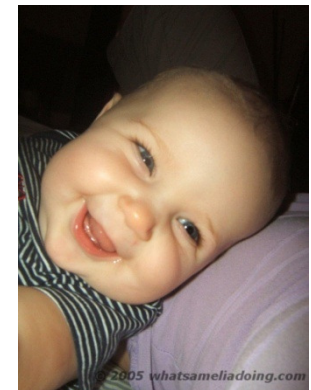
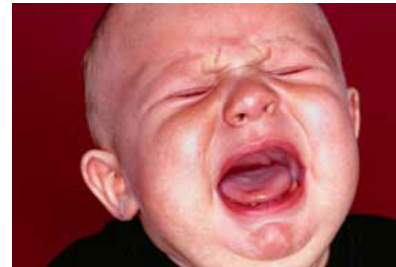




Satisfaction: Quality versus Service

The minimum required quality of service depends on the service in question:

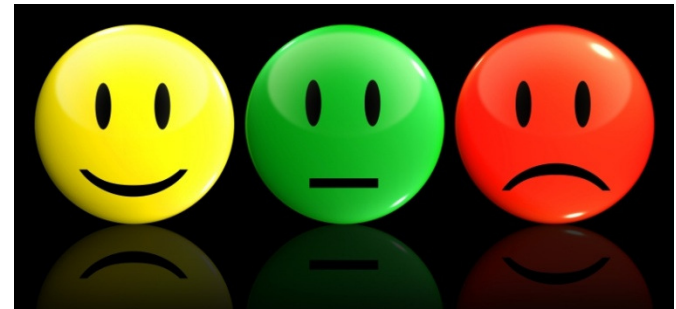
- ★ Facsimile
- ★ Digital image (bi-level, grey or colour)
- ★ Analogue TV
- ★ Videotelephony
- ★ Videoconference
- ★ Digital television
- ★ High definition digital television



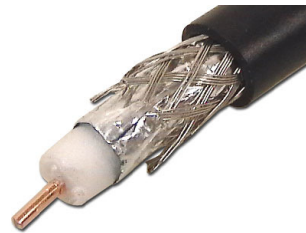
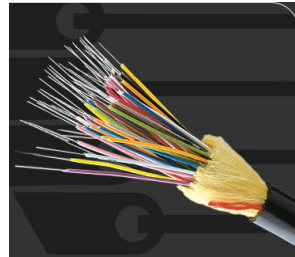


Quality ? What Quality ?

- ★ **What is and determines ‘good quality’ ? What ‘quality’ ? Quality of the multimedia experience ?**
- ★ **YouTube video and audio quality are sometimes quite poor ... still, this does not prevent some of this content to be very popular ...**
- ★ **Which are the components determining quality ?**
 - Signal fidelity
 - User profile
 - User involvement
 - Context, e.g. train, abroad
 - Natural environment, e.g. noisy, dark
 - ...



Service Paradigms: (Conventional) Broadcasting



- ★ **Unidirectional**
- ★ **Point to multipoint**
- ★ **Real-time or not**
- ★ **Low delay but not critical**
- ★ **High quality**
- ★ **Generic content**
- ★ **Centralized content production model**
- ★ **Several channels and networks**
- ★ ...

Service Paradigms: Interactive Broadcasting



- ★ Bidirectional but asymmetric
- ★ Point to multipoint and point to point
- ★ Real-time or not
- ★ Critical reaction delay
- ★ High quality
- ★ Generic content
- ★ Centralized content production model
- ★ Several channels and networks
- ★ ...

Service Paradigms: Storage



- ★ Local, no transmission
- ★ High storage capacity
- ★ Very high quality
- ★ Low delay
- ★ Generic content
- ★ Centralized content production model
- ★ Mainly optical storage
- ★ ...

Service Paradigms: Personal Communications



- ★ Bidirectional and symmetric
- ★ Point to point
- ★ Real-time
- ★ Critical delay
- ★ Low or medium quality
- ★ Specific content
- ★ Several channels and networks
- ★ ...

