



1.0

Game Engines

► >
► >
► > IL videogioco è la declinazione
► > moderna del gioco.
► >
► >
► > IL gioco viene fruito
► > attraverso uno SCHERMO.■

Il concetto di gioco

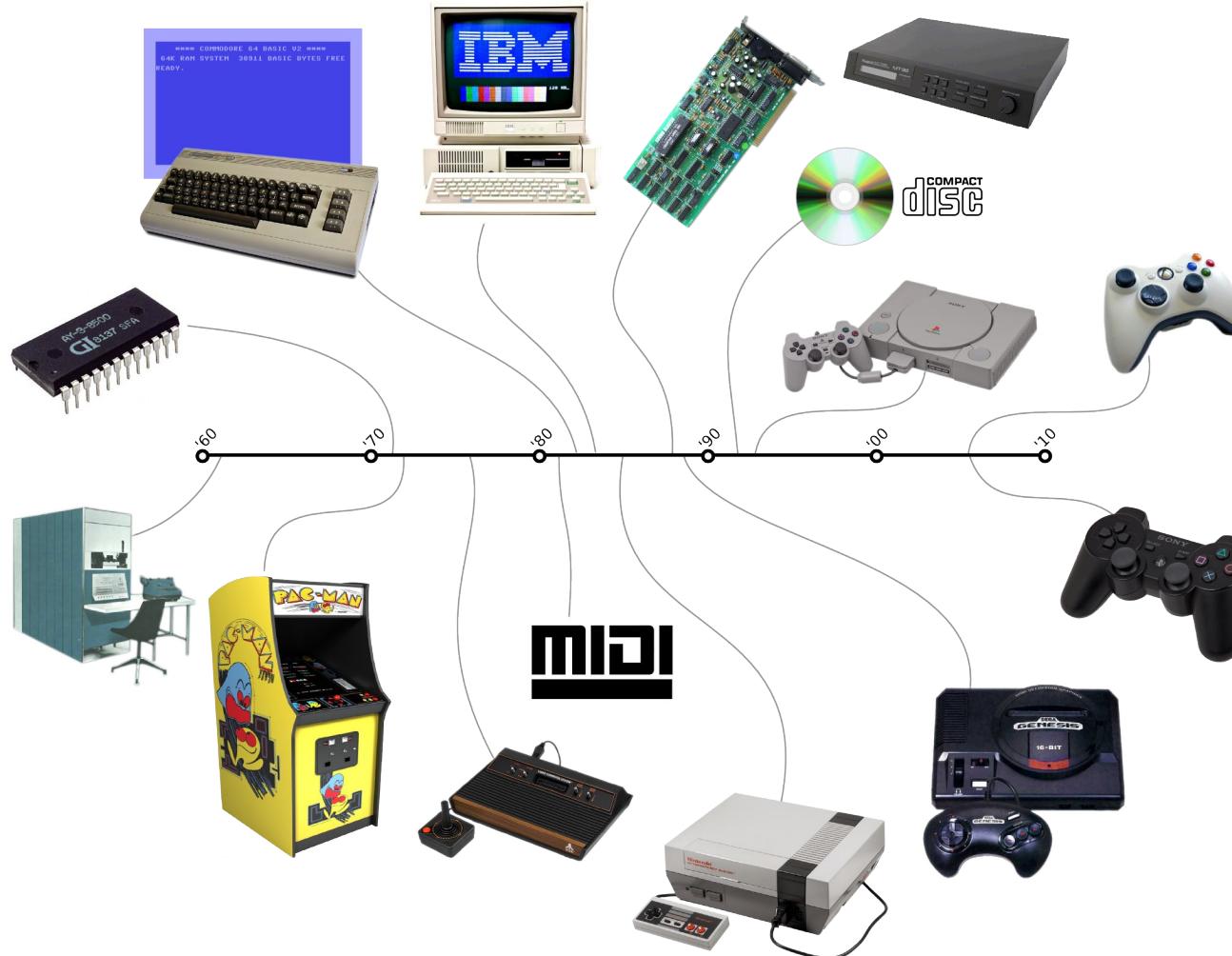
Narrazione guidata da **scelte** che uno o più **giocatori** compiono in conformità a un insieme di **regole** che limitano il campo d'azione

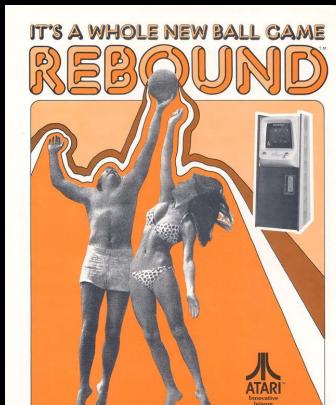
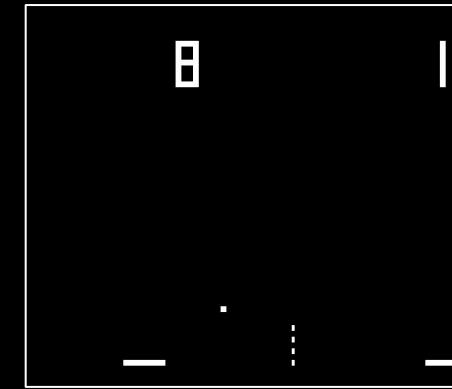
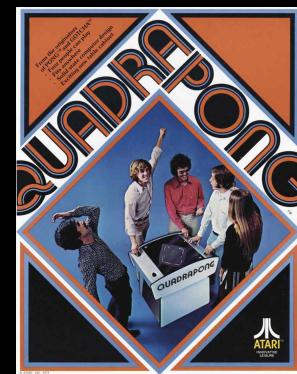
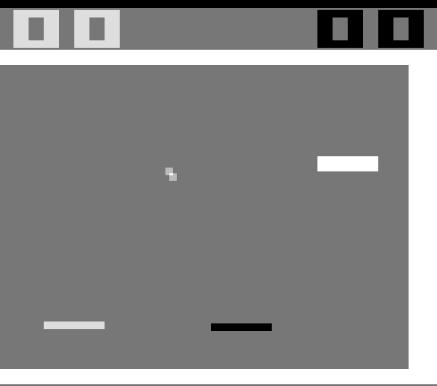
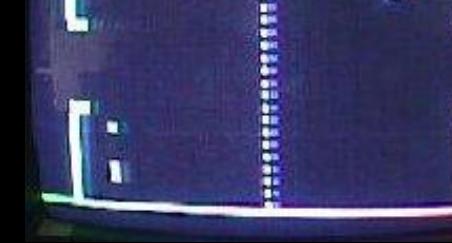
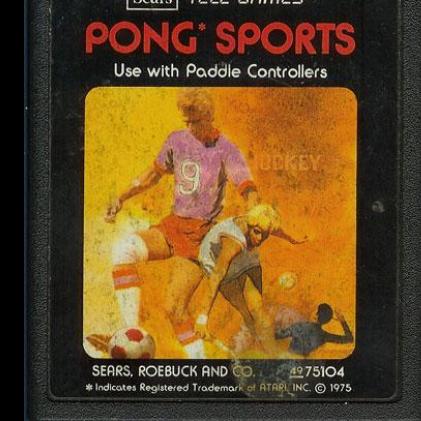
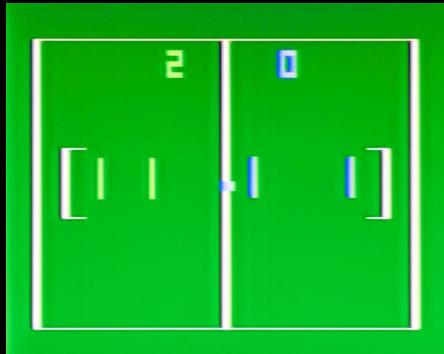
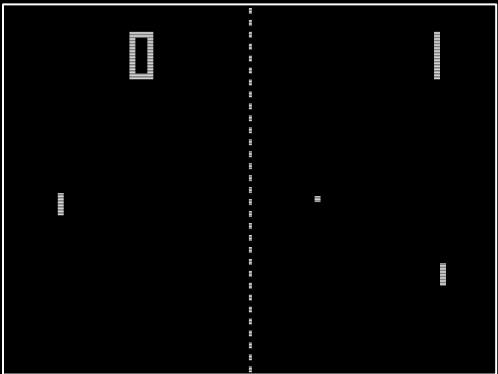
- Intrattenimento (non solo)
- Interattività

Nel videogioco in particolare

- Multimedialità









SOMEWHERE NEARBY IS COLOSSAL CAVE, WHERE OTHERS HAVE FOUND FORTUNES IN TREASURE AND GOLD, THOUGH IT IS RUMORED THAT SOME WHO ENTER ARE NEVER SEEN AGAIN.
LOAD GAME? NO
BEFORE A SMALL BRICK BUILDING SURROUNDED BY FOREST. A STREAM FLOWS OUT OF THE BUILDING AND DOWN A GULLY
OBVIOUS EXITS: N, S, E, W, D
?

DETECTIVELAND

Cases solved: 0/4 \$10.00

Another working day begins for Lanson Rose, private investigator. I got three clients waiting outside my office, and beyond that, a town full of creeps, clowns, mobsters and, if you know where to look, the occasional honest citizen. When trouble is your business, you're rarely short of work in New Losago.

DETECTIVELAND, by Robin Johnson
For instructions, touch:

instructions

I'm in my office.

> out

Ok

I'm in a dimly lit office building.

> talk to dame

"Step into my office, Miss..."
"Mrs Macdonald," she says

save game restore game

restart game undo

options credits hints

Talking to: Mrs Macdonald
Ask about:

husband

home

another woman

money

end conversation



I'm in my office.

Exits: out

I can also see:

- Mrs Macdonald talk

- door reading "EVITCETED ETAVIRP"

- filing cabinet open

- bookcase

- book titled "1001 Detectiving

Tips" (on bookcase) take

wait

I'm carrying: money (\$10.00)



"I'm outta here. Try not to sell out the store while I'm gone."





2 damage
Thief attacks! Hit!
16 damage
>Y

Hits: 46
Food: 64
Exp.: 1229
Coin: 87

Character Record, Kane Tensen

	Human, Neutral Evil	
Fighter (7)		
Blackguard (1)		
Strength	19	4
Dexterity	13	1
Constitution	17	3
Intelligence	8	-1
Wisdom	8	-1
Charisma	10	0
AC	26	
HP	95/89	
	Experience: 29421	
	Next Level: 36000	

Main Weapon: Desert's Fury
Attack bonus: +14/+9
+14/+9 vs. Undead
Damage: 1-8 + 4 (Critical: 20 / x2)
+1d8 Fire Damage vs. Undead
+1 Bludgeoning Damage
+2 Bludgeoning Damage vs. Undead

Equipped item swapped out.
Armor/Shield Applied: Skill Armor Check Penalty: -10 Arcane Spell Failure: 50%
Armor/Shield Applied: Skill Armor Check Penalty: -10 Arcane Spell Failure: 95%
Equipped item swapped out.

Talk:

GAMESPOT

LAP INFO LAP 0 OF 10 LEAD LAP
LAST 0:00.00 0.00 MPH
-0:00.0 POS 33





Quando si utilizzano i game engines?

Fase di produzione/sviluppo

Semplificazione del lavoro in team

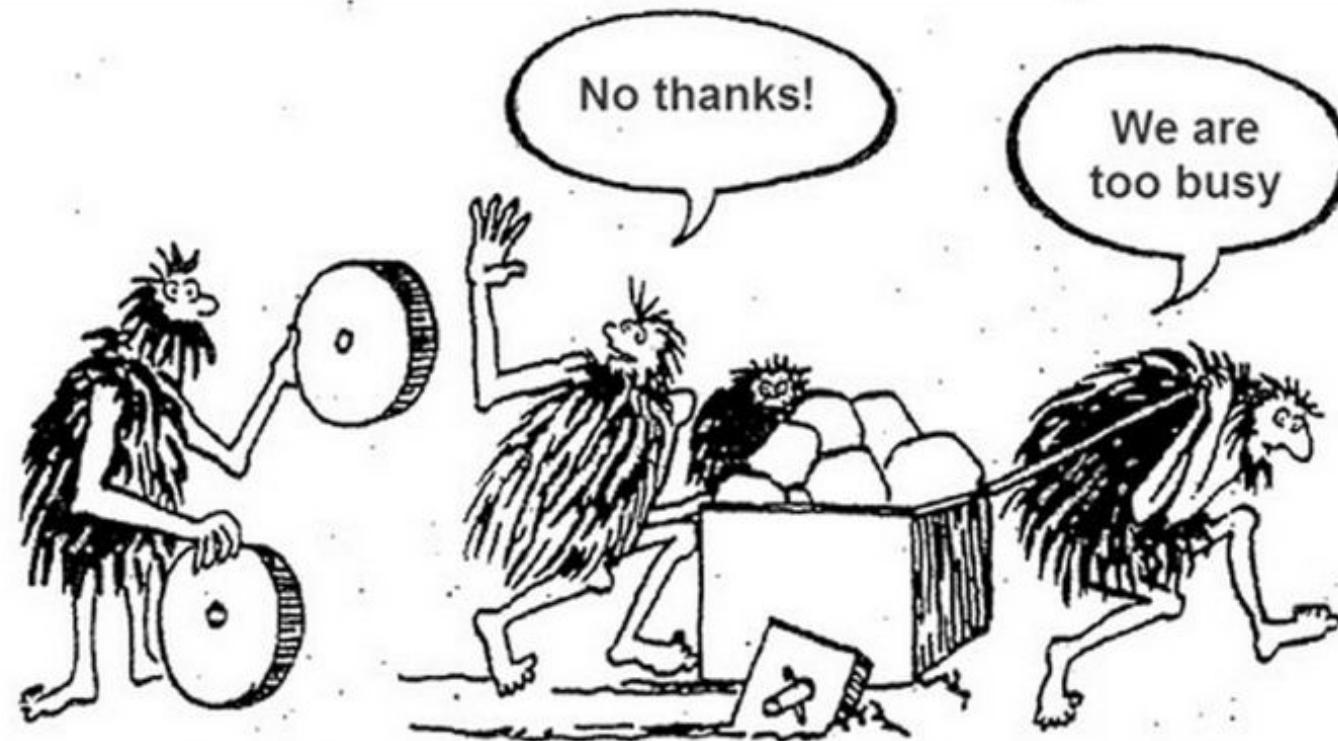
Astrazione da tecnicismi eccessivi

Lavoro ottimizzato per i programmatori

Perchè si utilizzano?

mettiamoci nei panni di....





Evoluzione storica del motore di gioco

Da strumenti software a tool grafici di sviluppo.



SCUMM engine (1987)



AGI a SCI di Sierra On-line (1984)



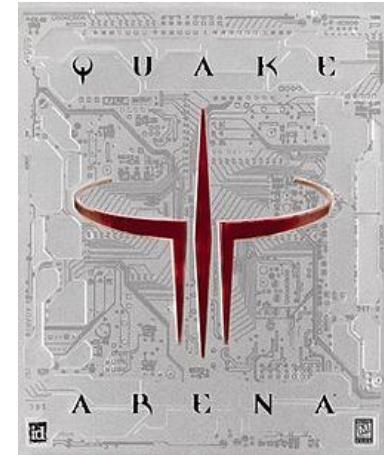
Z-machine di Infocom (1979)

Game engine di moderna concezione?

