UNIVERSITÀ DEGLI STUDI DI MILANO

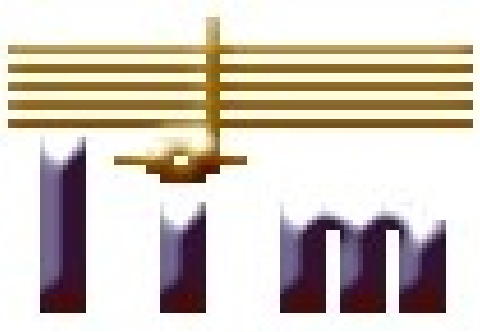
DIPARTIMENTO DI INFORMATICA

Bootstrap day 2022-2023

Presentazione CdL Informatica Musicale

Federico Avanzini

Un po' di storia



- 1985: fondazione del LIM
- 2002: CdL "Scienze e Tecnologie della comunicazione musicale"

- 2010: CdL "Informatica Musicale
- 2018: Il "nuovo" LIM

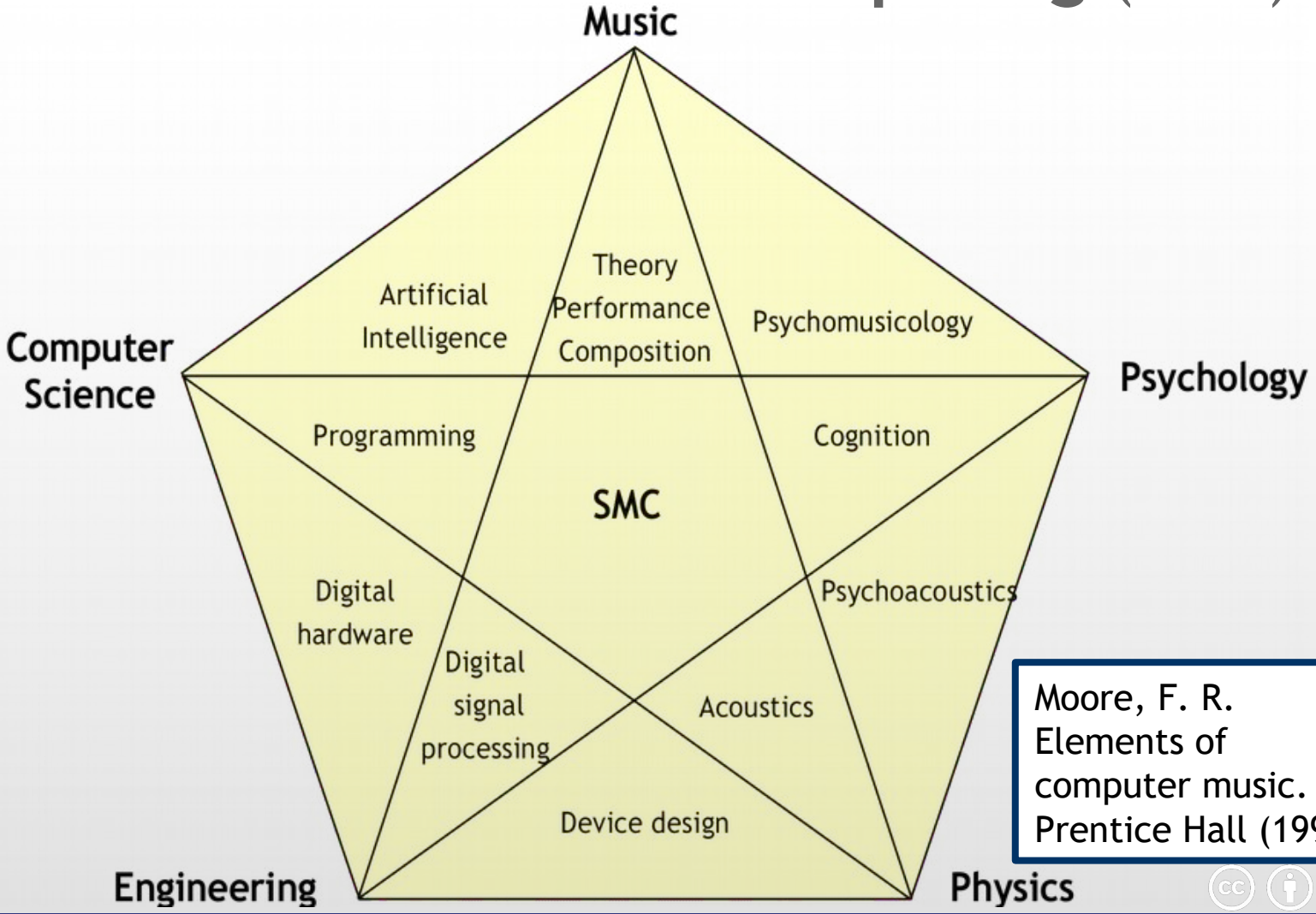
https://www.lim.di.unimi.it

Il nuovo LIM

UNIVERSITÀ DEGLI STUDI DI MILANO
DIPARTIMENTO DI INFORMATICA

Informatica Musicale

- AKA **Sound and Music Computing** (SMC)



Moore, F. R. Elements of computer music. Prentice Hall (1990)

Informatica Musicale

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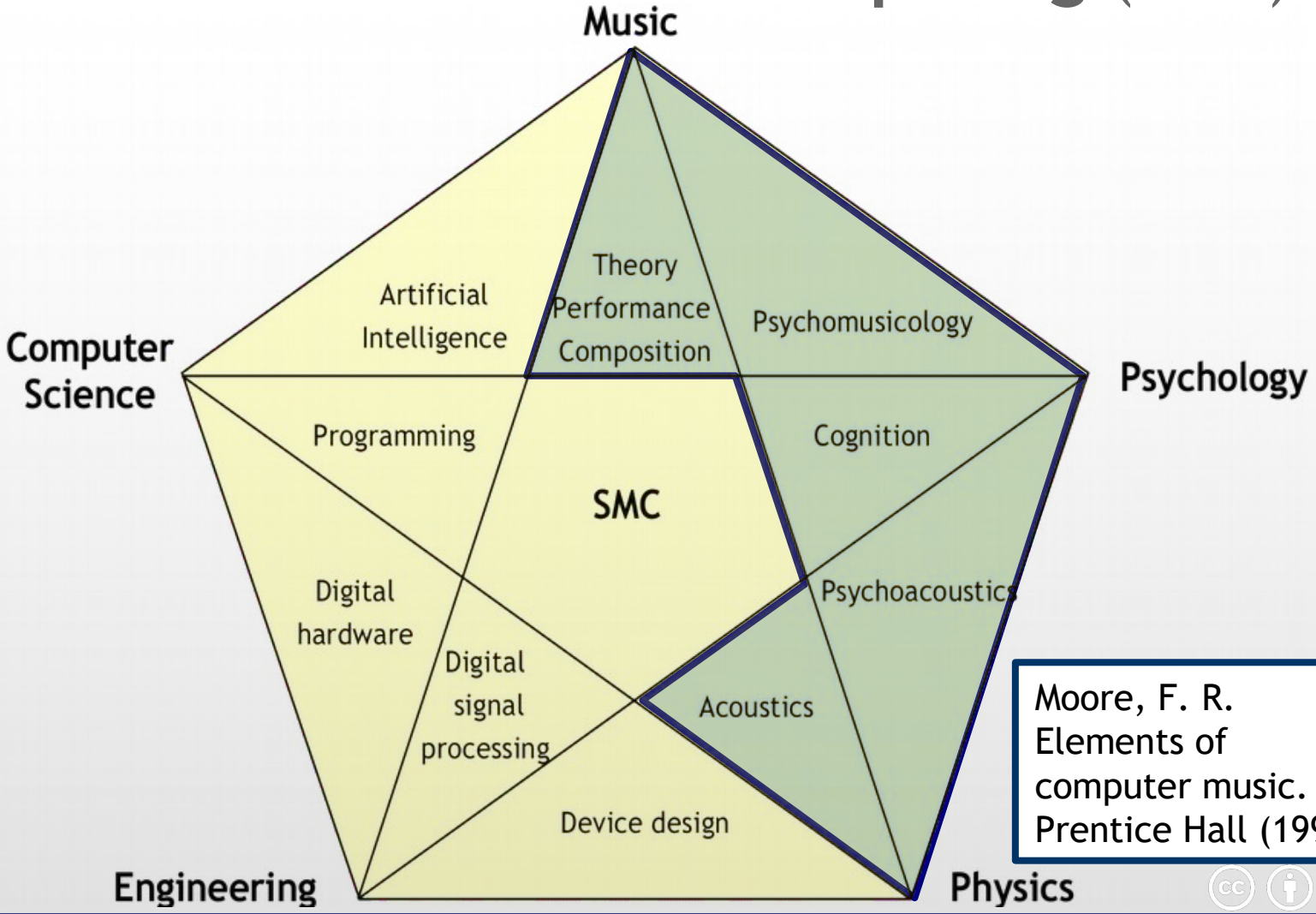