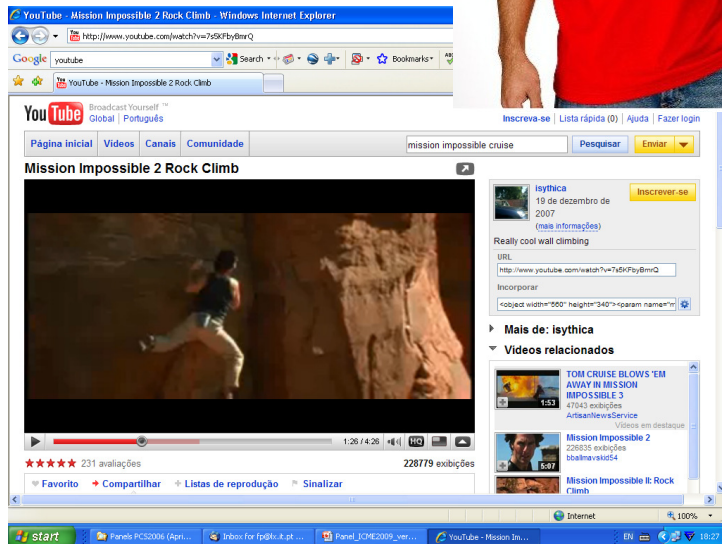
Service Paradigms: Games



- ★ Storage (or bidirectional)
- ★ Point to point (or multipoint)
- ★ Real-time
- ★ Critical delay
- ★ High quality/realism
- ★ Synthetic and natural content mix
- ★ Centralized content production model
- ★ Mainly optical storage
- ★ ...

Service Paradigms: Monocasting Sharing

You Tube
Broadcast Yourself™



- ★ Bidirectional but asymmetric
- ★ Downloading and streaming
- ★ Point to point
- ★ Real-time (down) and no real-time (up)
- ★ Critical delay
- ★ Large range of qualities
- ★ Distributed content production model (prosuming)
- ★ Sharing approach
- ★ Social networking
- ★ Several channels and networks