Unreal (Epic Games)



Doom / Quake (id Software)



Doom Engine - 1995

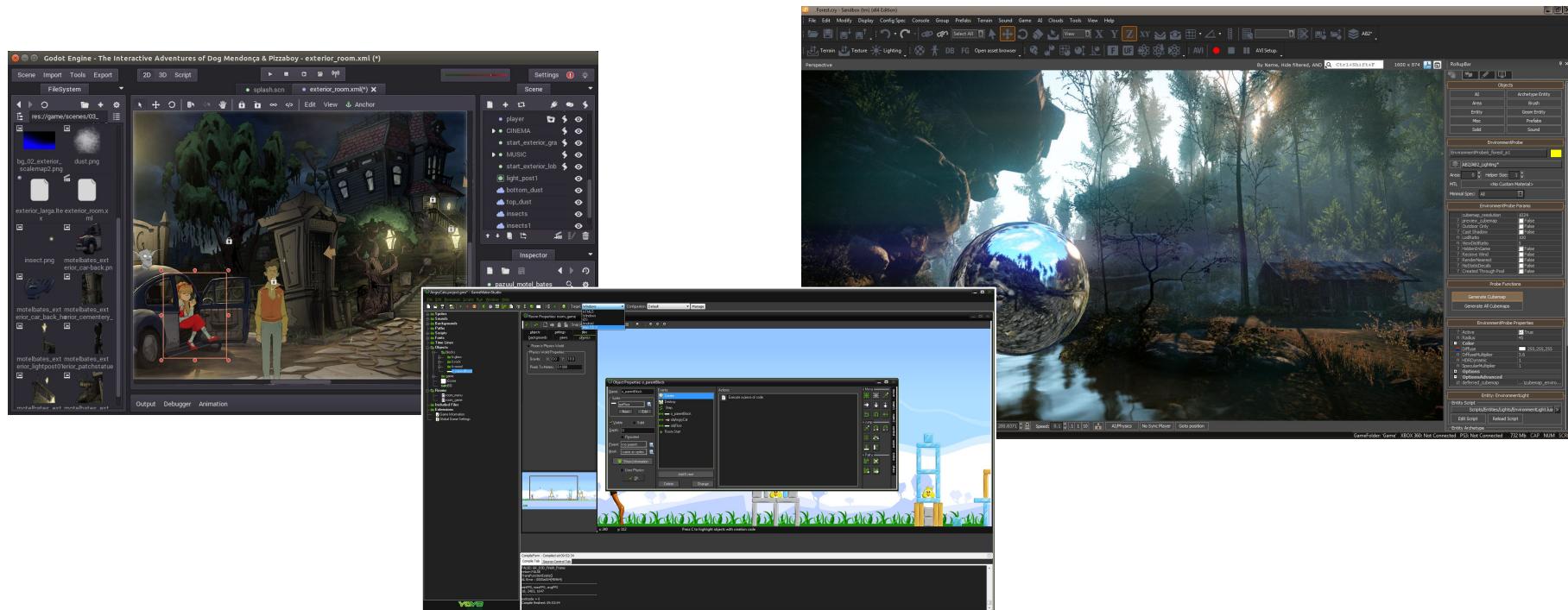
Unreal engine - 1998

idTech3 - 1999

DOOM

In cosa differiscono dai precedenti?

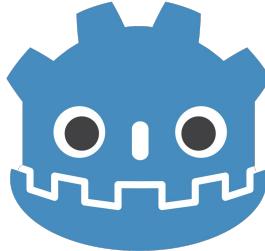
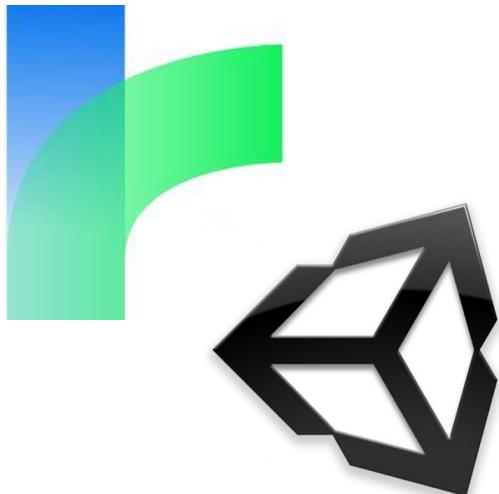
IDE (Integrated Development Environment): interfaccia grafica di sviluppo



Un game engine per ogni tipo di gioco



CRYENGINE®



Middleware





Large Scale Destruction



XBOX 360



XBOX LIVE

ESRB

18+

www.zpg.it

XBOX 360

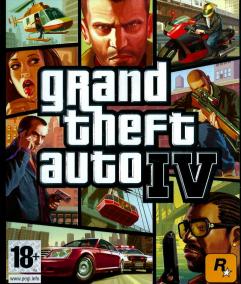
LIVE

ESRB

18+

www.zpg.it

R



XBOX 360

ESRB

18+

www.zpg.it

Microsoft Studios

ESRB

18+

www.zpg.it



XBOX 360

XBOX LIVE

ESRB

12+

www.zpg.it

Corporazione di calibrazione

Version Repubblica Italiana

Gruppo Activision

ACTIVISION

ESRB

12+

www.zpg.it

Corporazione di calibrazione

Version Repubblica Italiana

Gruppo Activision

ACTIVISION

ESRB

12+

www.zpg.it



Tuttavia...

...i game engines sono uno strumento che velocizza e semplifica la fase di sviluppo, ma non si sostituiscono alla programmazione



Perché programmare?

1. linguaggio comune
2. nuova alfabetizzazione
3. tools creativi

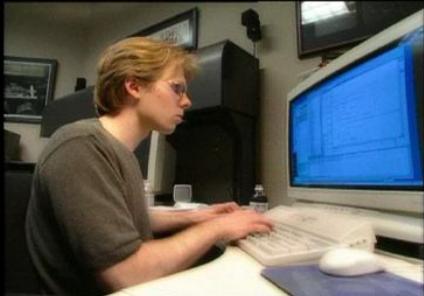


Panoramica sulla programmazione

COMPUTER PROGRAMMING



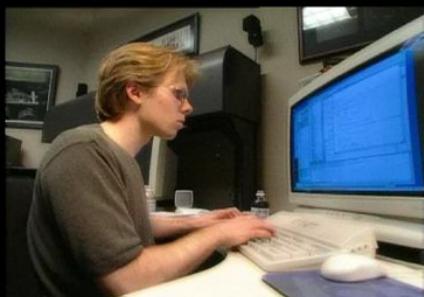
**What my Family
Thinks I Do**



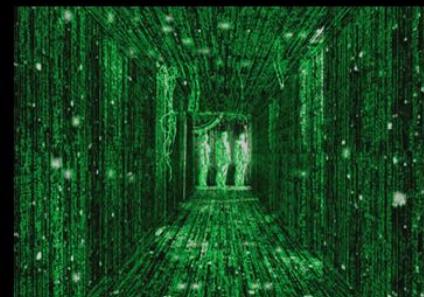
**What my Friends
Think I Do**



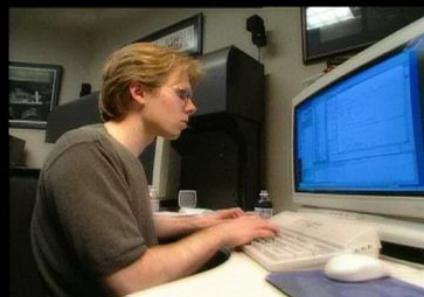
**What Society
Thinks I Do**



**What Hard Sciences
Majors Think I Do**



What I Think I Do



What I Actually Do

file binario

codice assembly

```

*-----*
*-----*
* P L A Y B A C K
*-----*
* Playback all sounds listed in sound table
*-----*
*-----*

PLAYBACK
    lda soundon
    beq :rts ;sound switched off?

    idx soundtable
    beq :rts ;sound table empty?

:loop lda soundtable,x

    stx savex

    jsr makesound ;make sound #A
;(may destroy registers)
    idx savex

    dex
    bne :loop

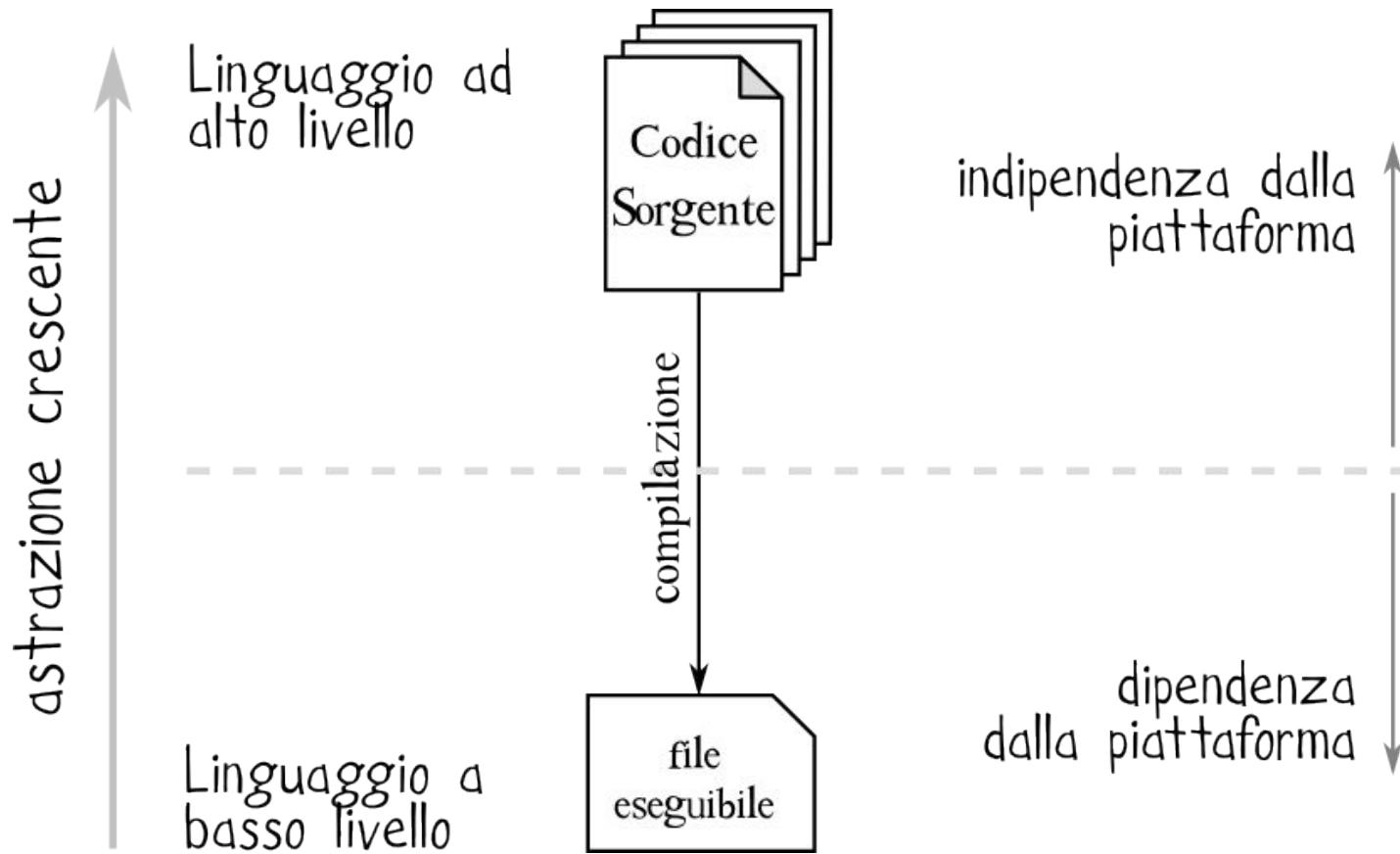
:rts rts

```

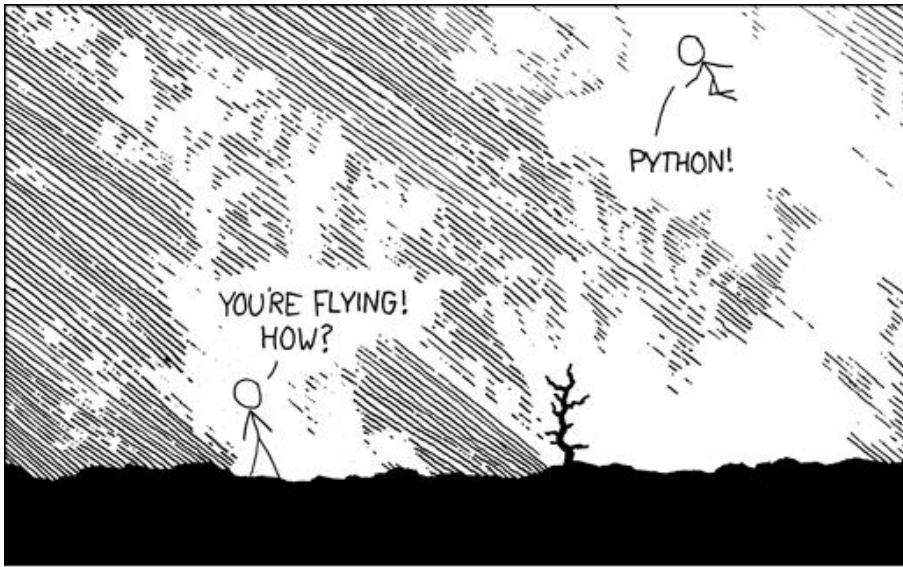


file in linguaggio C

```
1 #include "stdio.h"
2
3
4 int main() {
5
6     FILE *pToFile = fopen("text.txt", "r");
7
8     int line = 0;
9
10    char input[512];
11
12    while( fgets( input, 512, pToFile ) ) {
13        line++;
14        printf("Line:%d -> %s",line,
15    }
16
17    return 0;
18
19
20 }
```



Linguaggio di scripting

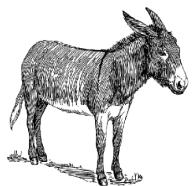


I LEARNED IT LAST NIGHT! EVERYTHING IS SO SIMPLE!
HELLO WORLD IS JUST
print "Hello, world!"

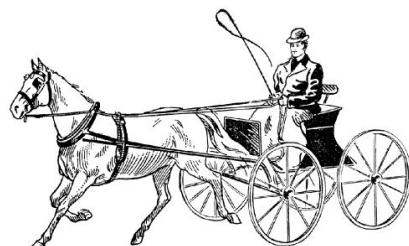
I DUNNO...
DYNAMIC TYPING?
WHITE SPACE?
COME JOIN US!
PROGRAMMING IS FUN AGAIN!
IT'S A WHOLE NEW WORLD UP HERE!
BUT HOW ARE YOU FLYING?

I JUST TYPED
import antigravity
THAT'S IT?
... I ALSO SAMPLED
EVERYTHING IN THE
MEDICINE CABINET
FOR COMPARISON.
BUT I THINK THIS
IS THE PYTHON.