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Informatica Musicale

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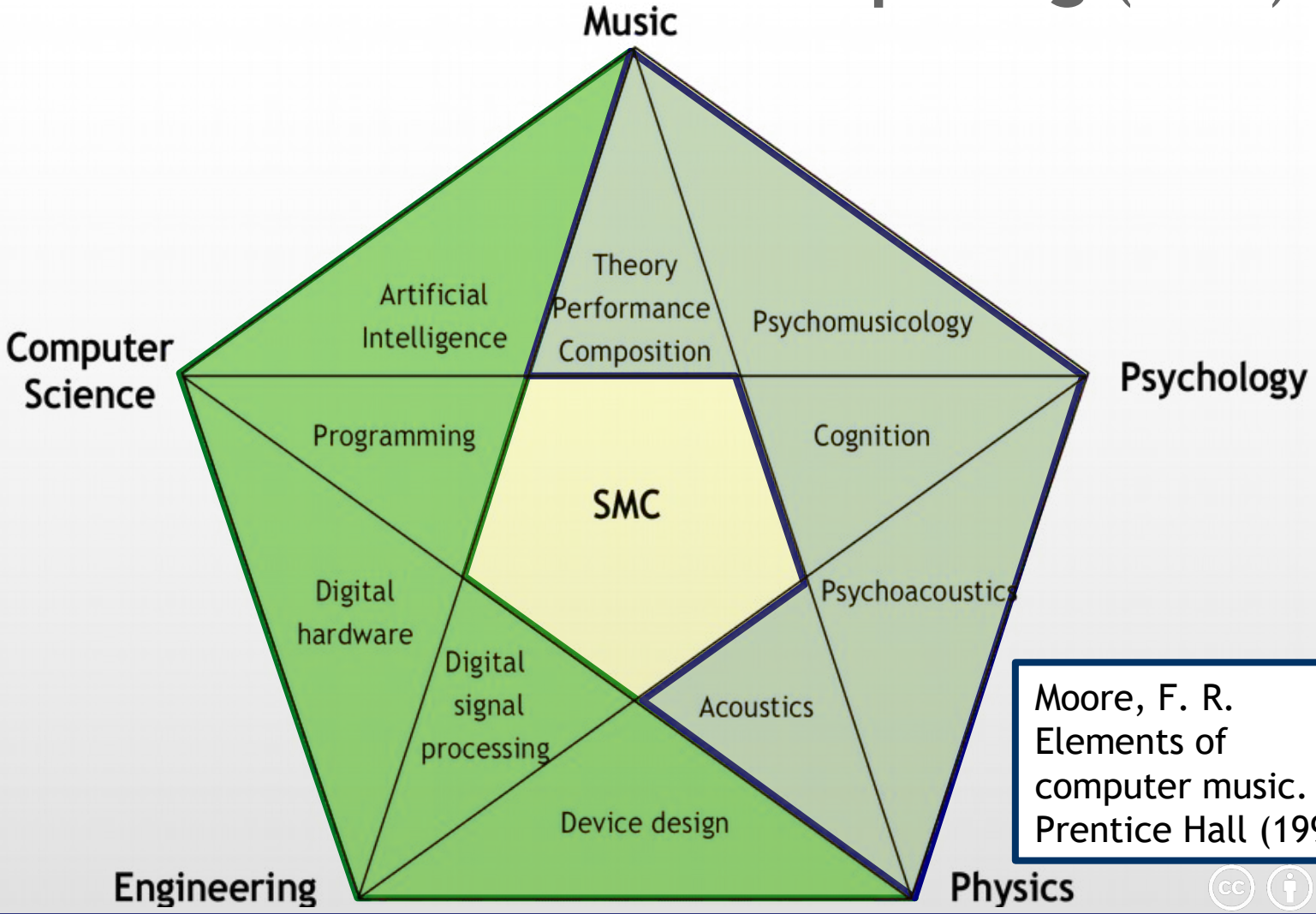

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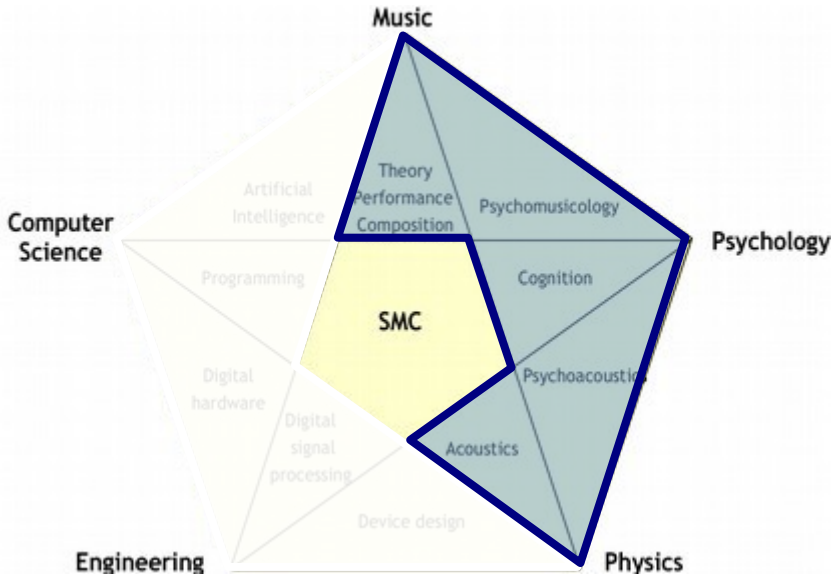
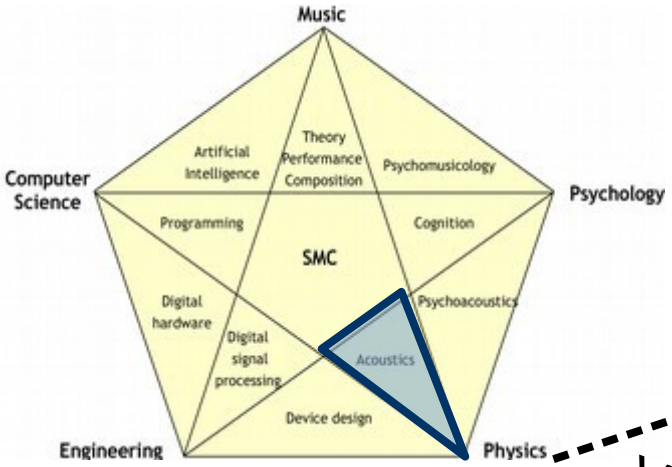
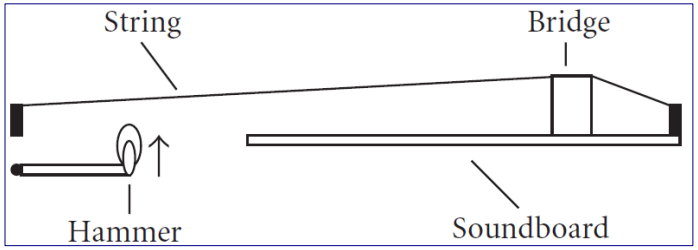
SMc