The Contents



Program: a Summary

1. Introduction

2. Analogue Audiovisual Communication Systems

2.1 Black and white analogue TV

2.2 Colour analogue TV

3. Digital Audiovisual Communication Systems

3.1 Facsimile

3.2 Digital imaging

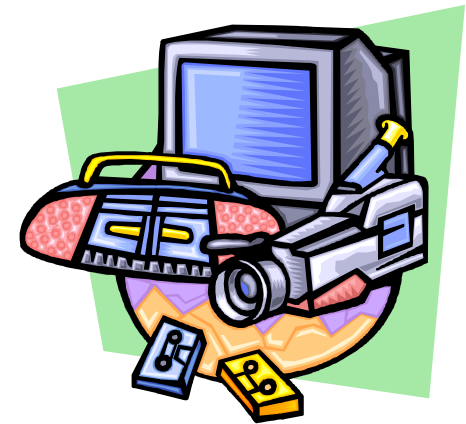
3.3 Videotelephony and videoconference

3.4 Digital video storage

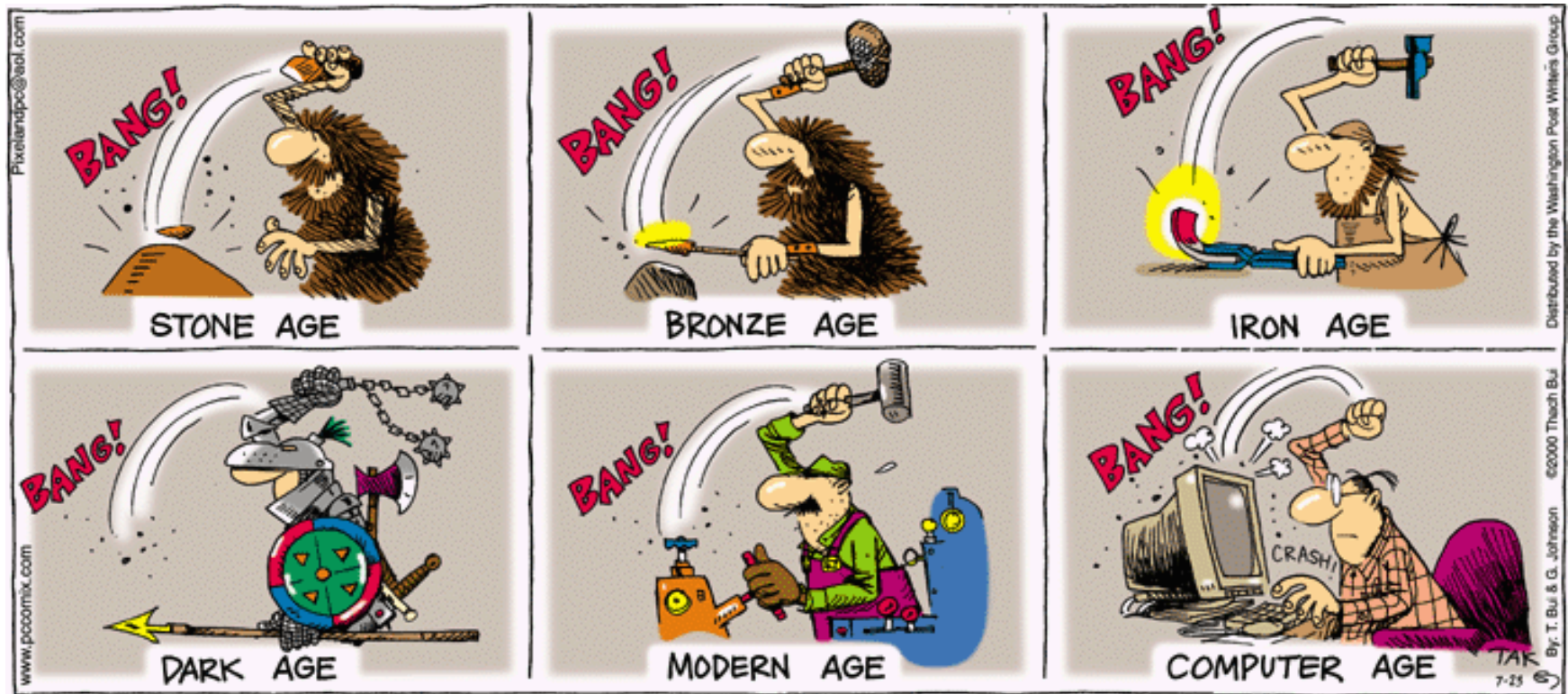
3.5 Digital television

3.6 Advanced audiovisual communication systems

4. Trends on Audiovisual Services

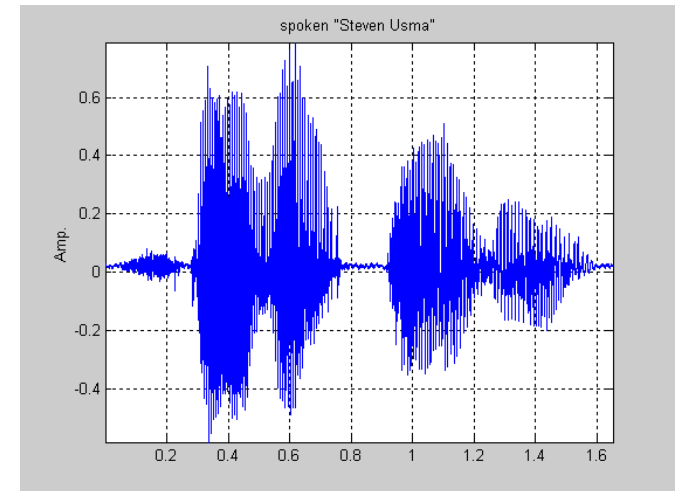


Program: an Evolutive Perspective



Analogue Communications World ...

1876



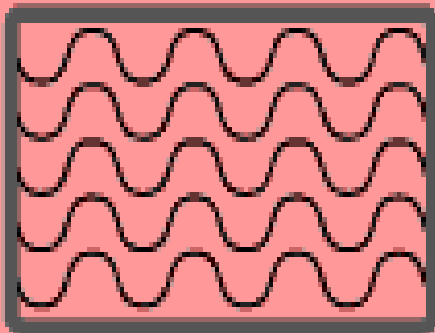
±1920



Audiovisual Communications, Fernando Pereira

Bit Jumping ...