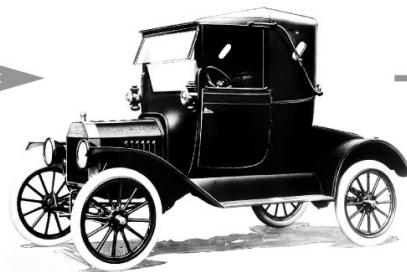
Binary



Assembly



Compiled
languages



Scripting

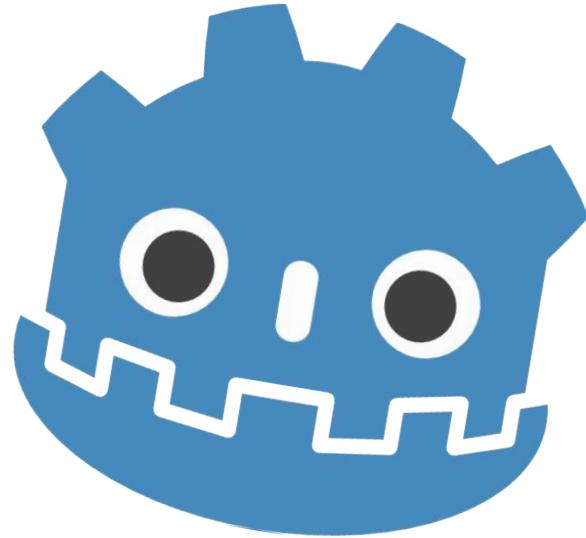


Game Engine: cosa c'è dentro?

- rendering engine (3D/2D)
- physics engine
- interprete del linguaggio di scripting
- AI engine
- animation tools
- sound engine
- memory management
- threading (physics engine e AI engine)
- supporto video (codec)
- GUI/UI
- particle systems



Godot





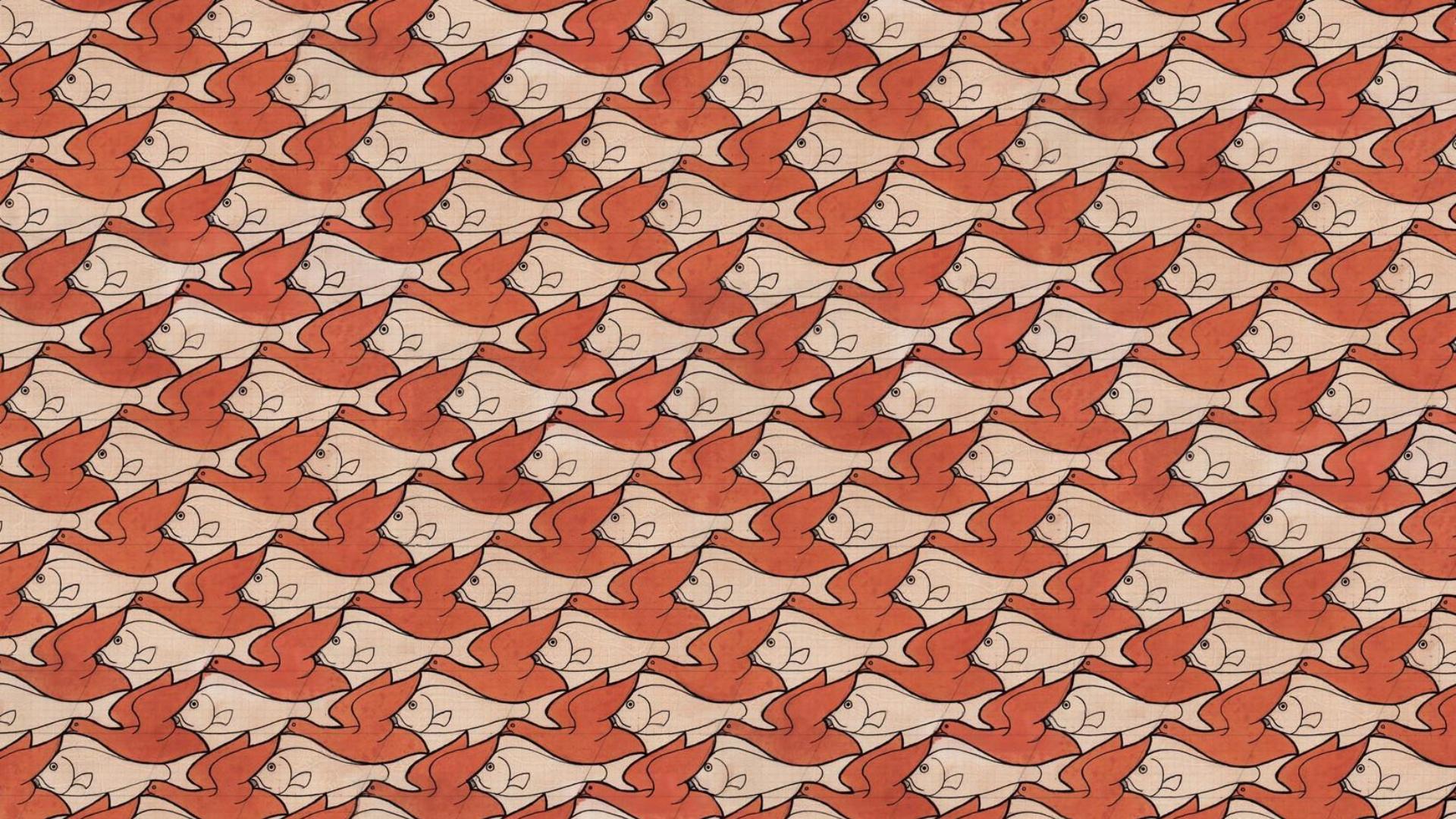
Global Illumination with Real-Time Lighting

Perchè Godot?

- **open source**: posso modificarlo come voglio e c'è una community che amplia e consolida la piattaforma;
- **multipiattaforma**: linux, Windows, Mac OS
- **2D e 3D**: parimenti sviluppato per entrambi i formati di gioco
- **leggero e veloce** non pesa sulla memoria del sistema operativo
- **GDScript** è mutuato su Python (Godot3 ha porting per Python): è un linguaggio molto usato (dalla computer vision alla AI, al NLP)
- **visual programming** (dalla versione 3)

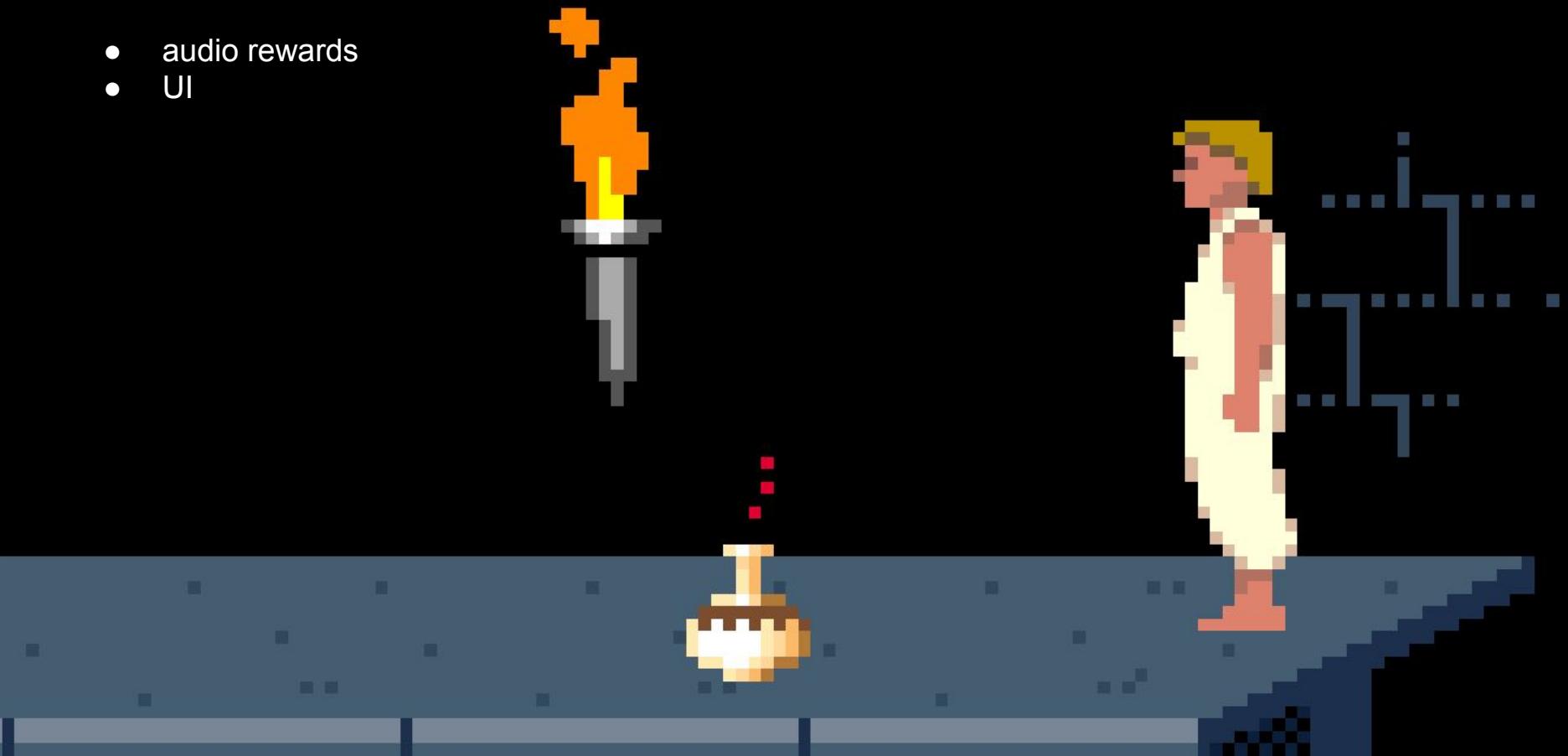
2.0





La ripetizione è un bene

- audio rewards
- UI



La ripetizione è un male

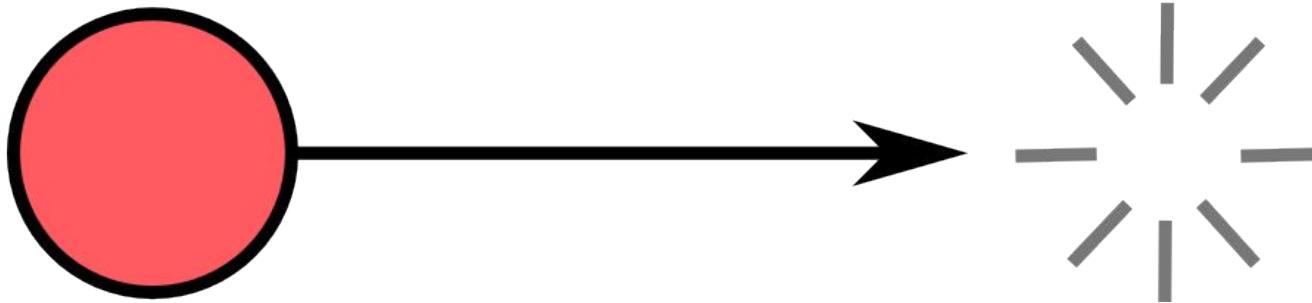
- dialoghi;
- fooley;
- fisica;
- suono senza corrispondenza visiva;



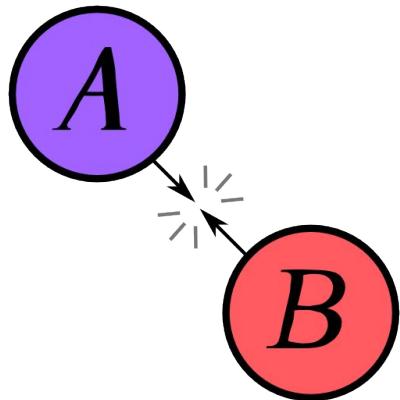
Che cos'è un evento?

event

sound



Crescita combinatoria:

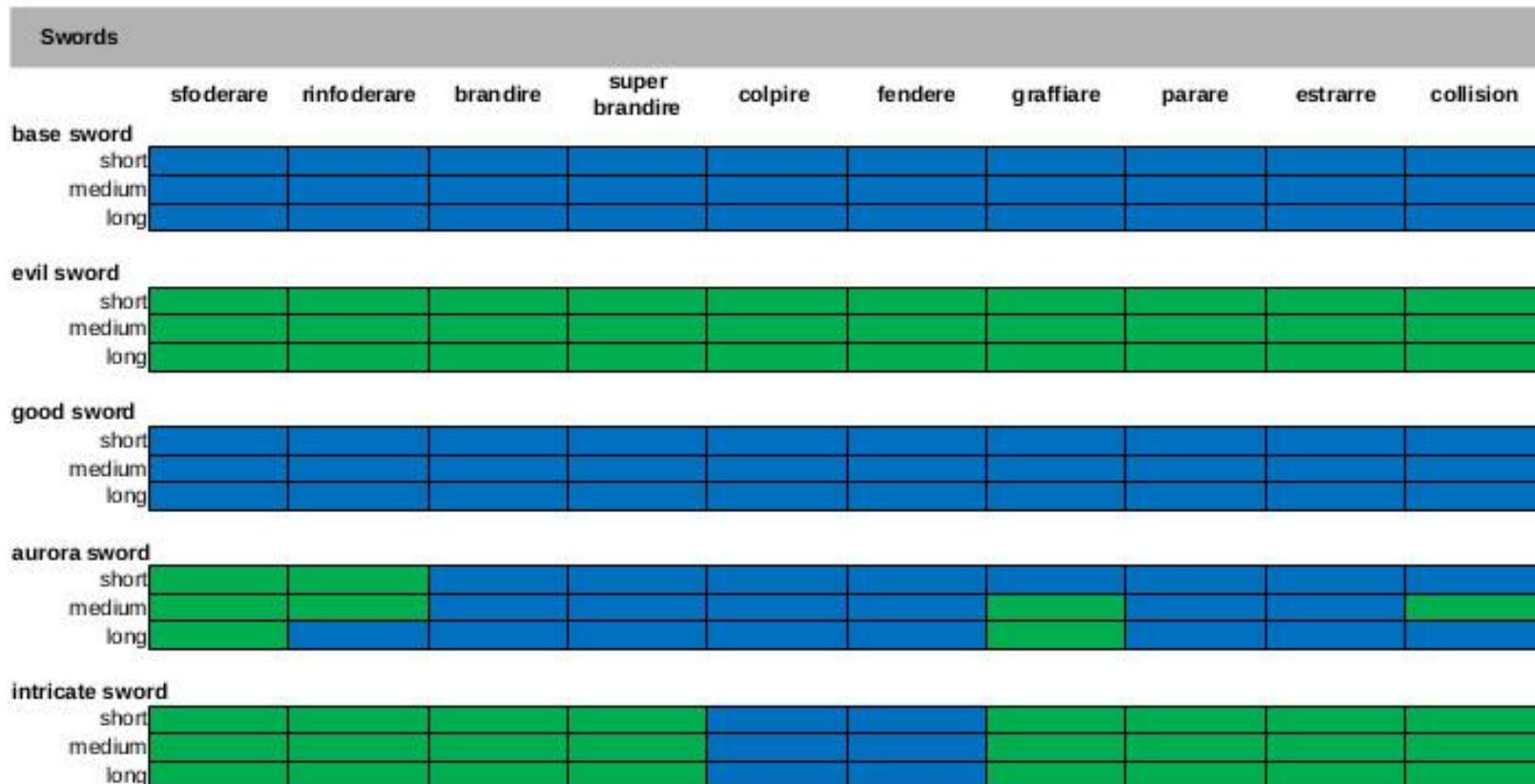


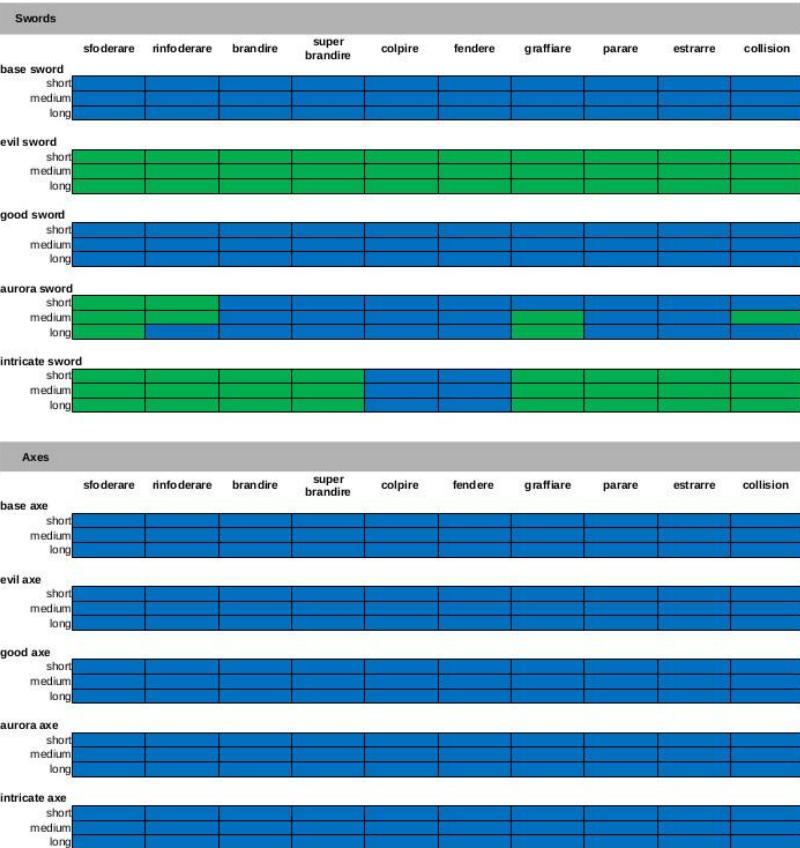
$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