Sound and Music …

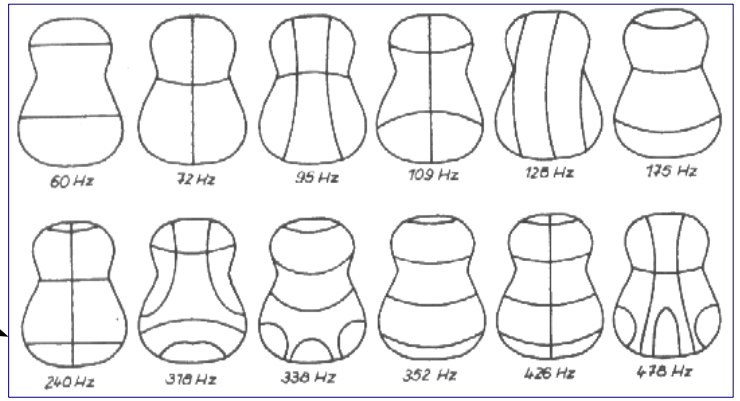




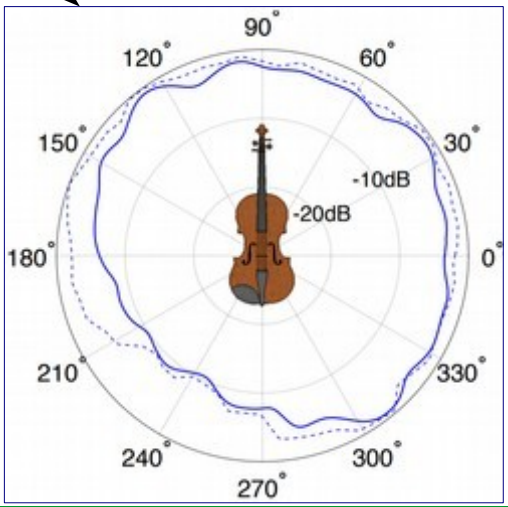
Produzione del suono



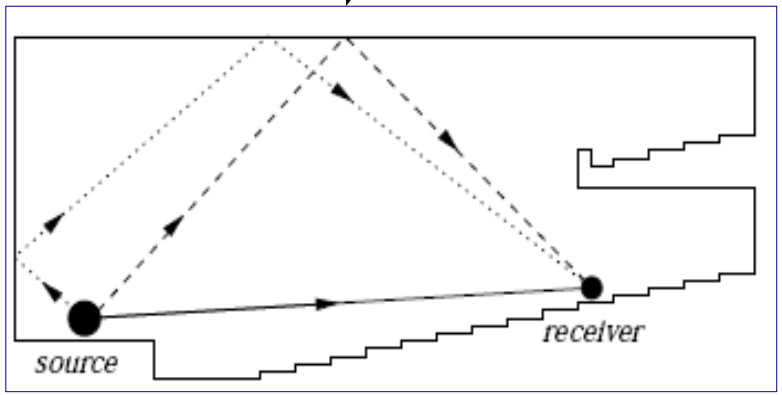
Vibrazioni e risonanze

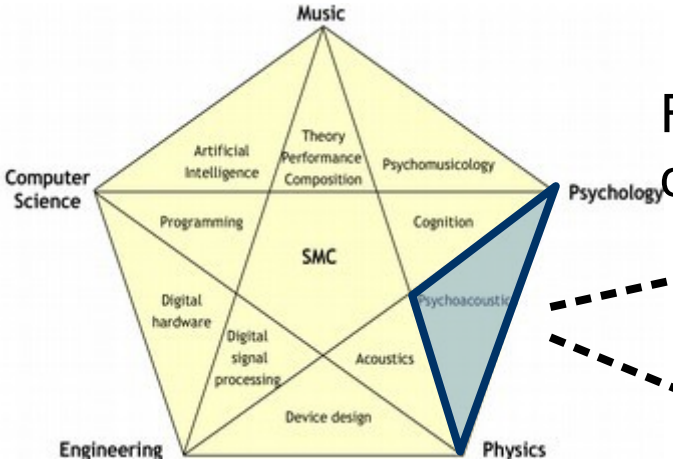


Radiazione

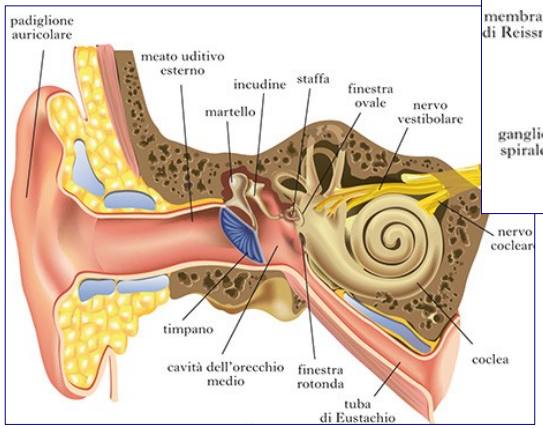


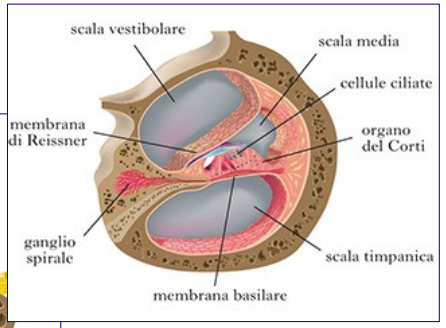
Trasmissione del suono e ambienti





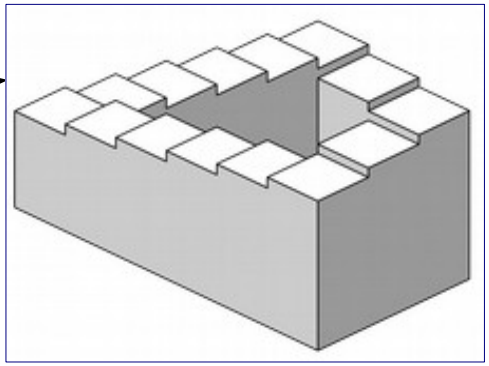
Fisiologia dell'orecchio



