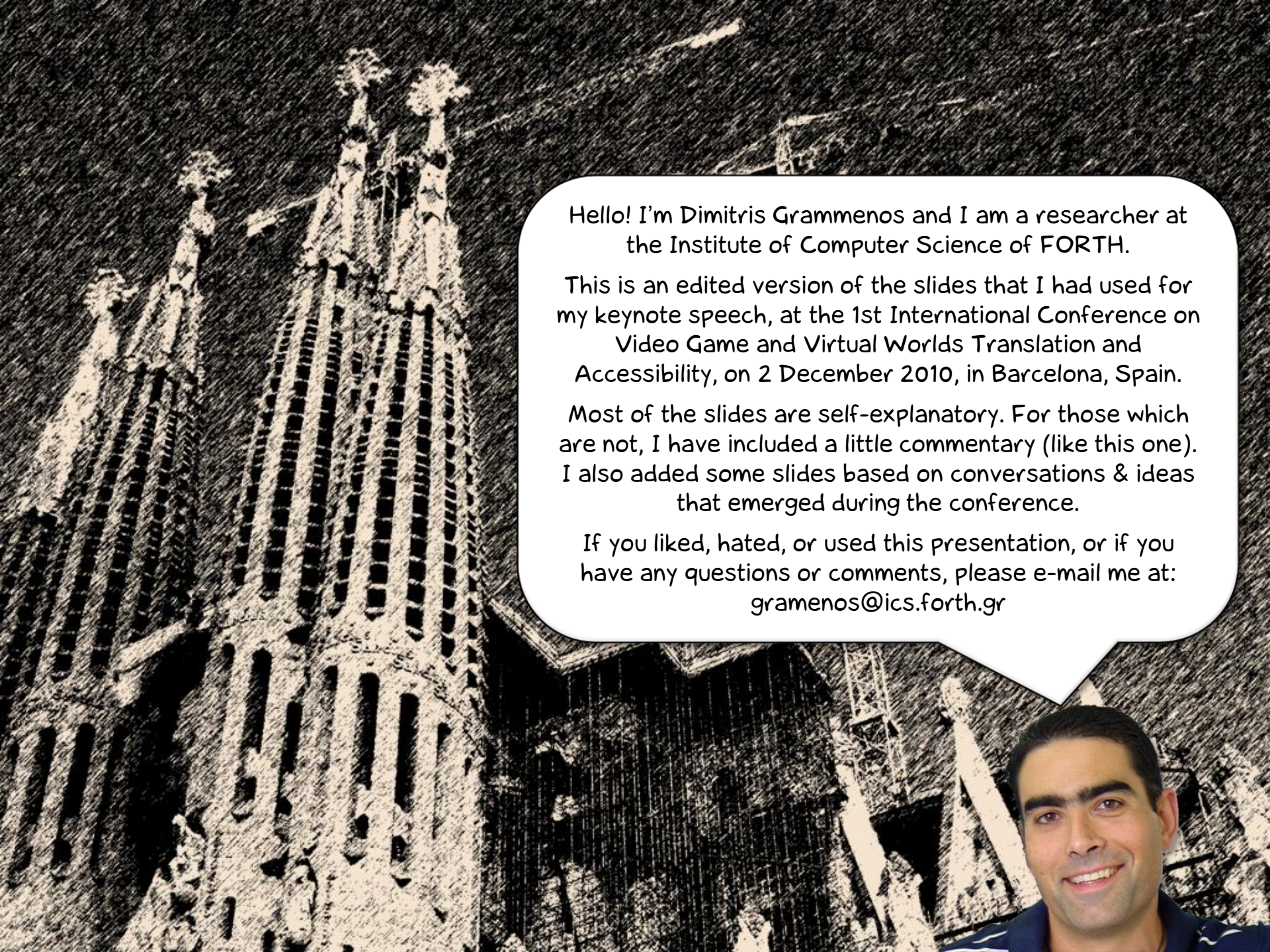
First edition (online): 9 December 2010


Hello! I'm Dimitris Grammenos and I am a researcher at the Institute of Computer Science of FORTH.
This is an edited version of the slides that I had used for my keynote speech, at the 1st International Conference on Video Game and Virtual Worlds Translation and Accessibility, on 2 December 2010, in Barcelona, Spain.
Most of the slides are self-explanatory. For those which are not, I have included a little commentary (like this one). I also added some slides based on conversations & ideas that emerged during the conference.
If you liked, hated, or used this presentation, or if you have any questions or comments, please e-mail me at: gramenos@ics.forth.gr

I International Conference on Video Game and Virtual Worlds Translation and Accessibility

2-3 December 2010 - Barcelona, Spain

Universally Accessible Games & Parallel Game Universes

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http://ics.forth.gr/hci/people/dgrammenos.html

Blue Pill, Red Pill

I guess that most of you have watched a film called "The Matrix". The most critical scene of the film is when Morpheus and Neo sit on two facing armchairs, and Morpheus presents Neo with two alternative choices in the form of a **red** and a **blue** pill, saying the following words...