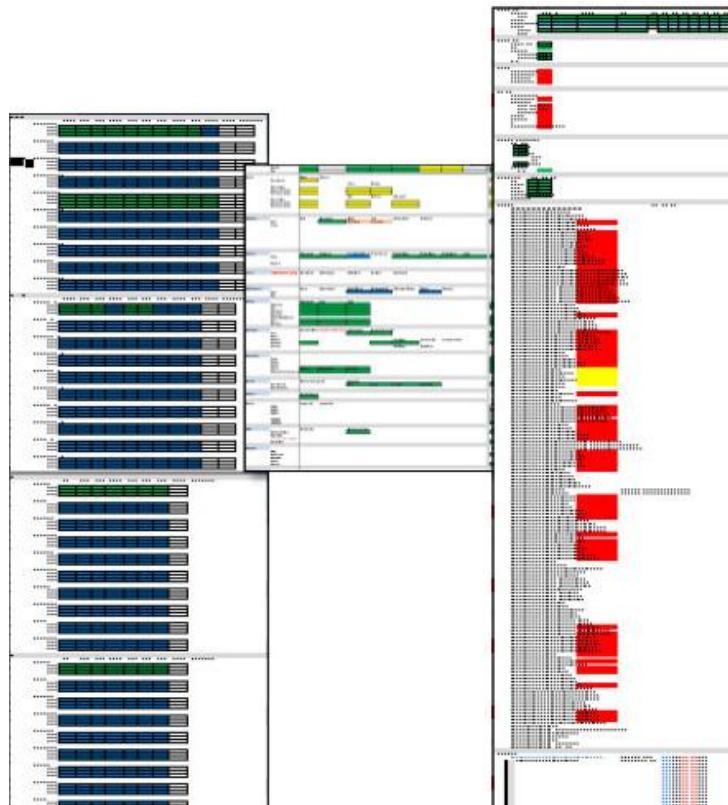
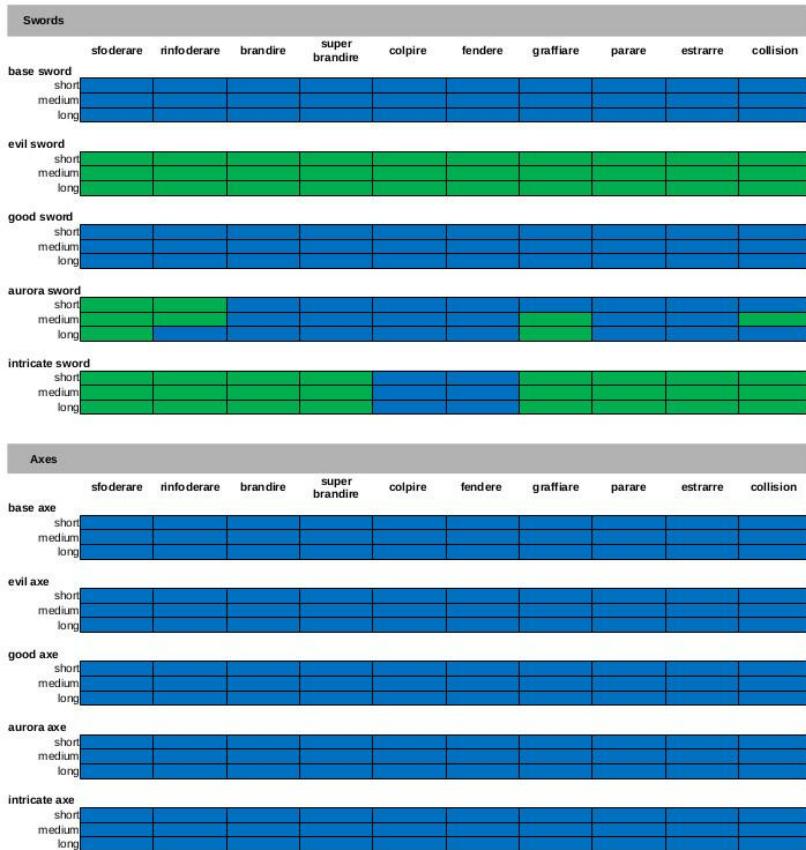


$$\binom{13}{2} = 78$$









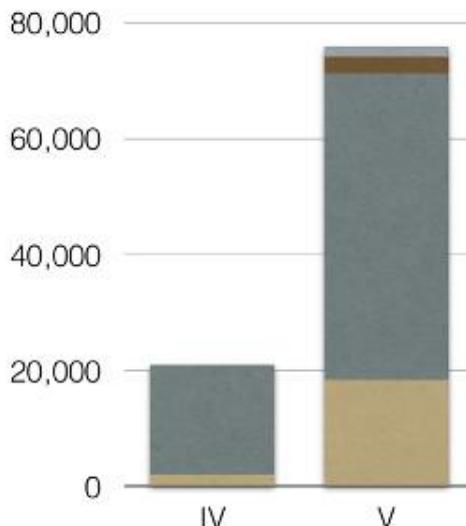
Asset Sizes

GameObjects
DynamicMixer

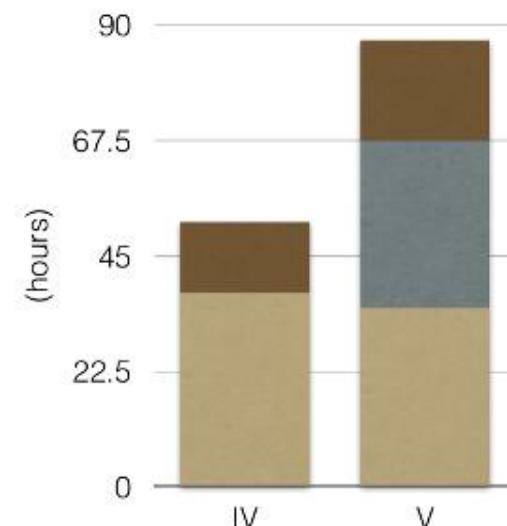
Radio
Cinematics

Scripted

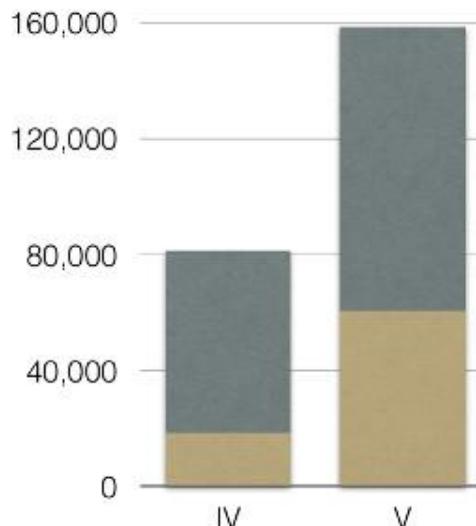
Metadata



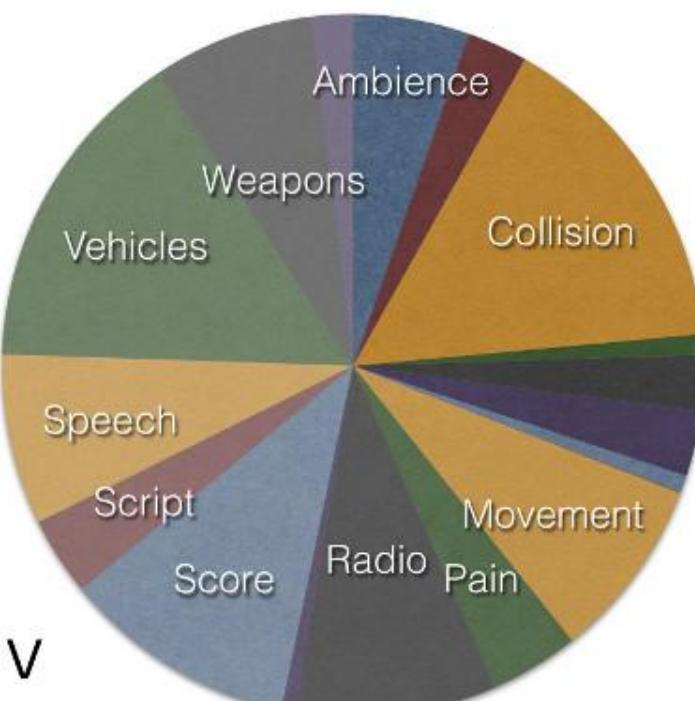
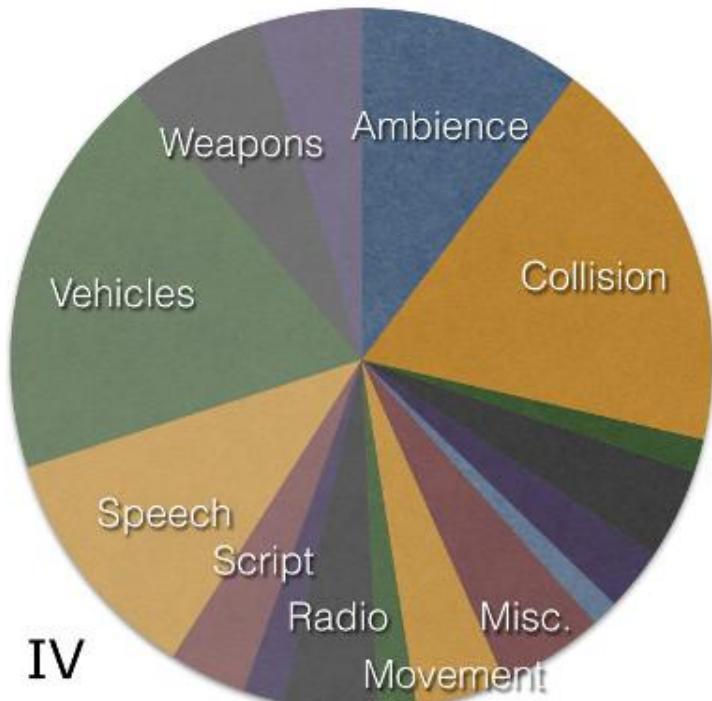
Streaming Assets