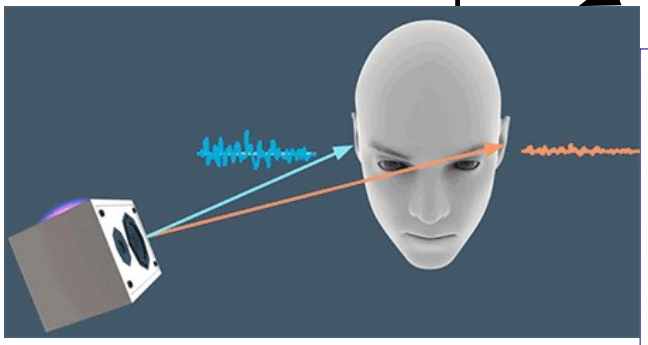


Percezione di attributi del suono

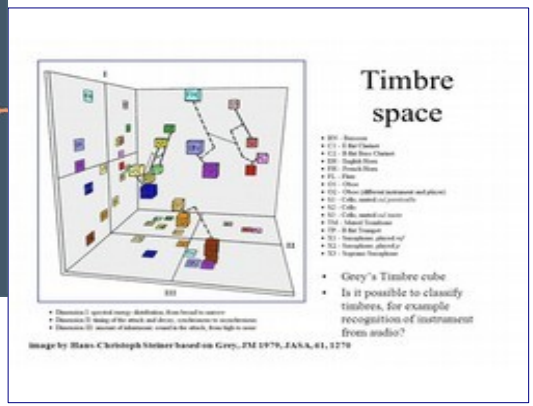
Altezza



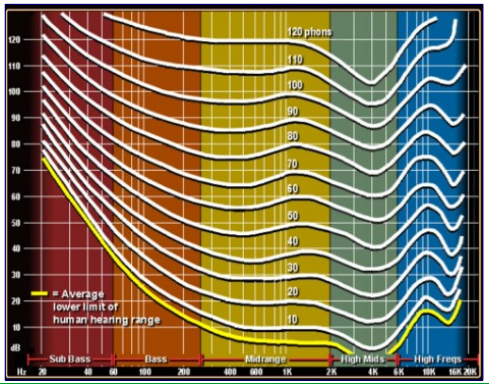
Spazio

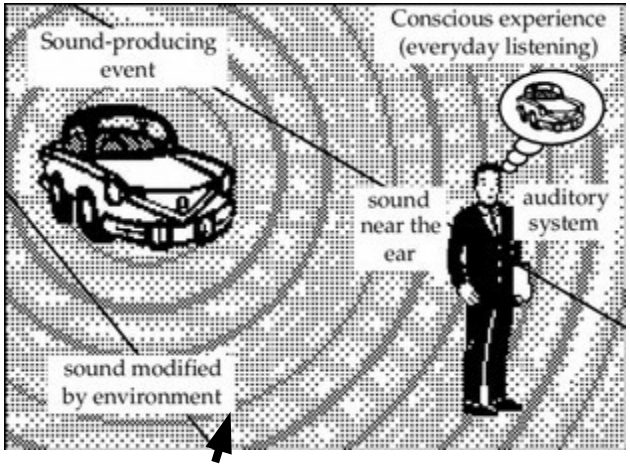


Timbro



Intensità

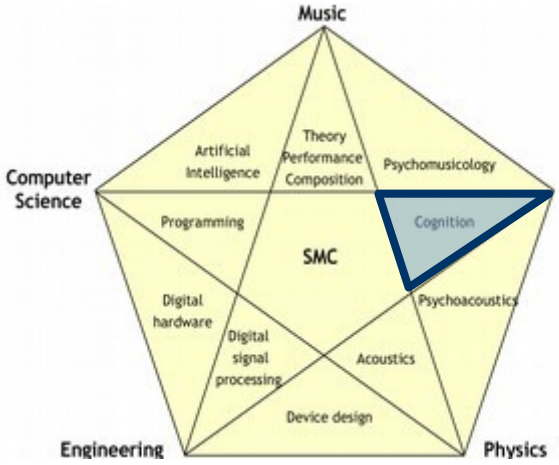




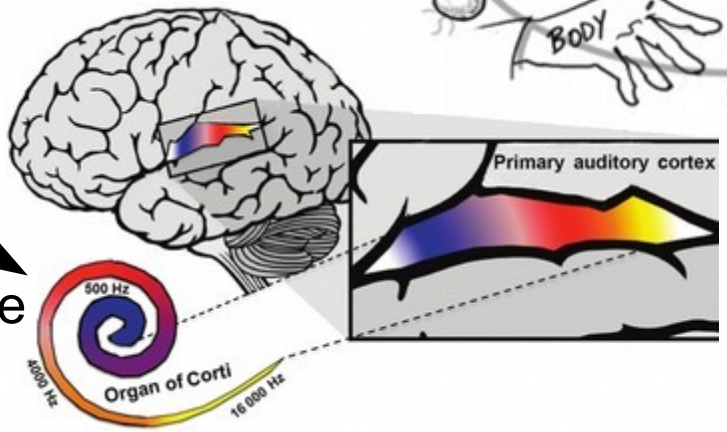
Acustica ecologica

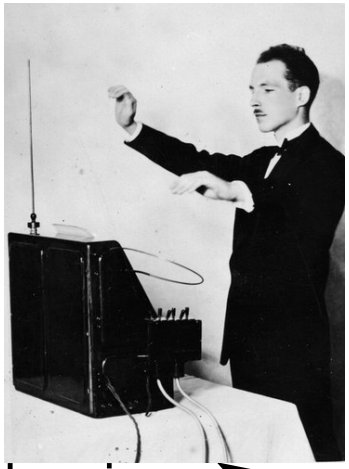
Analisi della scena uditiva

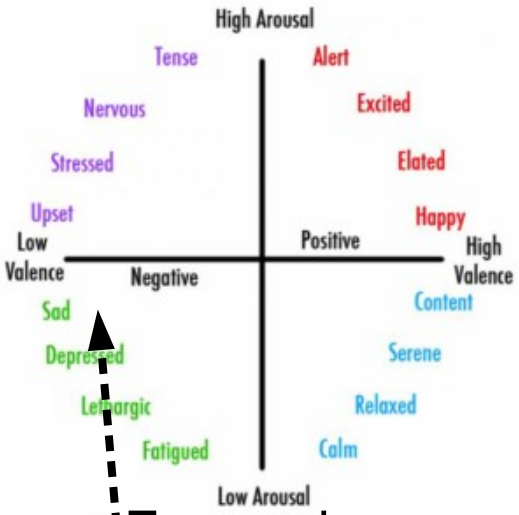
Cognizione “embodied”