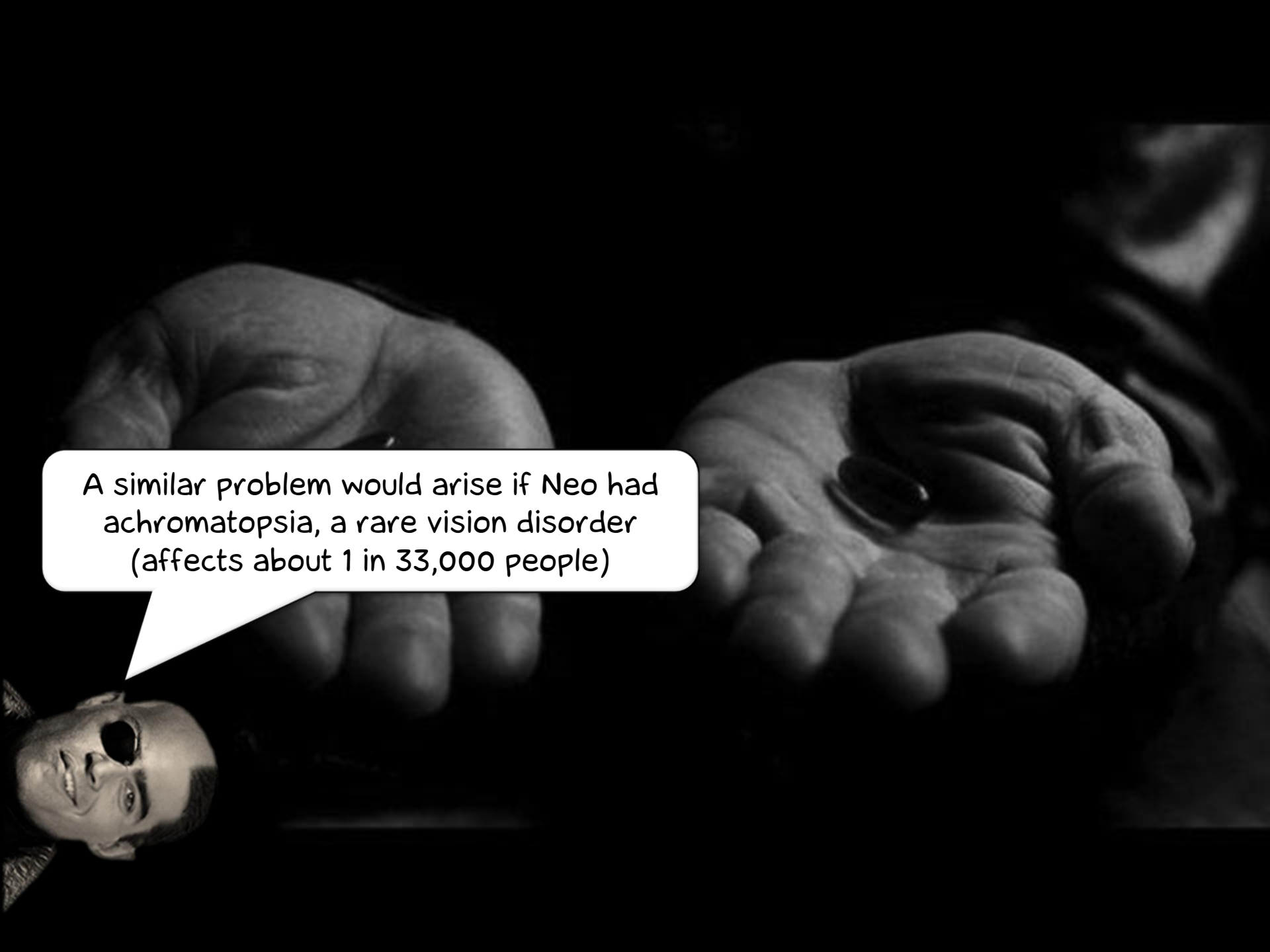

This is your last chance.
After this, there is no turning back.


You take the blue pill - the story ends, you wake up in your bed and believe whatever you want to believe.