Lines of Dialogue



Wave Memory



Applicare variazioni real-time

Volume

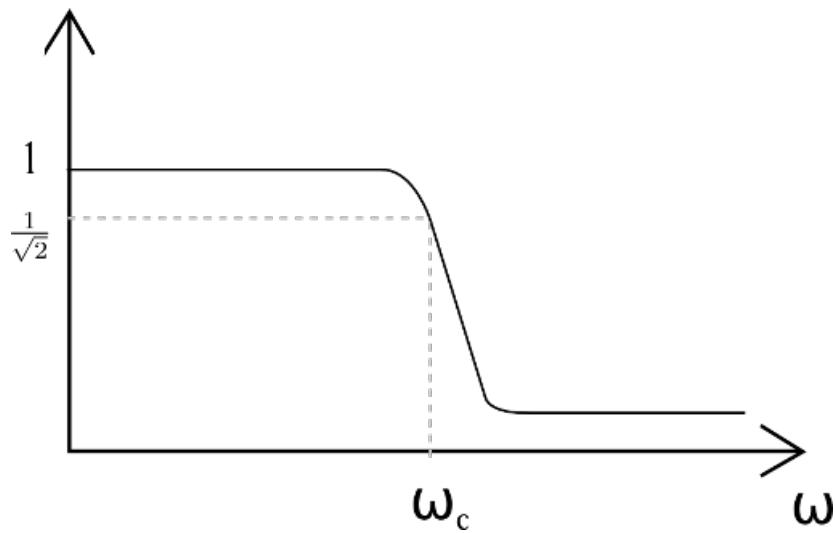


Pitch shifting



Applicare variazioni real-time

Filtering

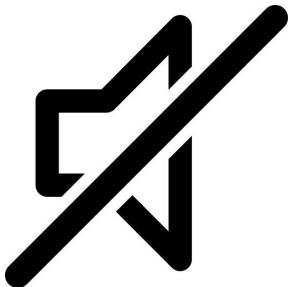


Timing variations

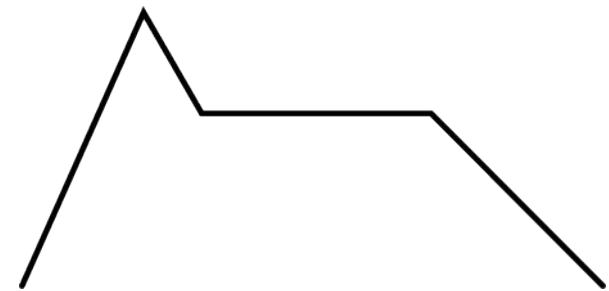


Applicare variazioni real-time

Silence

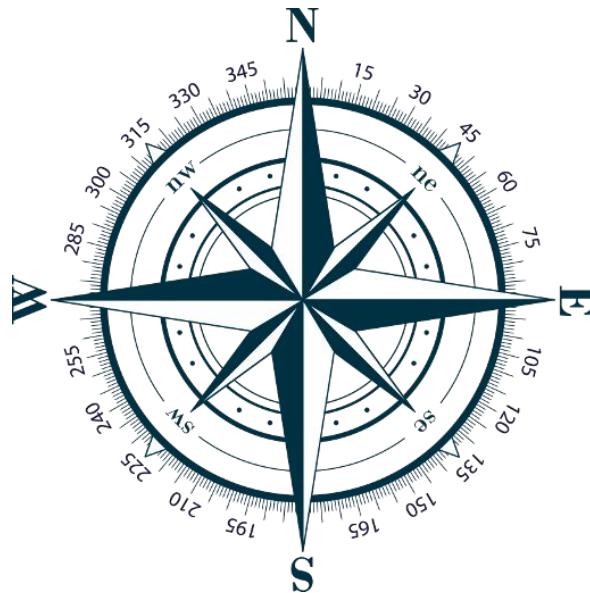


Envelope

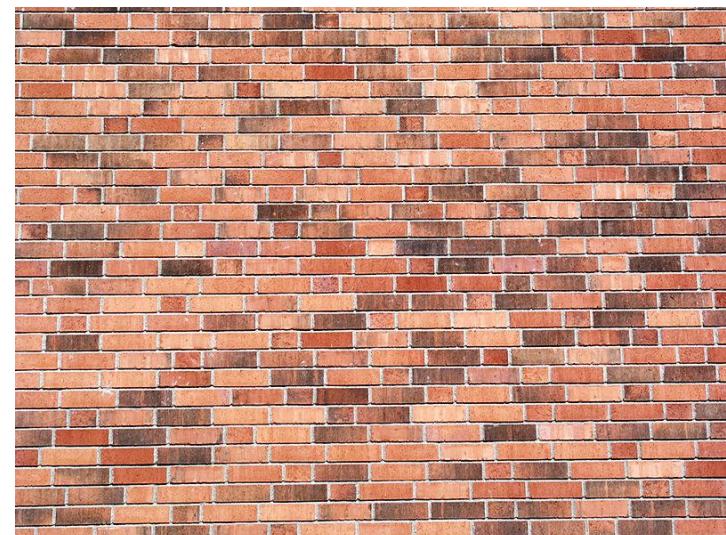


Applicare variazioni real-time

Positional variation



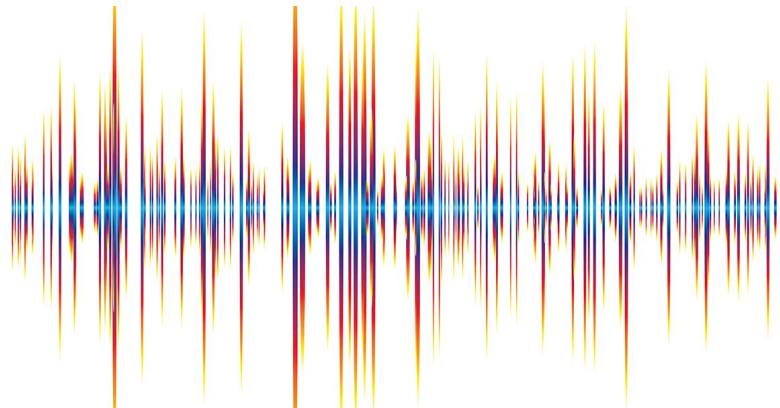
Environmental variation

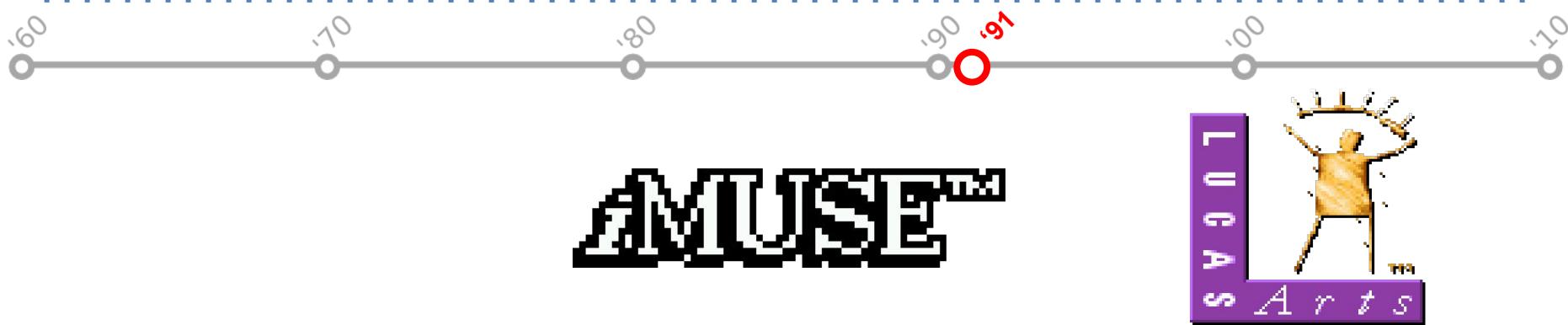




Quando applicare queste modifiche:

- dialogs (ADR, masking, interazioni di gruppo);
- sndfx
- music





1991 Michael Land e Peter McConnell sviluppano iMuse, il sound engine di SCUMM, il game engine per le avventure grafiche P&C di LucasArts

Introduzione di componenti audio dinamici tramite invio di messaggi SysEx nei file MIDI.

iMuse come funziona

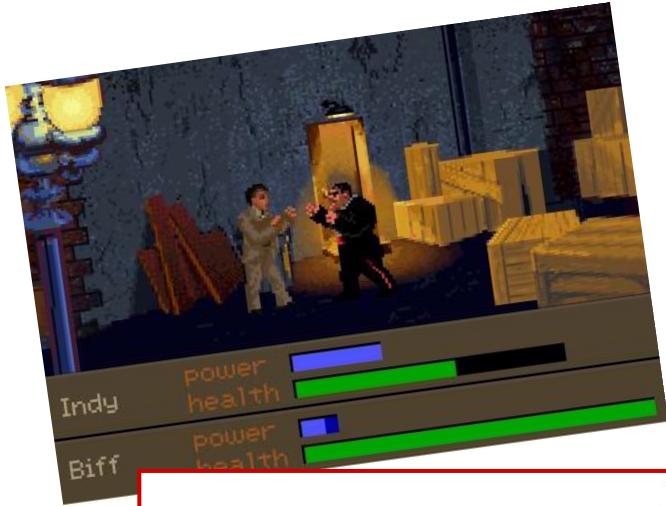
2 tipi di messaggi SysEx: markers e hooks

markers (ID):

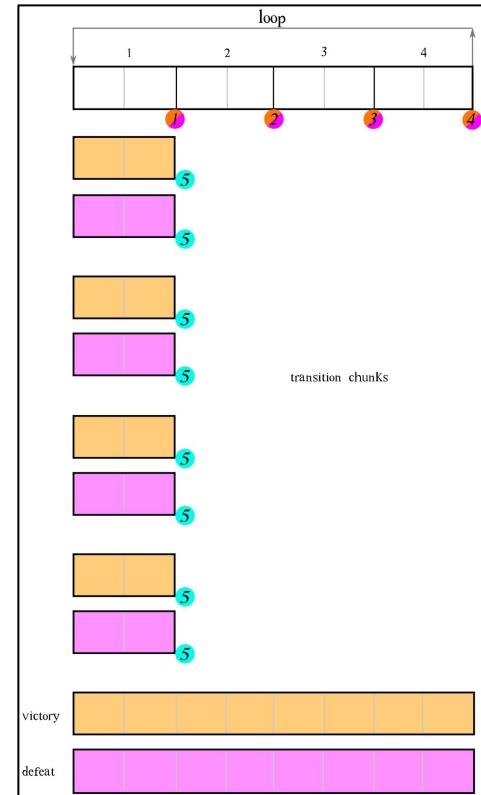
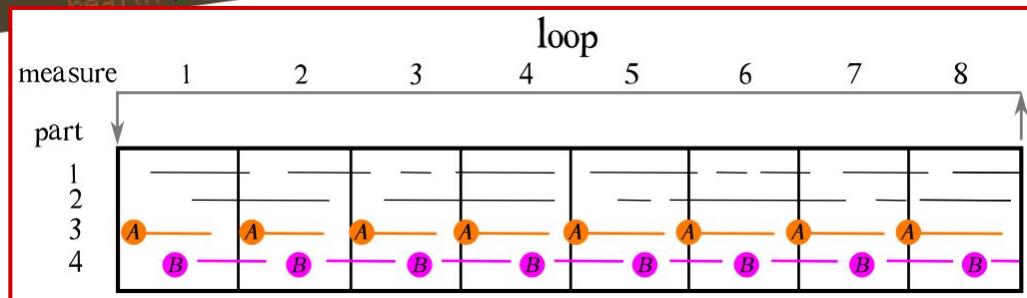
- posti nel file MIDI nel punto in cui deve essere eseguito un comando
- il comando è inserito in una coda di comandi nella memoria del sistema
- quando il lettore MIDI raggiunge il punto, il marker triggerà l'esecuzione del comando legato all'ID del marker stesso
esempio: fade in/out, variazioni in volume, pause/resume

hooks (ID + comando)

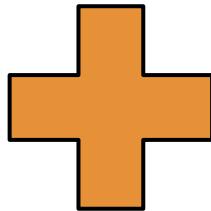
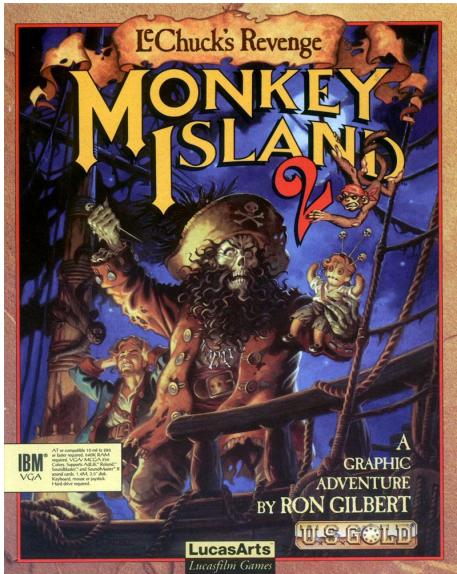
- al messaggio si aggiunge non solo un ID ma anche un comando.
- il sistema resta in ascolto
- se il lettore MIDI incontra un hook il sistema esegue il comando specificato nello stesso
esempio: salti, trasposizioni, abilitazione/disabilitazione di strumenti



IMUSE™



iMuse: testiamolo



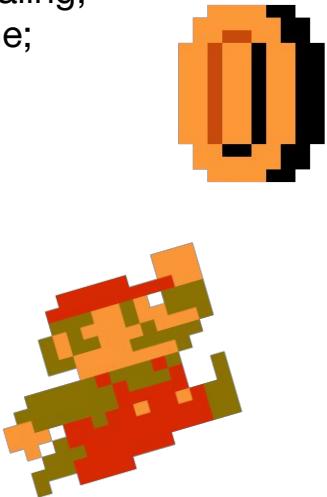
caratteristiche di un moderno audio engine

fmod.studio



Switching

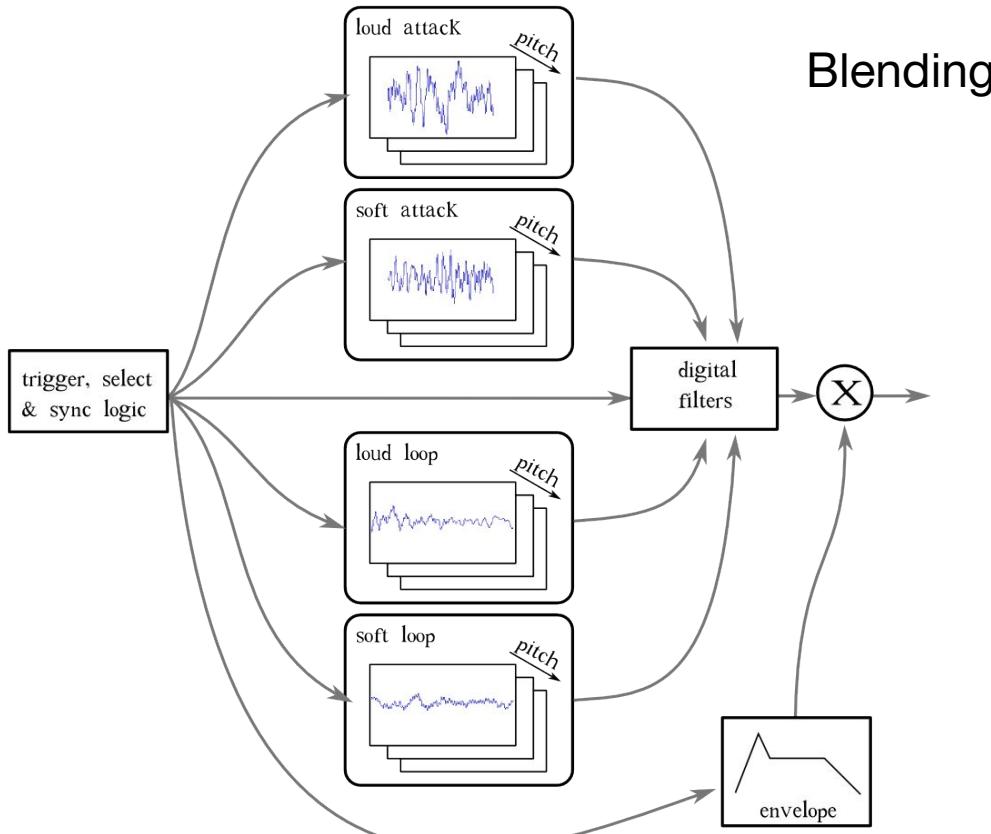
- polyphony;
- voice allocation;
- voice stealing;
- narrazione;