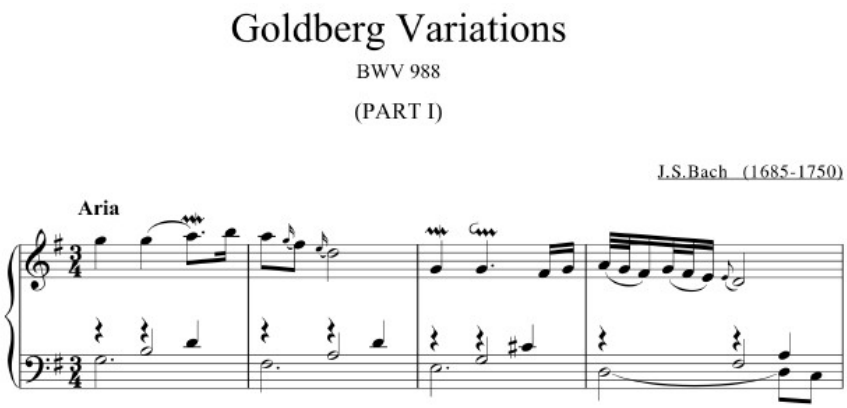


Neuroscienze uditive









Nuovi strumenti

Espressione ed emozioni

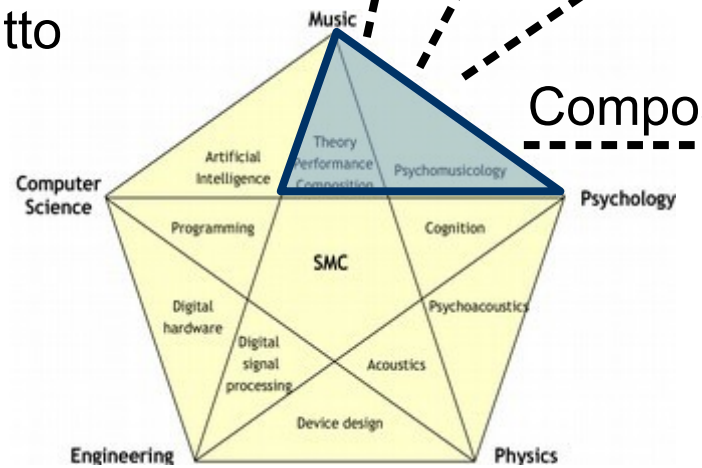
Performance

Teoria, armonia, notazione, …

Musica concreta

Storia
Economia
Diritto
…

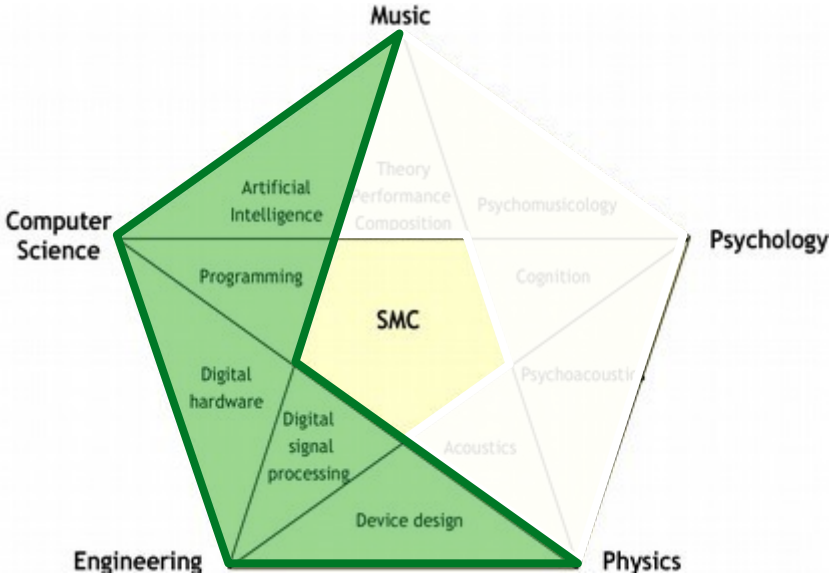
Composizione



Musica formalizzata

smC

… Computing

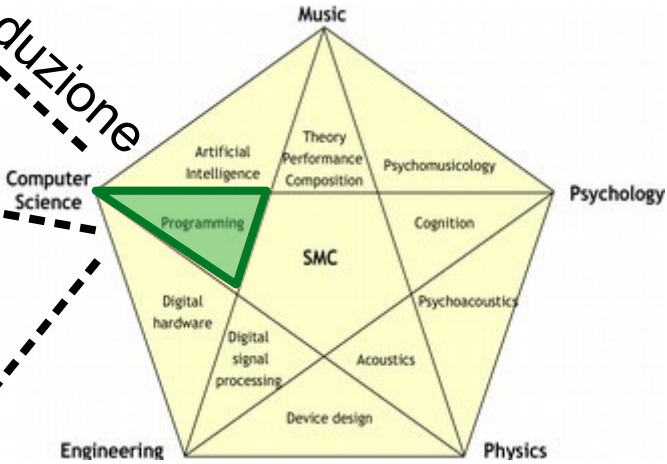


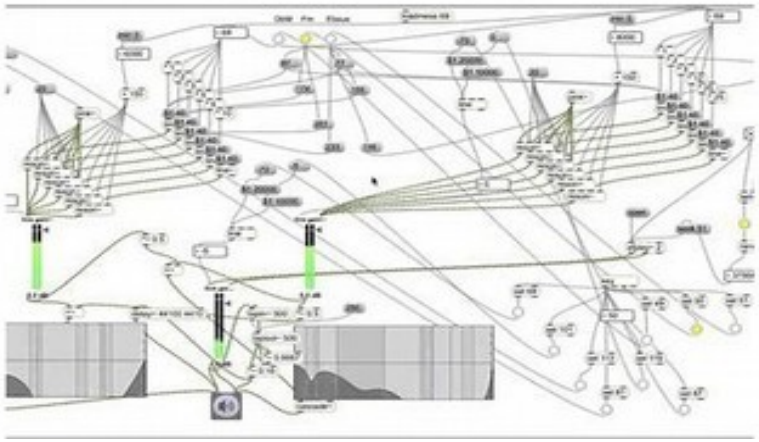
Plugin audio

Digital Audio Workstation (DAW)