ANALOGUE



DIGITAL

```
110100101001010010  
010010010010101011  
111010100100101010  
001010010101000101  
010010101010101010  
101101010100100101  
010111010100010100
```

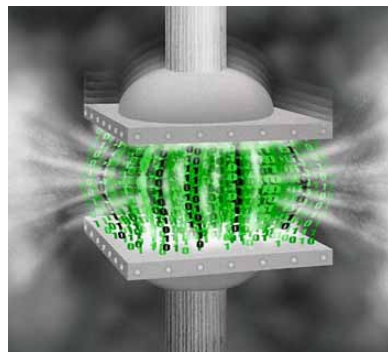




Digitalization ... Many, Really Many, Bits ...

- ★ **Speech** – e.g. 8000 samples/s with 8 bit/sample – **64000 bit/s = 64 kbit/s**
- ★ **Music** – e.g. 44000 samples/s with 16 bit/sample – **704000 bit/s=704 kbit/s**
- ★ **Vídeo** – e.g. $(576 \times 720 + 2 \times 576 \times 360) \times 25$ (20736000) samples/s with 8 bit/sample – **166000000 bit/s = 166 Mbit/s**

We need a ‘miracle’ !



Audiovisual Communications, Fernando Pereira



Digital TV: Only an Example

- ★ ITU-R 601 standard: 25 images/s with 720×576 luminance samples and 360×576 samples for each chrominance, at 8 bit/sample

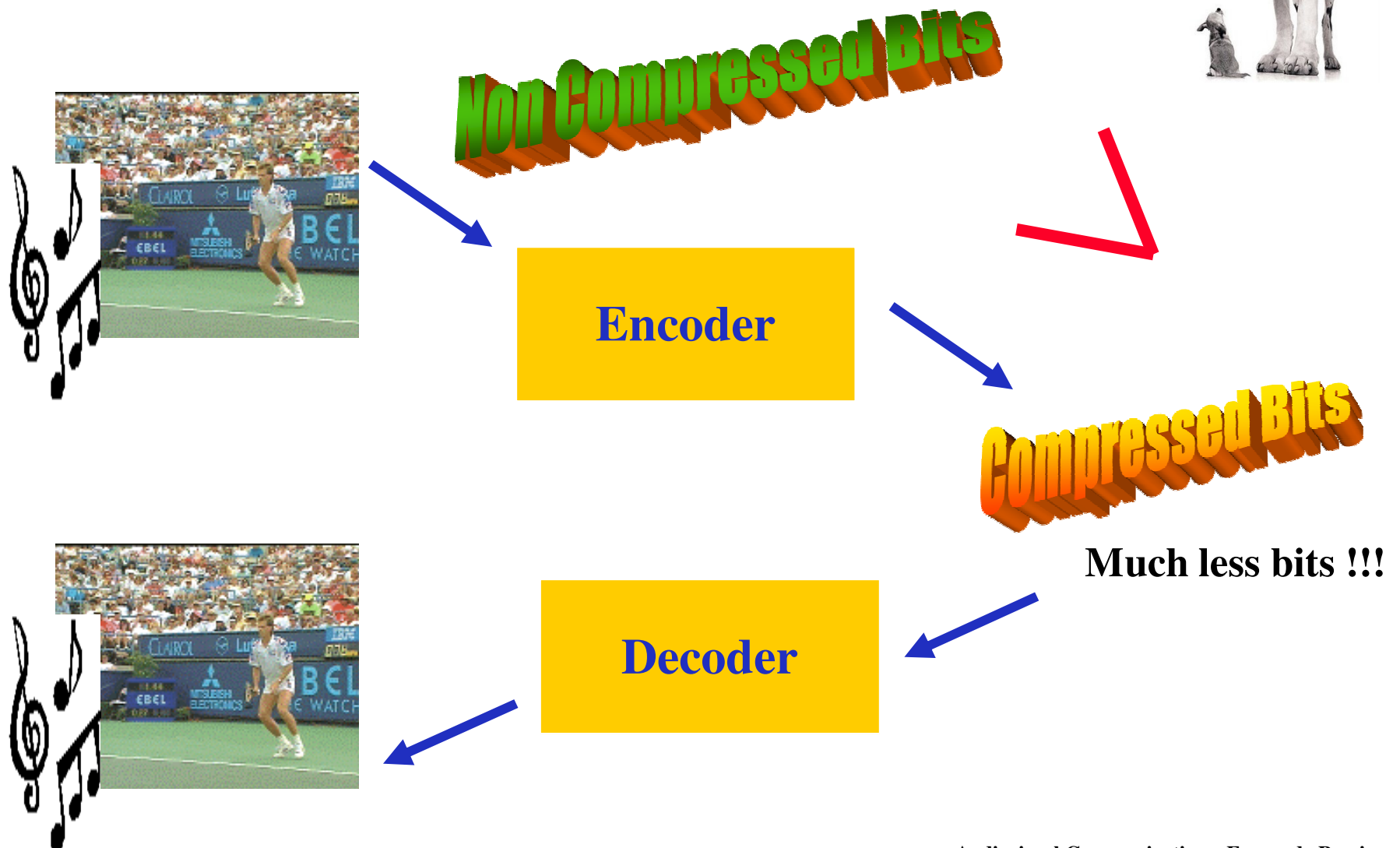
$$[(720 \times 576) + 2 \times (360 \times 576)] \times 8 \times 25 = \mathbf{166 \text{ Mbit/s}}$$