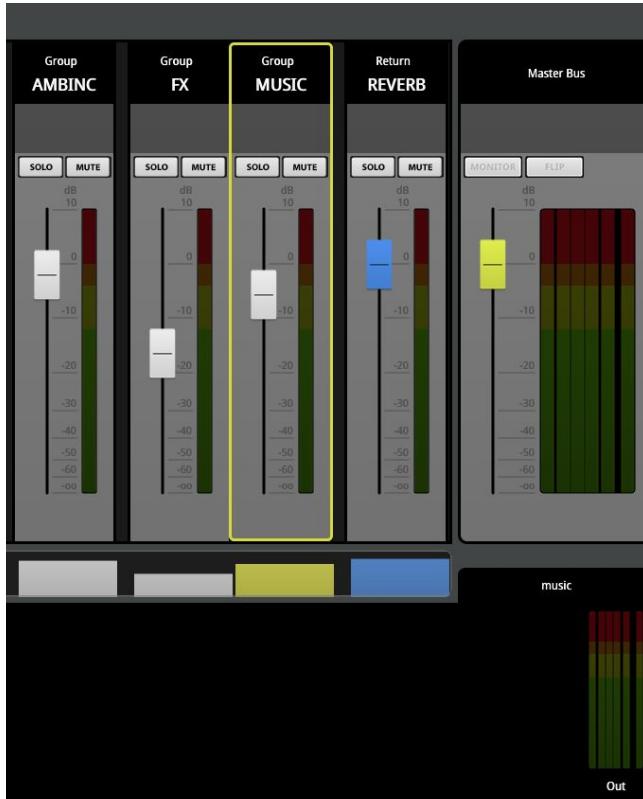




Random

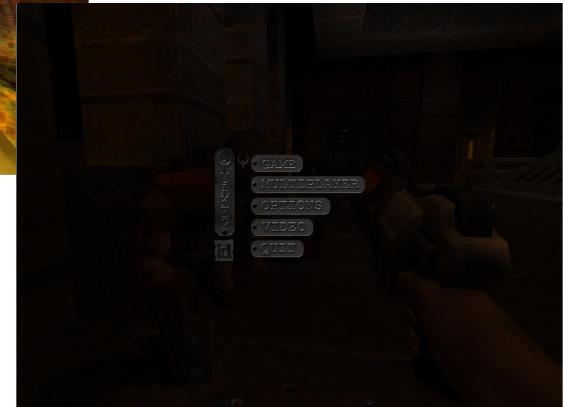




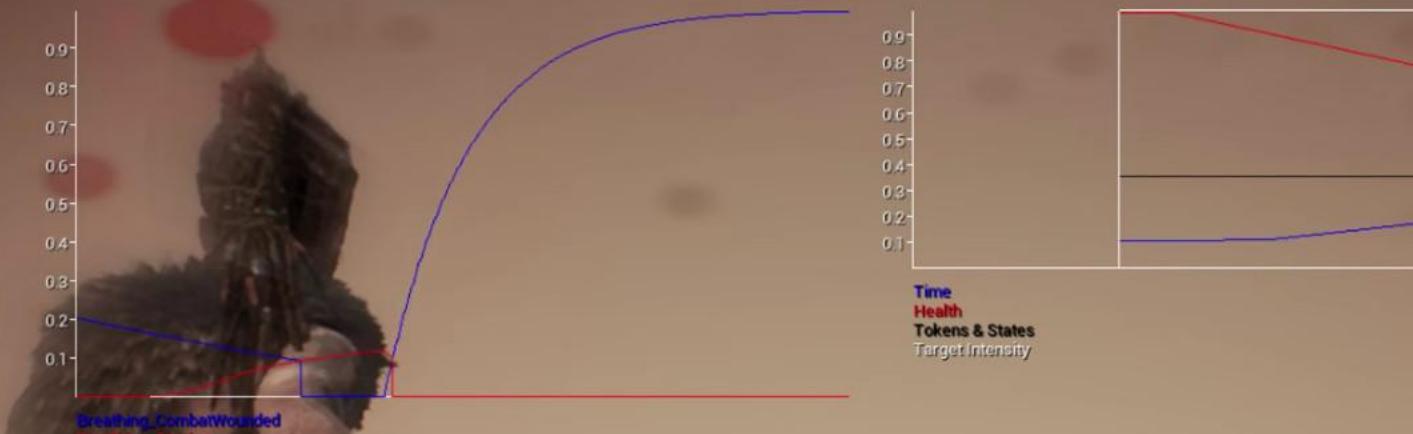


Mixer, grouping and Buses

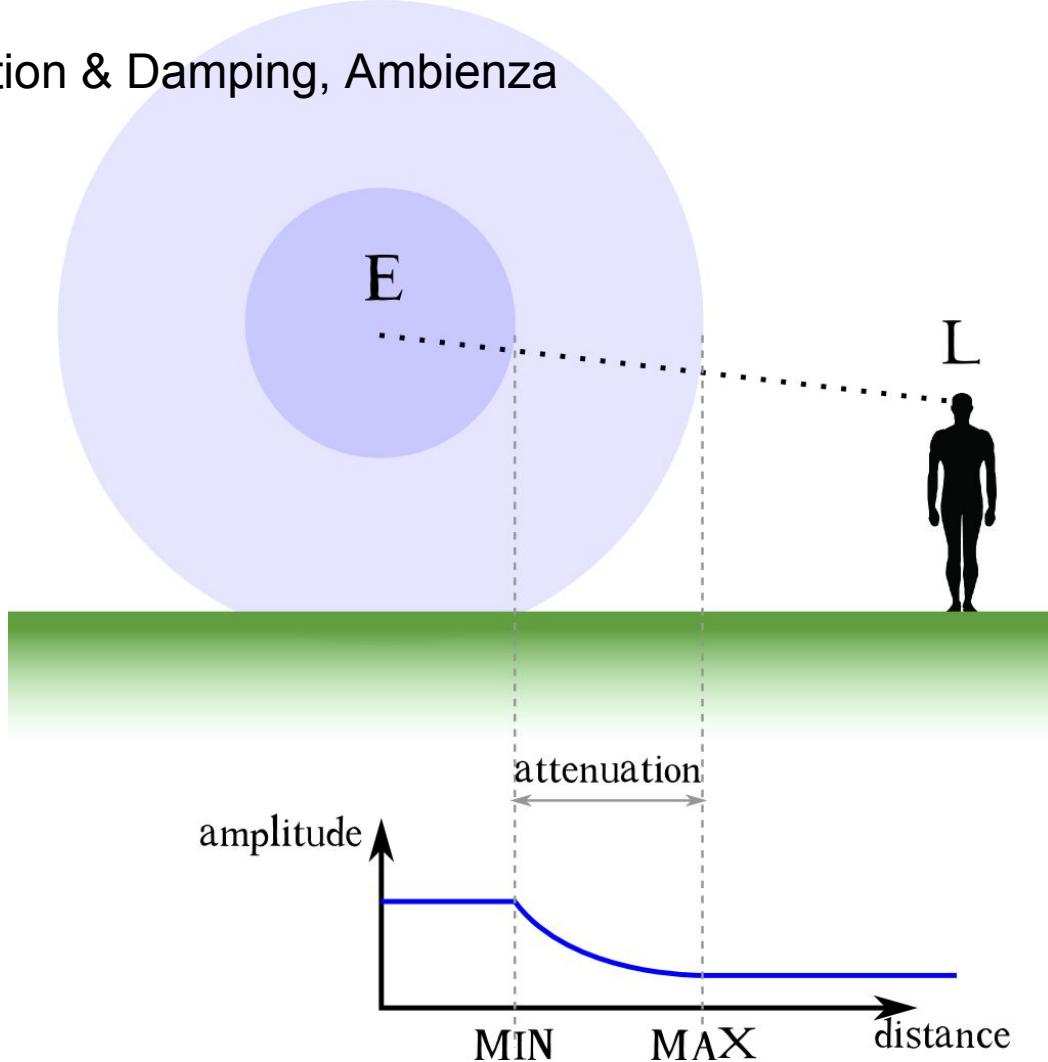
riconfigurabile rapidamente (snapshot)



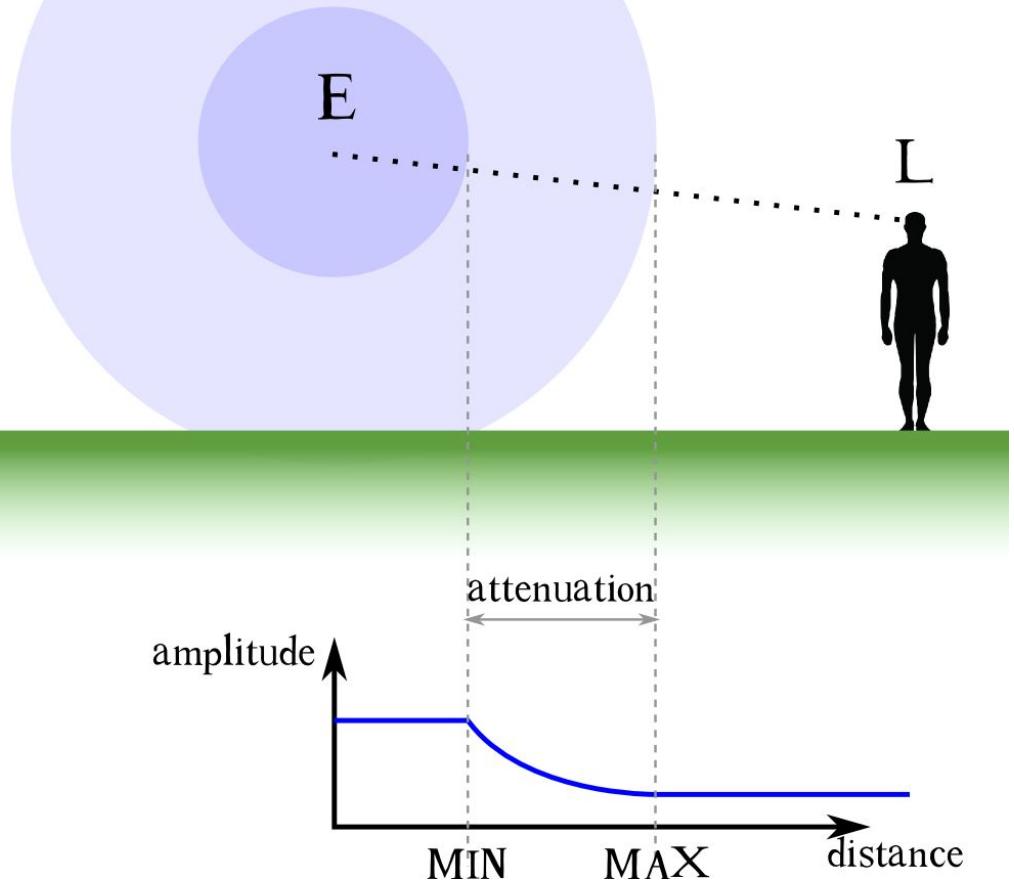
Real Time controllers



Position, Attenuation & Damping, Ambienza



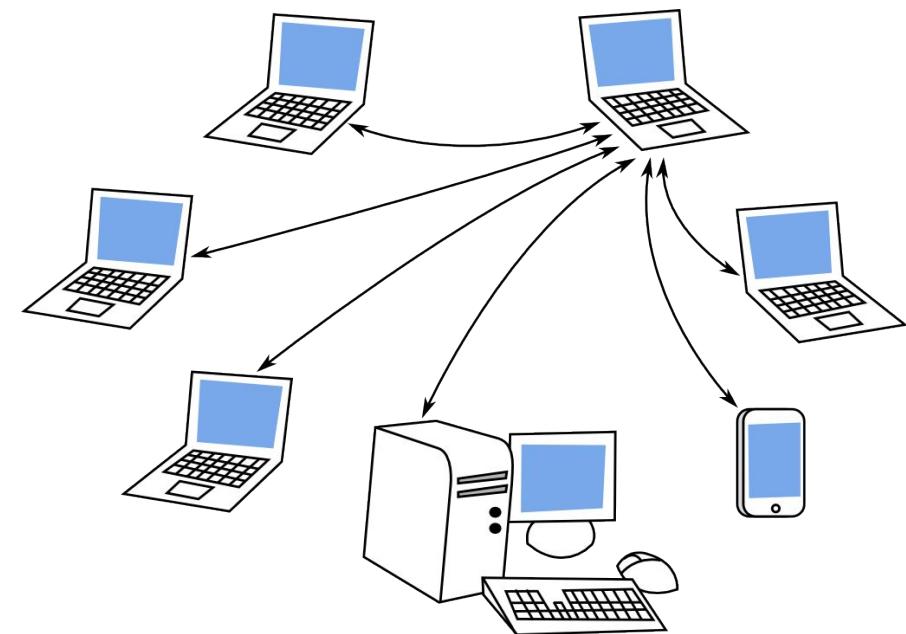
Position, Attenuation & Damping, Ambienza





ASk About:
Voodoo
Voodoo Murders
New Orleans
HerSelf
MeSSageS
Request ReSearch
Exit

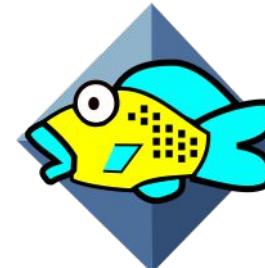
Alignment



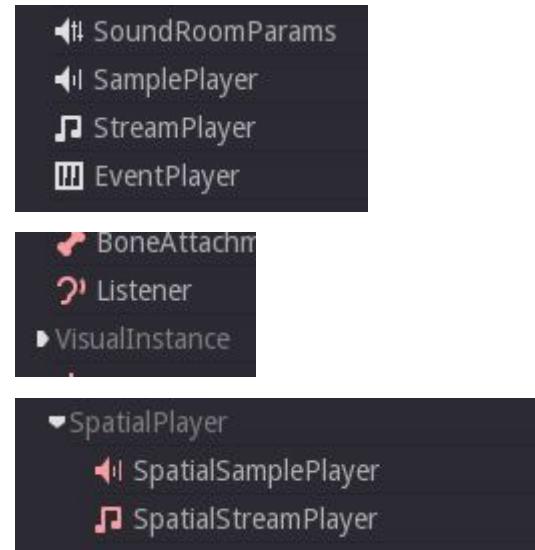
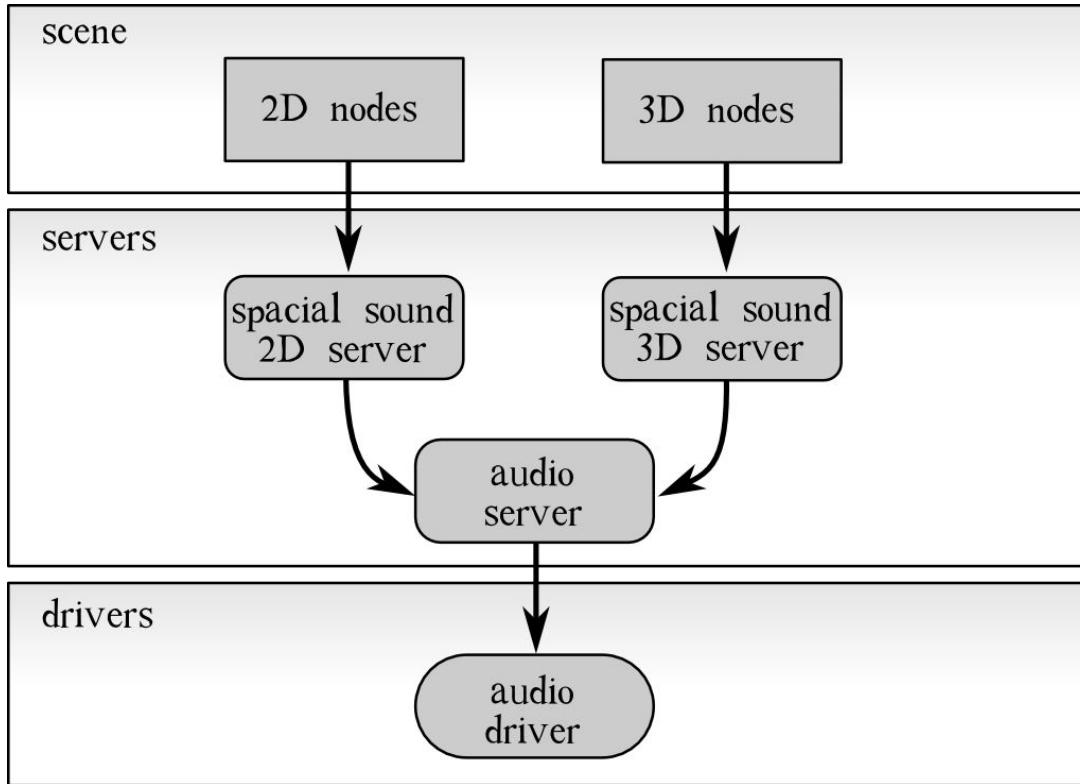
Decoding data streams