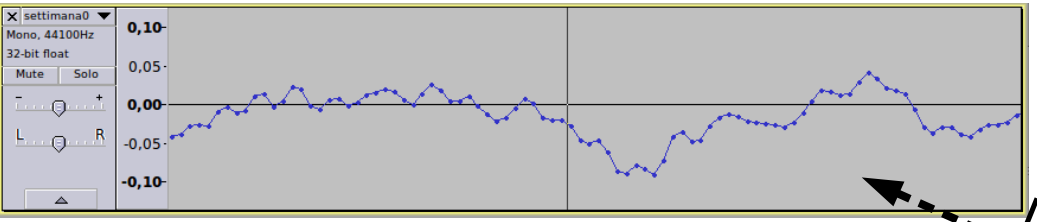
Produzione

Notazione

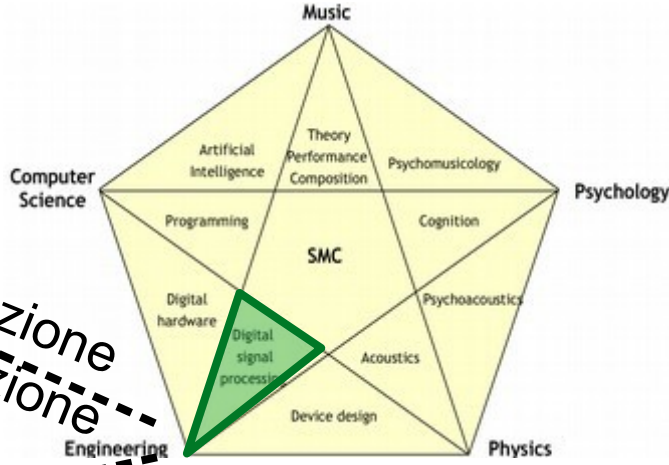


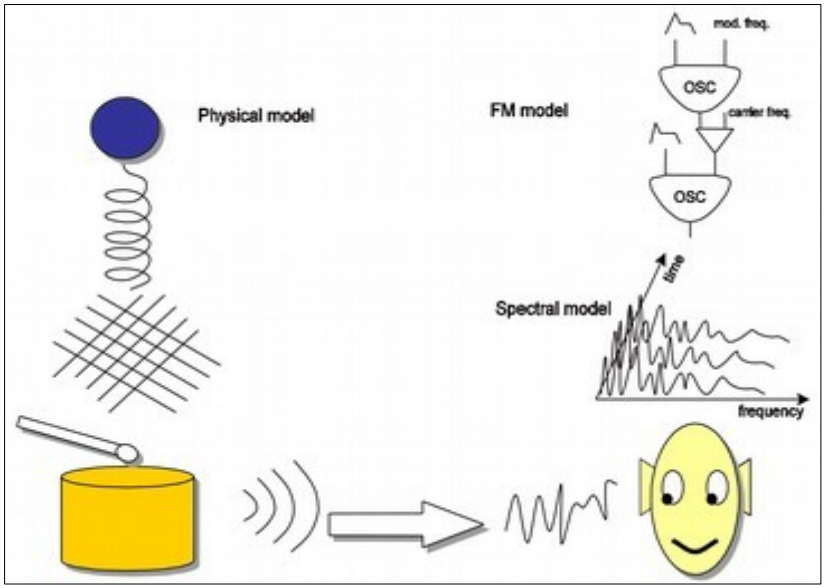


Composizione



Digitalizzazione ed elaborazione

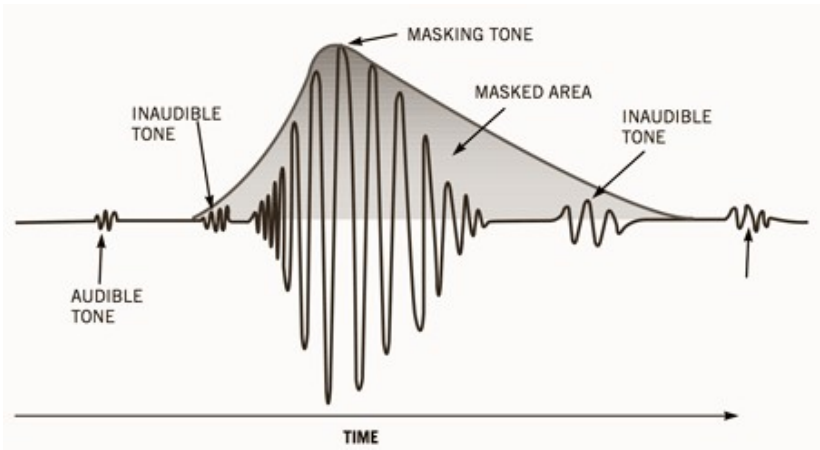




Sintesi ed effetti

Audio 3D

Modelli uditivi e codifica percettiva

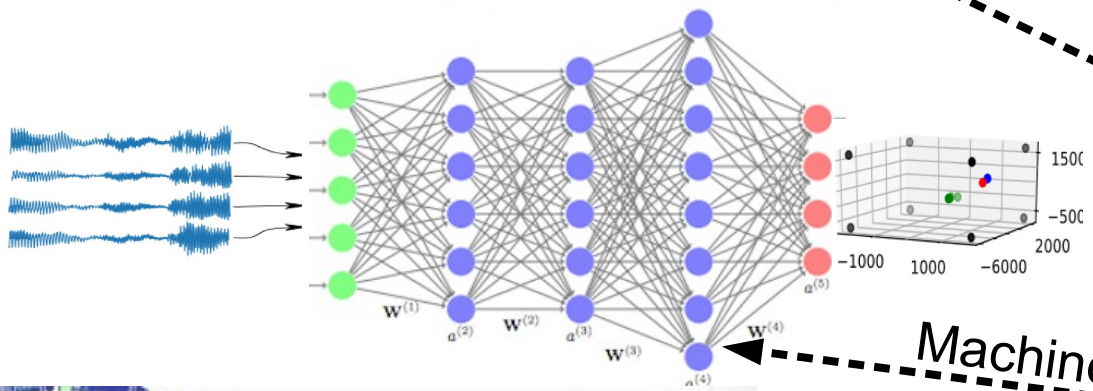


Brani

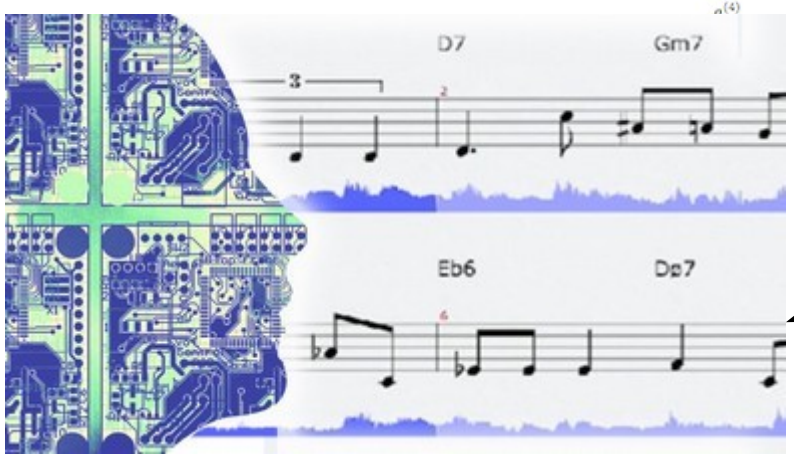
Accordi

Ecc.