- ★ Practical bitrate with H.264/MPEG-4 AVC codec: **2 Mbit/s**

$$\Rightarrow \mathbf{\text{Required Compression Factor: } 166/2 \approx 80}$$

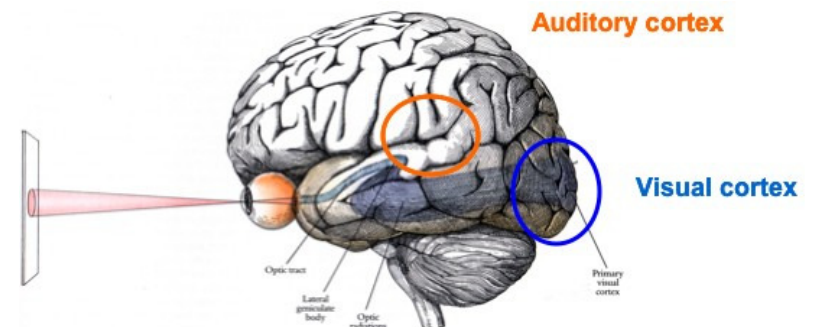
The difference between coding or not implies the existence or not of many largely used services.

The Coding Miracle ...



The Secret of the Miracle ...

- ★ **REDUNDANCY** – Related to the similarities, correlations and predictability between the samples of images, video or audio.
- ★ **IRRELEVANCY** – Related to the information imperceptible for the human visual or auditory systems.



The Consequences of the Miracle (1) ...



The Consequences of the Miracle (2) ...



The Multimedia Babel Tower ...



4 billion (June 2009)

- ~4000 uploads/minute
- 128 years to view all of them (1s per image)
- 2% Internet users visit
- Daily time on site: 4.7 minutes



120 million (July 2009)

- ~20 hours uploaded/minute
- 600 years to see all of them
- 20% Internet users visit
- Daily time on site: 23 minutes
- 2007 bandwidth = entire Internet in 2000
- March 2008: bandwidth cost US\$1M a day



15 billion (April 2009)

- ~22000 uploads/minute
- 480 years to view all of them (1s per image)
- 24% Internet users visit
- Daily time on site: 30 minutes

The Impact of Interoperability ...



Too Much is Too Much ...





Filtering TV ...