PCM
ADPCM



Godot Audio Architecture



3.0

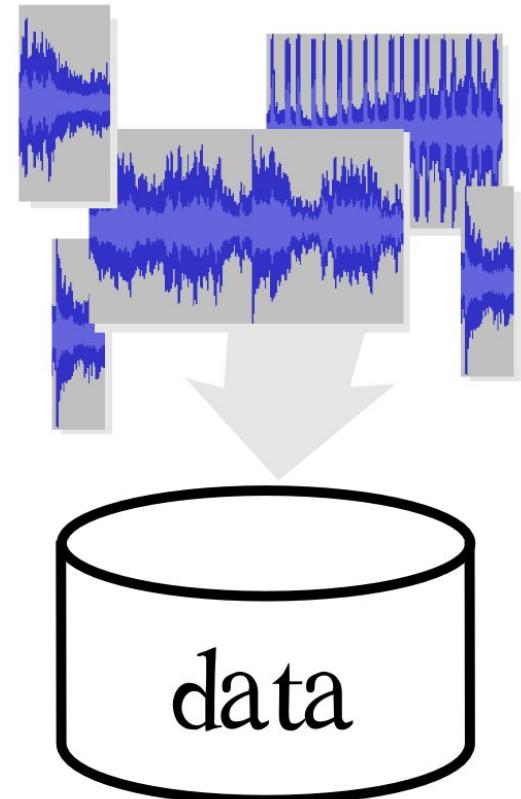
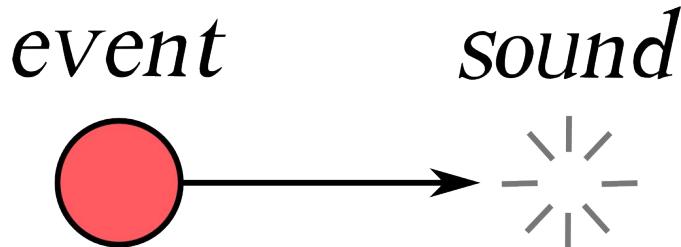


Modello data driven

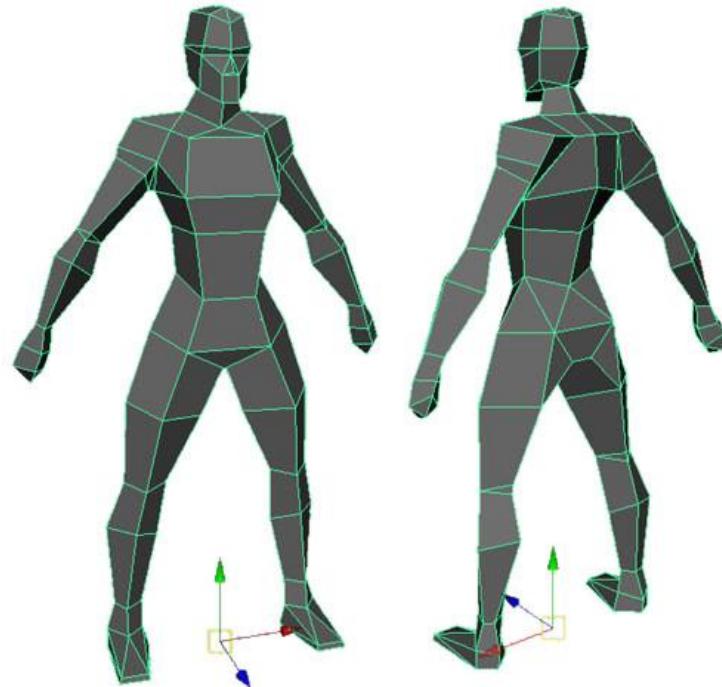
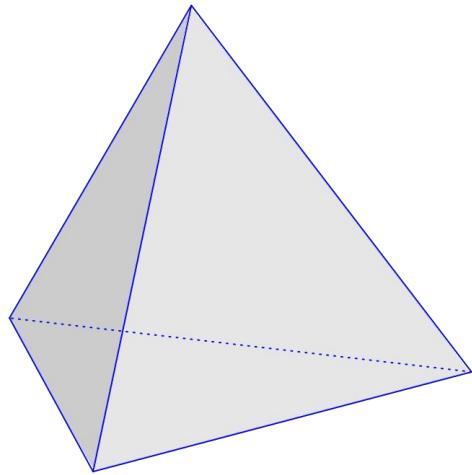
Nell'ultima parte della sua storia, il suono nel videogioco si presenta come un modello guidato dai dati (**data driven model**).

File audio triggerati a seguito del verificarsi di particolari eventi (**event driven system**).

Ai suoni riprodotti si applicano **modificazioni in tempo reale**



Grafica per la ricerca del realismo

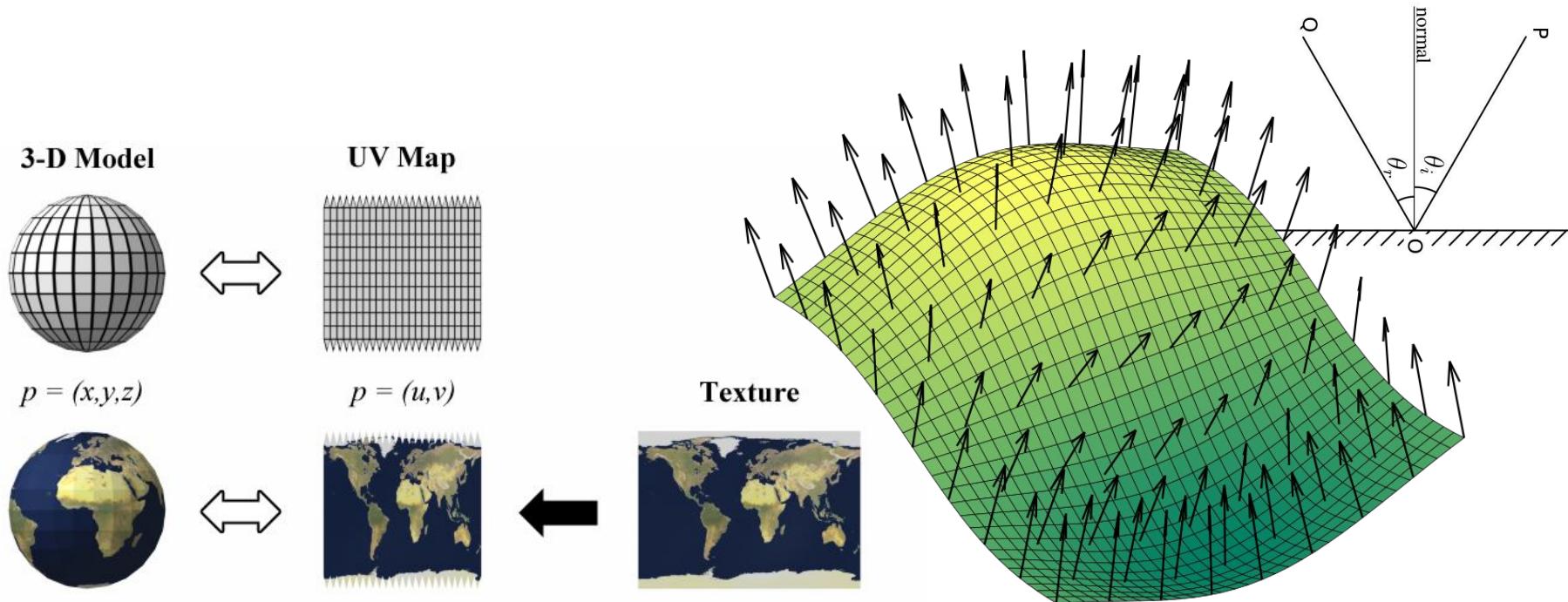


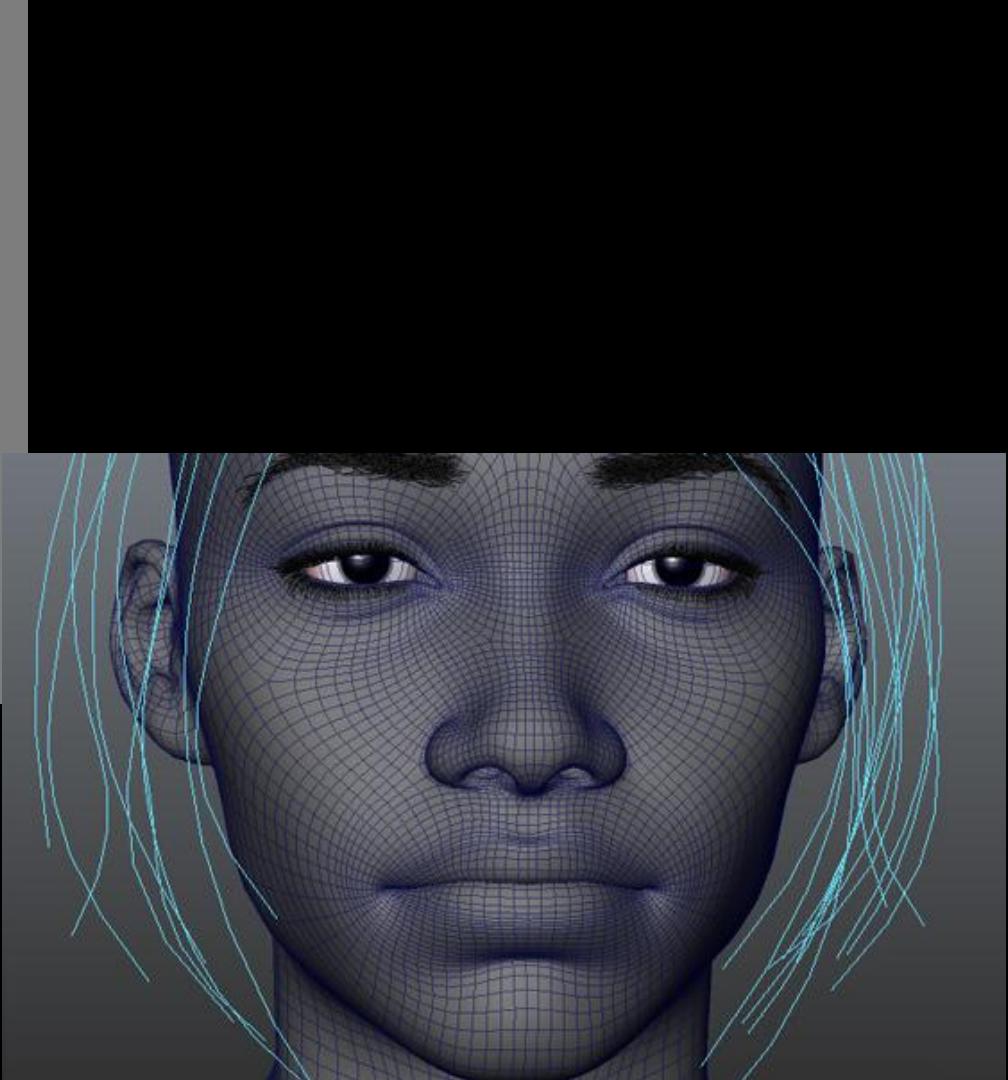
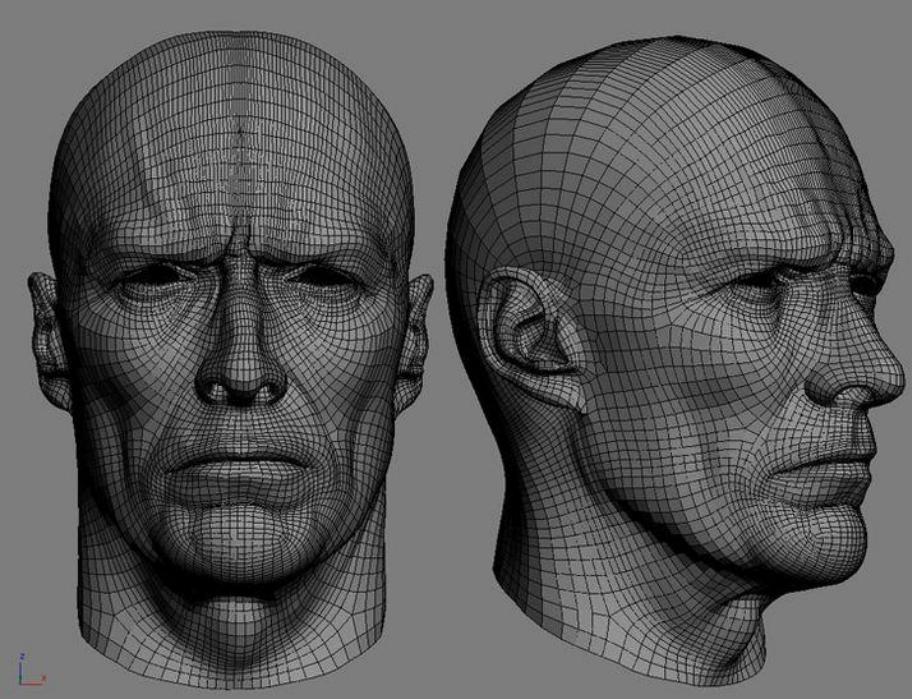


Crash Bandicoot (1996)



Alone in The Dark (1992)





Suono come processo

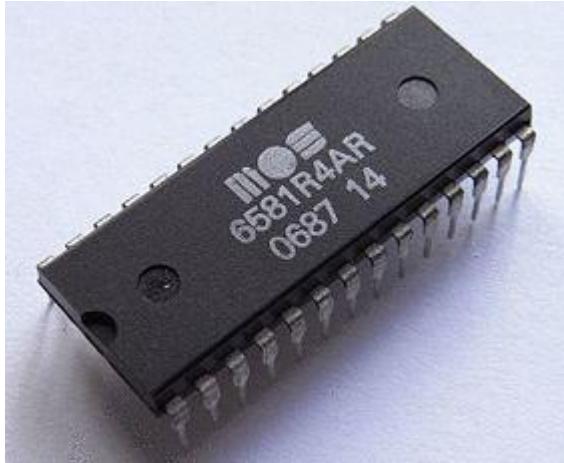
- sample audio, di cosa stiamo parlando?
- 2 concezioni di “realismo” contrastanti



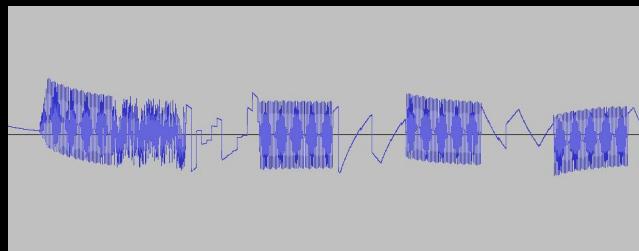
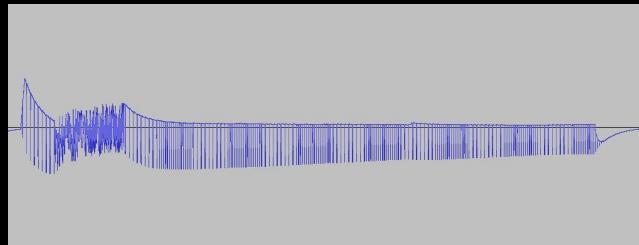
Suono come processo