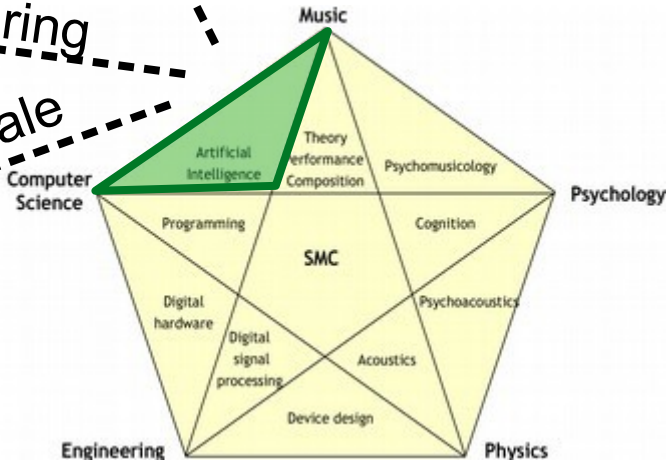
Music Information retrieval

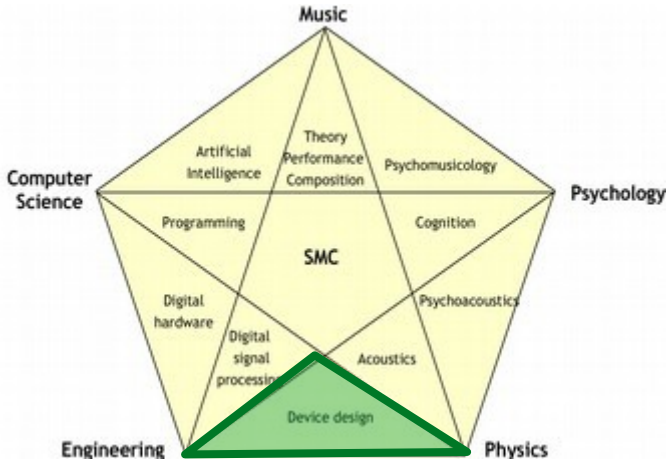


Machine hearing



Generazione artificiale di suono e musica



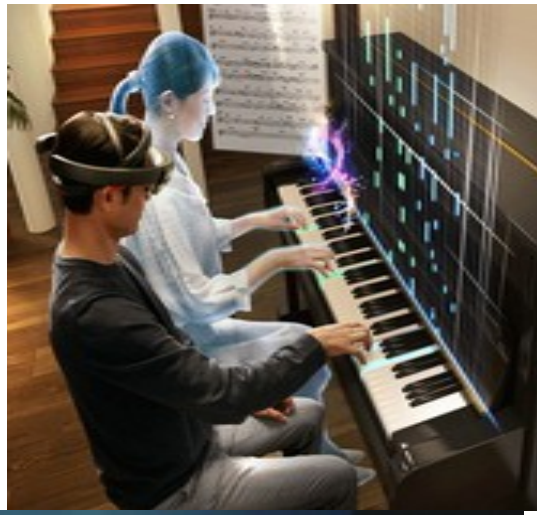


Human-Computer Interaction

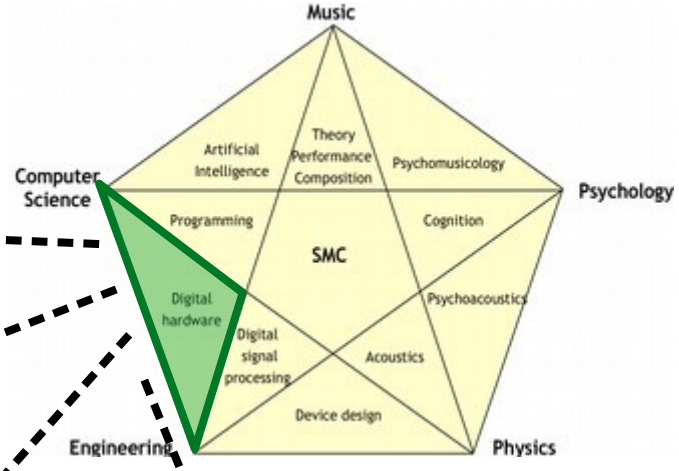
Strumenti digitali e aumentati

Sonic interaction design

Realtà virtuale e aumentata



Riproduzione



Cattura

Sensori e attuatori

Conversione

Struttura (anno.semestre)

Lingua inglese livello B1 (I.1)	Informatica applicata al suono (II.1)
Matematica del continuo (I.1)	Sistemi operativi (II.1)
Programmazione (I.1)	Informatica applicata alla musica (II.2)
Semiotica della musica (I.1)	Statistica e analisi dei dati (II.2)
Acustica (I.2)	Elementi di diritto dell'informazione musicale (III.1)
Architettura degli elaboratori (I.2)	Metodologie e tecnologie per l'editoria musicale (III.1)
Elementi di economia dei beni musicali (I.2)	Programmazione per il web (III.1)
Modelli della percezione musicale (I.2)	Reti di calcolatori (III.1)
Algoritmi e strutture dati (II.1)	A scelta guidata (III)
Basi di dati (II.1)	A scelta libera (III)
Elaborazione dei segnali (II.1)	Tirocinio e prova finale

Area Informatica
Area matematica e fisica
Area informatico-musicale
Area musicale

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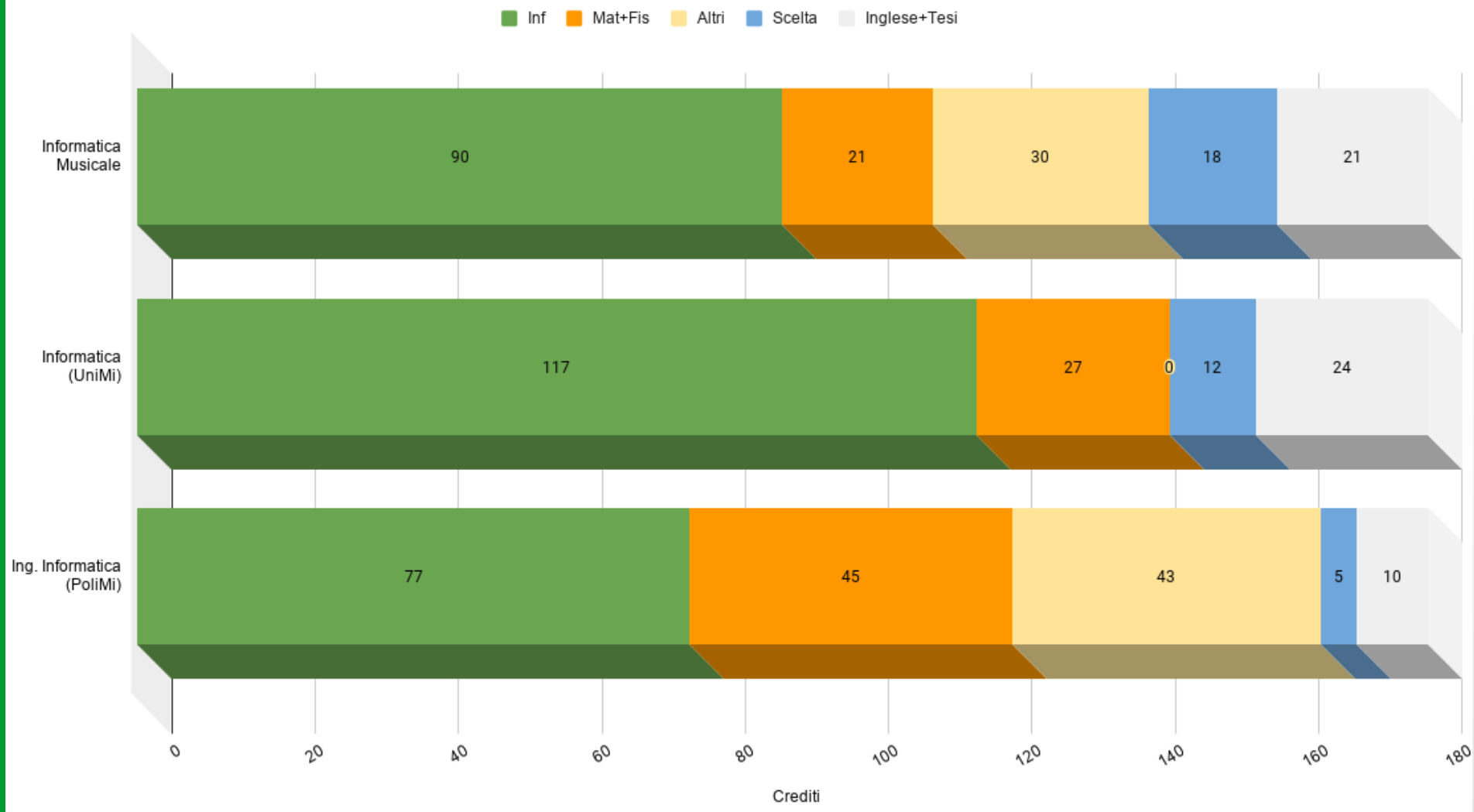
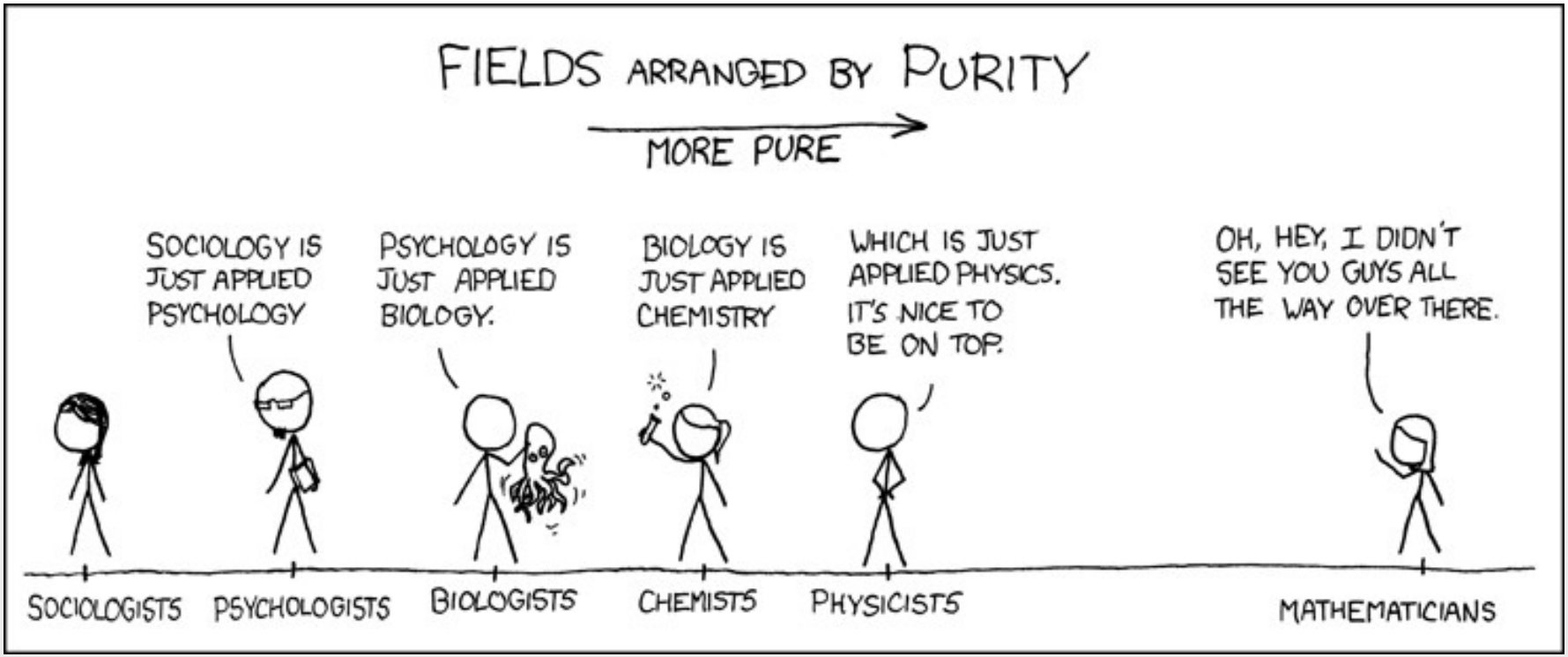
Confronto con altri CdL