File TV Channel Radio Channel Digital Text Channel EPG Capture Video Recorder Help

PVR Main Menu

- 1 7 Day Guide
- 2 Timer
- 3 TV Recordings
- 4 Radio Recordings
- 5 Playlist

Today

- BBC ONE
- BBC TWO
- ITV 1
- Channel 4
- five
- ITV 2

BBC TWO Ready Steady Cook

Take a coup Ainsley Harr

Programm-Führer

3 SAT.1 19.33, 11/11/2002 (Mon)

19:30 - 20:15	Die Quiz Show
20:15 - 21:15	SK Kölsch
21:15 - 22:15	Brotli & Patek - irgendwa...
22:15 - 23:15	Helicops
23:15 - 23:55	Spiegel TV-Reportage
23:55 - 00:25	24 Stunden

EPG Ansicht wählen Vorheriger Tag
 OK Markierte Sendung auswählen.
 Pfeil nächster/vorheriger Kanal.

番組ナビ 番組表 (全チャンネル一覧) 1/16(日) 10:25

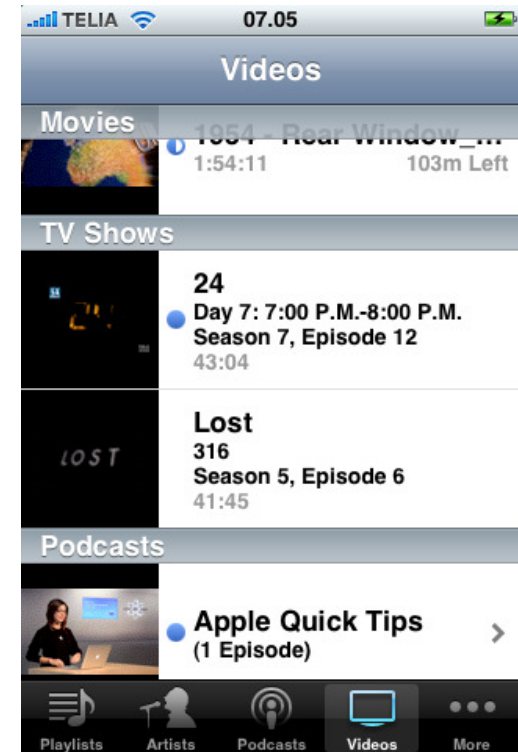
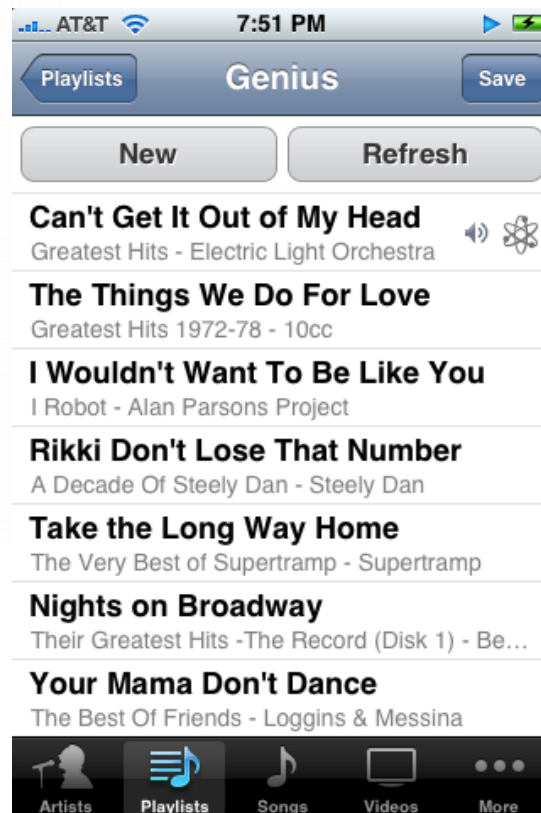
	1/19(水)	19	20
BS207	穴蔵酒造華の鶴「春」	ウィーニーとチッチ	
BS208	めだかの夜	EDIT	
BS209	憂愁	追跡「アレはどこいった？」スペシャル	
WMM	CQ・地底人とモグラ達の暮らし	重機とデザ...	
RED-Q	趣味の演歌	テックハウスの時間	
011	ニュース7	試しました	
021	オリバ	ひ、み、つ	福祉教室
022	蟬の命と今	ルネッサンス	

BS209 M-BS DT BS-D 内蔵 1/19(水) 19:30-21:30
 追跡「アレはどこいった？」スペシャル 01 S 16:9

ドラマ全種 映画全種 スポーツ全種 アニメ/特撮全種 音楽全種

前時間 選択 予約 上下頁 モード 番組別 次時間

Managing iPods Data ...