- sample audio, di cosa stiamo parlando?
- 2 concezioni di “realismo” contrastanti





```
10 SI=54272
11 FL=SI
12 FH=SI+1
13 W=SI+4
14 A=SI+5
15 H=SI+6
16 L=SI+24
20 POKE L,15
30 POKE A,16+9
40 POKE H,4*16+4
50 POKE FH,29
55 POKE FL,69
60 POKE W,17
70 FOR T=0 TO 500: NEXT
80 POKE W,0
85 POKE A,0
90 POKE H,0
READY.
```



focus su
basso livello



focus su
alto livello

sound spinge il
progresso tecnologico



grafica spinge il
progresso tecnologico

programmatore



compositore/sound
designer

multitasking



iper specializzazione



Niente “trucchi” da quattro soldi :P

il paradigma data driven non riesce a soddisfare tutte le necessità



Modelling: Virtual Analog

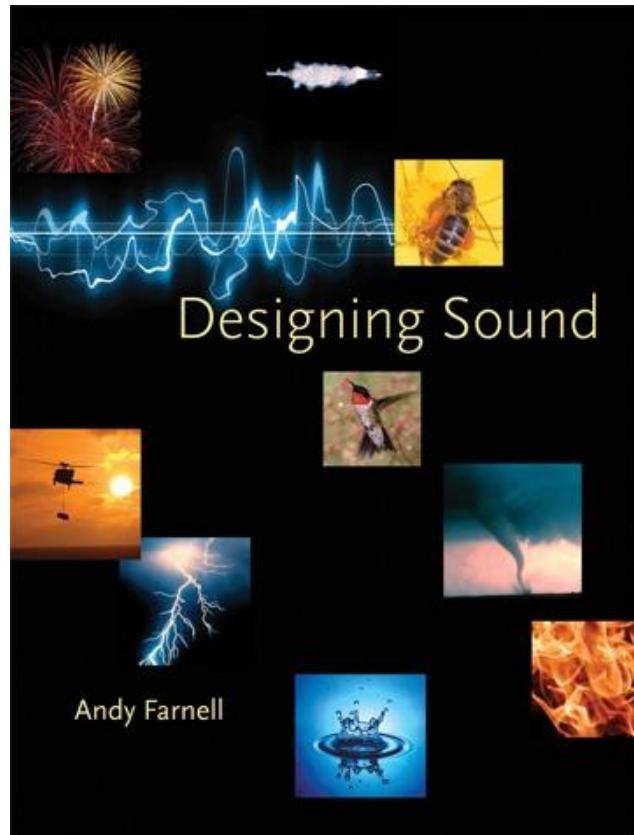


Modelling: Physical modelling

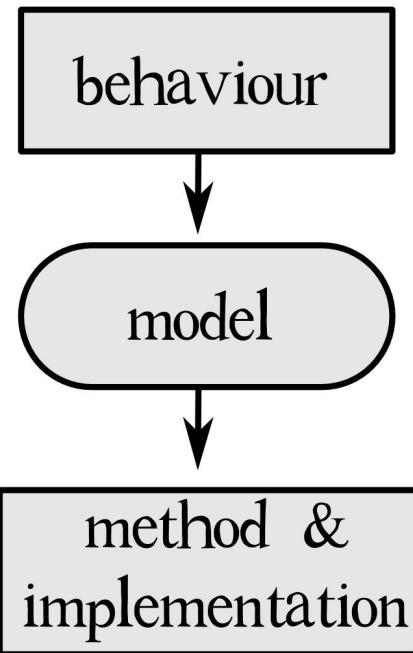




Company	VI Labs	Modartt
Name	Ravenscroft 275	Pianoteq
samples	17000	0
Disk space req.	5.32 GB	40 MB
RAM	4 GB	256 MB

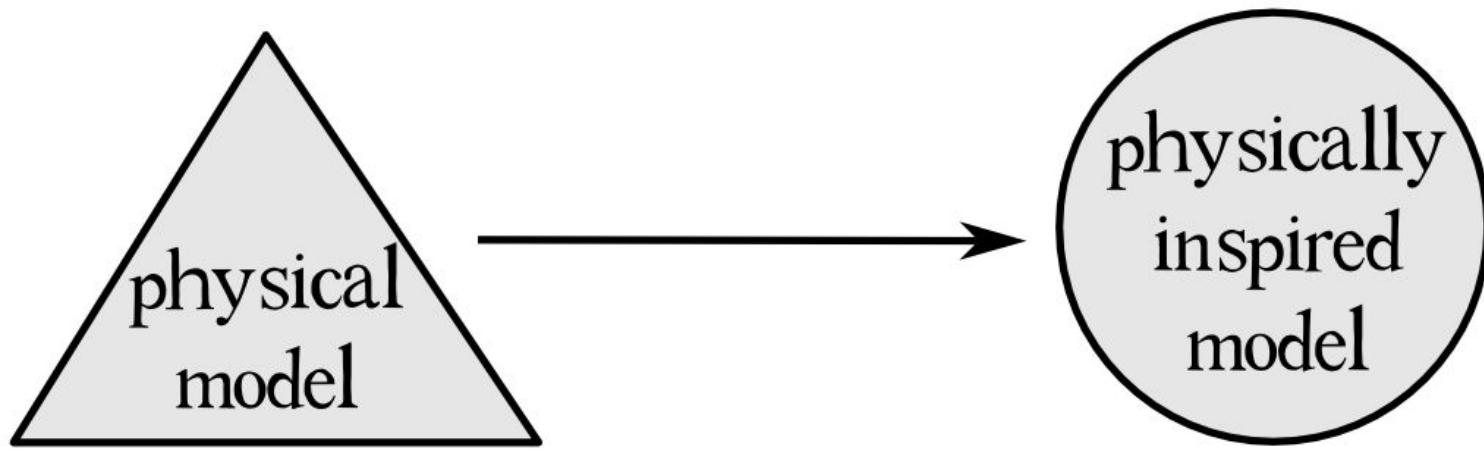


Suono Procedurale



“**Procedural audio** is non-linear, often synthetic sound, created in real time according to a set of programmatic rules and live input.”

Andy Farnell



Vantaggi:

Differimento

- recording: decisione prese in anticipo;
- procedurale: molte decisioni sono lasciate al *real-time*;

Variabilità

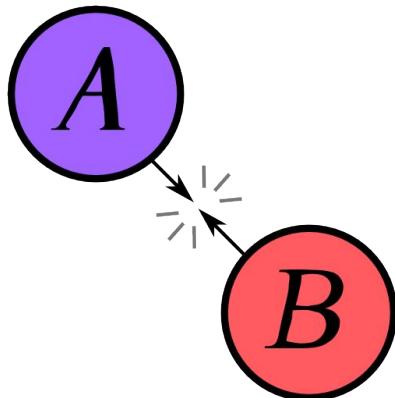
- modifica del suono in tempo reale;
- modello completamente parametrico;



Vantaggi:

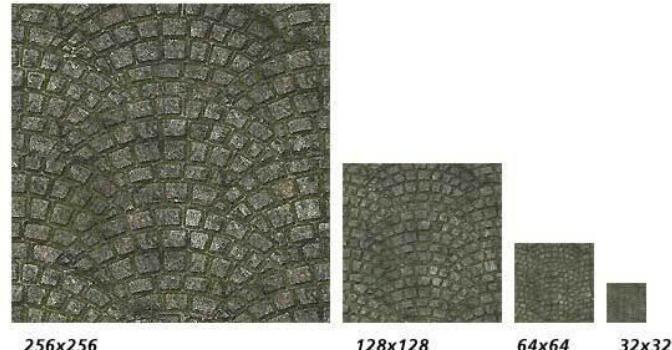
Default forms

- crescita combinatoria
- suono di default associato



LOAD

- “*mipmapping*” audio
- modello stratificato
- più layer indipendenti
- psicoacustica



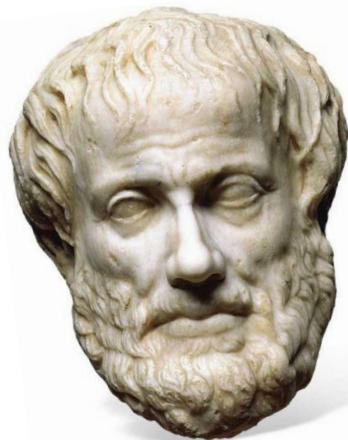
Svantaggi



- industrial inertia
- new workflows, new skills
- sintesi = falso

do we really need *realism*?

“verosimiglianza & resa vs. reale”
“ valore aggiunto ”
Michel Chion



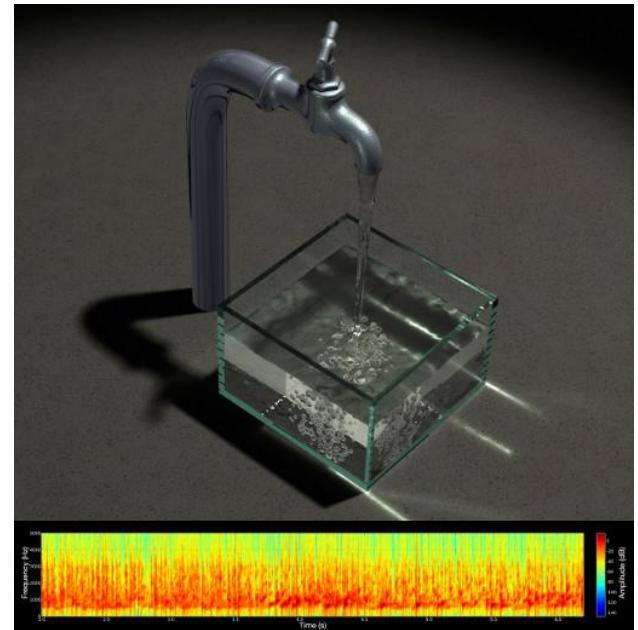
“l'intero è maggiore
della somma delle sue
parti”
Aristotele, Metafisica



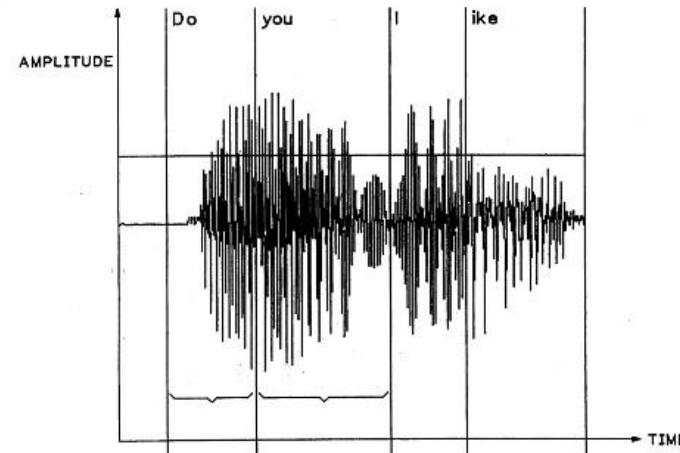
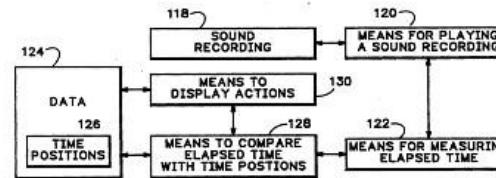
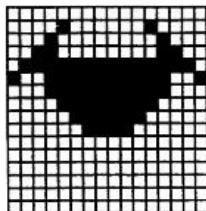
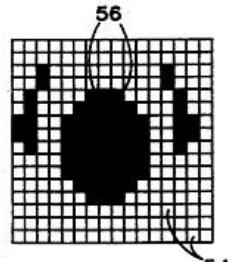
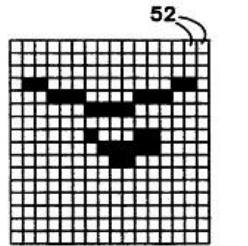
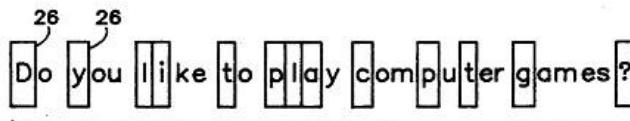
Il futuro

Nella computer graphics: rigging, textures, animazione, modellazione, light, visual fxs

fracture sound, friction, water and bubbles, fire, crumpling, impatti, acustica ambientale



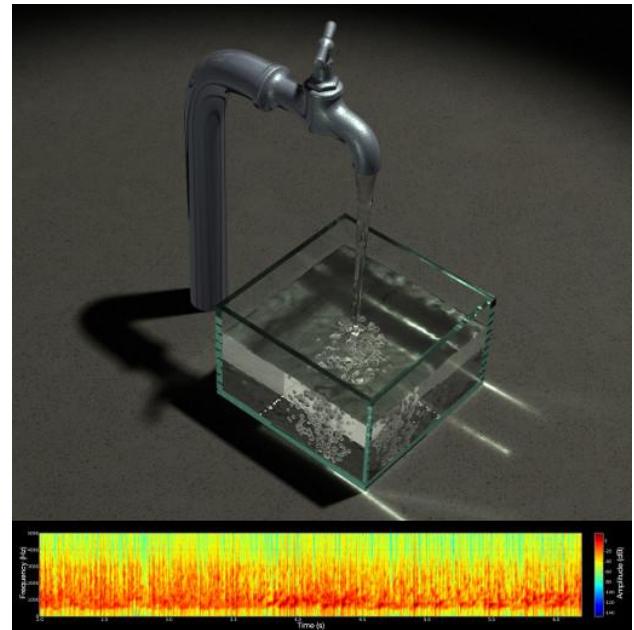
Animation driven by audio



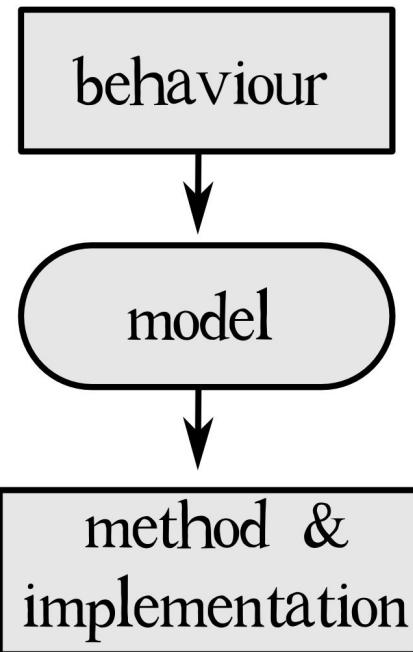


Il futuro

c'è poi chi si specializza nel processo inverso (inverse foley) con risultati sorprendenti.



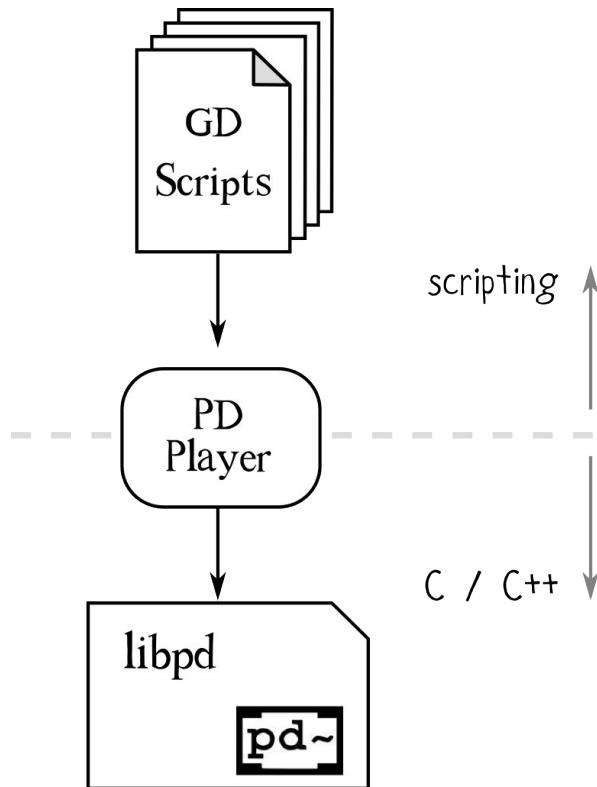
Esempi: Audio Procedurale, Game Audio Middleware



- Layer di implementazione
- Diversi tipi di linguaggi per l'implementazione
- PureData (Chuck, SuperCollider, CSound, etc...)
- fmod

Godot: **libpd / PureData** integration

<https://github.com/Limulo/godot>





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twitter	@limulo_lab, @vlaillel, @nicolaariutti



THANK YOU

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