“Why is math important?”



“Why is math important?”

- Voi: voglio programmare plugin VST
  - “Matematica del Continuo” non mi serve
- Io: … Really?
  - Lezione di programmazione plugin VST:

Prelude: filter phase-response

- Frequency response *H*:

$$Y\left(e^{j\omega_d}\right) = H\left(e^{j\omega_d}\right) X\left(e^{j\omega_d}\right)$$

- Magnitude response: $\left|H\left(e^{j\omega_d}\right)\right|$
  - Multiplies input magnitude
- Phase response: $\arg\left[H\left(e^{j\omega_d}\right)\right]$
  - Added to input phase
- Example: sinusoidal input

with d_0 defined as $d_0 := -\arg[H] / \omega_0$

$$x[n] = A\cos(\omega_0 n)$$
$$y[n] = (h * x)[n] =$$
$$= A\left|H\left(e^{j\omega_0}\right)\right| \cdot \cos\left(\omega_0 n + \arg\left[H\left(e^{j\omega_0}\right)\right]\right)$$

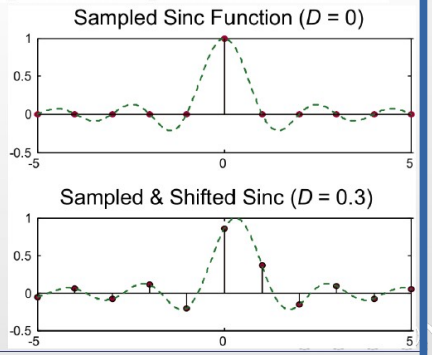
$\omega_0 (n - d_0)$

Ideal fractional-delay filter

- It’s an allpass with linear phase response
  - $H_{id}(\omega) = e^{-jD\omega}$
  - Then impulse response is a sampled sinc:

$$h_{id}(n) = \frac{1}{2\pi}\int_{-\pi}^{\pi} e^{-jD\omega} e^{j\omega n} d\omega = \frac{\sin[\pi(n-D)]}{[\pi(n-D)]} = \mathrm{sinc}(n-D)$$

- D integer
  - Sampled at zero-crossings: impulse!
- D fractional
  - Sampled between zero-crossings: IIR, non causal response



Attività complementari

- Ciclo di seminari su Cubase (24 ore)
  - 3CFU in piano di studi + Certificazione Steinberg

Attività complementari

UNIVERSITÀ DEGLI STUDI DI MILANO

Conservatorio di Milano

CONVENZIONE PER ATTIVITÀ DI COLLABORAZIONE SCIENTIFICA E DIDATTICA

- Accesso a insegnamenti del Conservatorio di Milano, e riconoscimento dei relativi crediti
  - Informatica musicale e Musica digitale
  - Informatica Musicale
  - Campionamento, sintesi ed elaborazione digitale dei suoni
  - Sistemi e linguaggi di programmazione per l'audio e le applicazioni musicali (1 e 2)

Laurea e oltre

- Tesi interne o in tirocinio esterno
- Laureati in Informatica Musicale
  - https://www.lim.di.unimi.it/people_former_students_ita.php
- Dati occupazione Almalaurea
  - https://www.almalaurea.it/universita/indagini/laureati/occupazione
- Corso di Laurea Magistrale in Informatica
  - Percorso in Informatica Musicale
- Dottorato in Informatica
  - Progetti di ricerca in Informatica Musicale

Link utili

- Sito del CdL
  - https://informaticamusicale.cdl.unimi.it
  - Orari, programmi, piani di studio, tesi, messaggi
- Siti degli insegnamenti
  - Su https://ariel.unimi.it/
  - Libri di testo, slide, videolezioni, comunicazioni, …
- Tutor di processo: manuele.dentello@studenti.unimi.it
  - https://orientamento.di.unimi.it/index.php/contatti/tutor-di-processo
  - Supporto a matricole
- Network studenti
  - https://studentiunimi.it/
  - Gruppi insegnamenti/CdL, servizi vari

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Bootstrap day 2022-2023

Presentazione CdL Informatica Musicale

Federico Avanzini