YouTube: Metadata, Searching ...

YouTube considers metadata fields such as

- ★ Title
- ★ Description
- ★ Category
 - *Autos & Vehicles, Comedy, Education, Entertainment, Film & Animation, Gaming, Howto & Style, Music, News & Politics, People & Blogs, Pets & Animals, Science & Technology, Sports, Travel & Events, ...*
- ★ Date of upload
- ★ Number of views
- ★ Scores
- ★ ...



Imagens

Resultados 1 - 20 de cerca de 232.000 para **napoleon**. (0,06 segundos)
Mostrar: **Todos os tamanhos** - [Grandes](#) - [Médias](#) - [Pequenas](#)

Looking for Napoleon or looking for 'Napoleon'?



napoleon-national-gallery.jpg
699 x 1184 pixels - 119k
fuenterrebollo.com/.../imagenes-napoleon.html



napoleon.jpg
435 x 515 pixels - 73k
www.paintingstogo.com/david/napoleon.jpg



napoleon.jpg
200 x 218 pixels - 15k
academic.brooklyn.cuny.edu/.../napoleon.jpg



napoleon.jpg
496 x 600 pixels - 471k
photos1.blogger.com/img/288/2196/640/napoleo



napoleon.gif
216 x 314 pixels - 59k
www.lucidcafe.com/library/95aug/napoleon.html



napoleon.gif
397 x 494 pixels - 25k
worldroots.com/brigitte/gifs/napoleon.gif



napoleon.jpg
786 x 650 pixels - 108k
www.wga.hu/art/m/meissoni/napoleon.jpg



napoleon-l.jpg
399 x 600 pixels - 91k
www.markchurms.com/.../graphics/napoleon-l.jpg



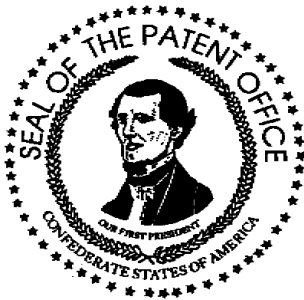
Piracy: The Snowball Effect





Patents and Copyright ...

Intellectual property (IP) enjoys legal protection and stems from the exercise of the mind. IP regards patents, trademarks, copyright, design protection and some minor rights.



- ★ **A patent for an invention is granted to the applicant, and gives him the right for a limited period to stop others from making, using or selling the invention without permission.**



- ★ **Copyright is a legal right (usually of the author or composer or publisher of a work) to exclusive publication production, sale, distribution of some work.**



Business Model: The Key to Success ...



A business model is the method of doing business by which a product/service can sustain itself - that is, generate revenue.

Some business models are quite simple. Other models can be more complex such as free television. The broadcaster is part of a complex network of distributors, content creators, advertisers, and listeners or viewers. Who makes money and how much is not always clear at the outset.

- ★ Digital representations and networks give rise to new kinds of business models, since acquiring, transmitting, and storing information (now just bits) became much easier.**
- ★ But it is also likely to reinvent ‘old’ models such as auctions. New and interesting variations of old models should be expected in the future.**

New Systems and ... New Business Models ...



iPod

Vídeos, Músicas, Fotos.
30GB, 80GB



iPod nano

Totalmente novo.
2GB, 4GB, 8GB



iPod shuffle

Leve suas músicas.
1GB



iPod may play the following audio formats: MP3, WAV, AAC, Protected AAC, AIFF and Apple Lossless.



Multimedia in Portugal



- ★ **It is today much easier than before to create and sell audiovisual communication related products (mainly software based).**
- ★ **Internet helps the success of small, innovative companies created without much investment.**
- ★ **The competition between companies may stimulate also the operators to embrace more innovative challenges.**
- ★ **Users are increasingly open to new services.**
- ★ **International contact is changing old habits and prejudices ...**

Moreover, multimedia technology is an interesting field for Portuguese young engineers with initiative to launch their own companies !