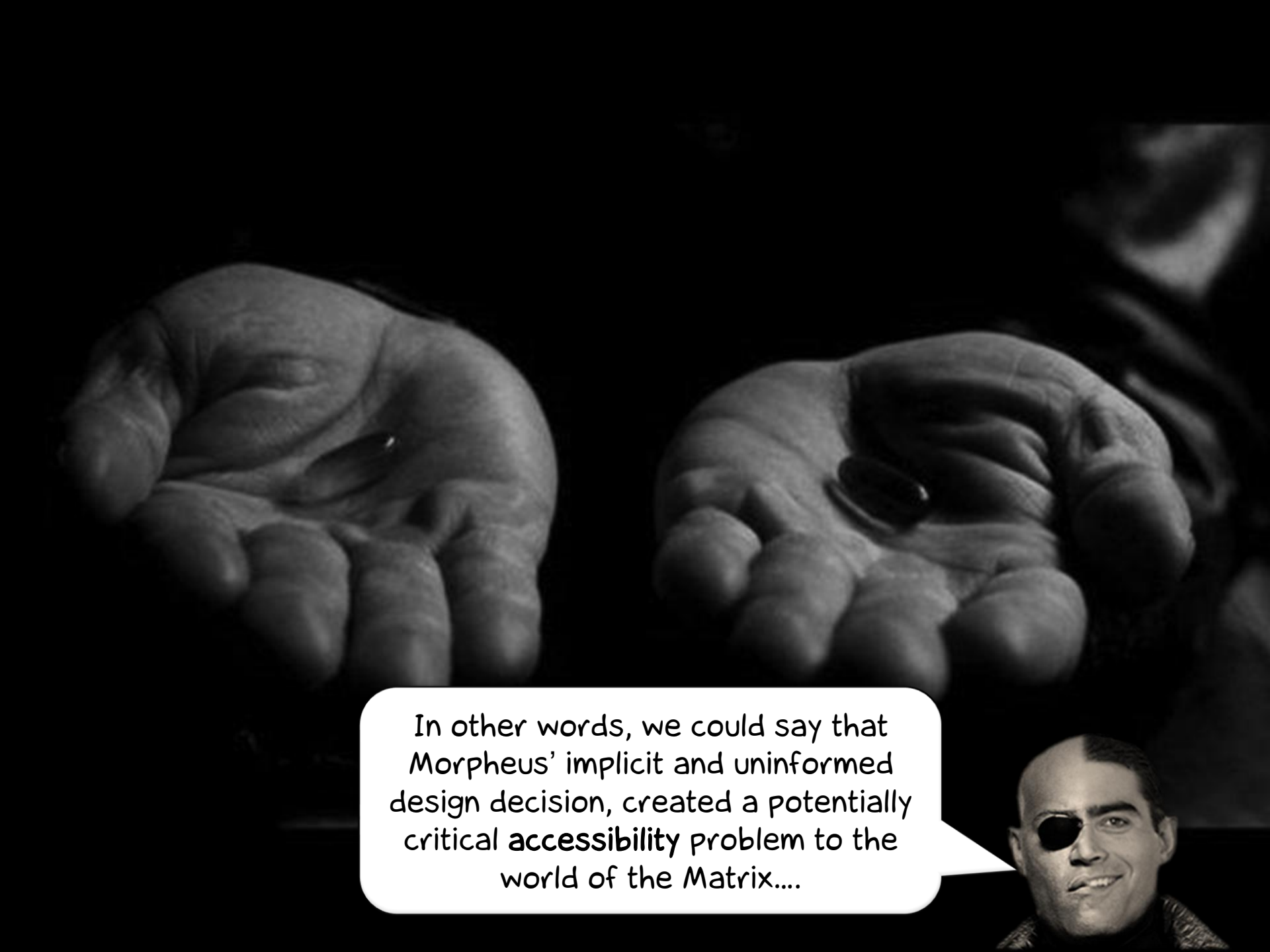

You take the red pill - you stay in Wonderland and I show you how deep the rabbit-hole goes.


If we wanted to shoot the very same scene 100 years ago, we would stumble upon a major obstacle – which has nothing to do with the advanced special FX techniques employed by Andy & Lana Wachowski...


100 years ago, movies were still black & white!
Thus, this scene would make no sense...


A similar problem would arise if Neo had achromatopsia, a rare vision disorder (affects about 1 in 33,000 people)


And all this, simply because in a technologically advanced environment as the Matrix, Morpheus decided to differentiate two such important options through color alone...


In other words, we could say that Morpheus' implicit and uninformed design decision, created a potentially critical **accessibility** problem to the world of the Matrix....

Introduction to Game Accessibility

Computer Accessibility

- Term traditionally associated with access to computer-based systems by people with physical, sensory or mental disabilities
- In this presentation also encompasses people with "diversified needs", due to:
  - the environment they operate in
  - the devices / software they use
  - their abilities or preferences

(Video) Game Accessibility

- Being able to play a game
  - Even when playing under "limiting conditions", or having "diversified needs"
- Limiting conditions
  - Disabilities
    - Permanent
    - Temporary
- GA = Game Accessibility

Diversified needs

- Non(-native) language
- Left- / single-handed
- Bright / loud / quiet /… environment
- On the move
- Novice / casual / tired / young / old
- I/O devices
  - Touchpad, mobile screen, TV too far, keyboard key not working, “other” joystick, …..

Accessibility ≠ Disability

Accessibility ≠ Disability

I hope that, up to this point, I have made it quite clear that accessibility not only addresses "physical, sensory and mental disabilities". It is a much broader term, which is used to refer to "providing to ANY person, access to SOMETHING".

If accessibility was a door key, it would be a skeleton ("pass-partout") key that can open ANY door – not just doors with a specific type of lock.

In any case...

What is considered as a 'disability', is usually just a matter of…

a. Statistics, or

b. Environmental variables

Statistically-disabled (1/2)

70%-90% of all people in the world are right-handed. In practice, this means that objects & tools created by them, are more likely to better fit their needs than those of the left-handed. This is sometimes done on purpose, by coincidence, or due to pure lack of knowledge.

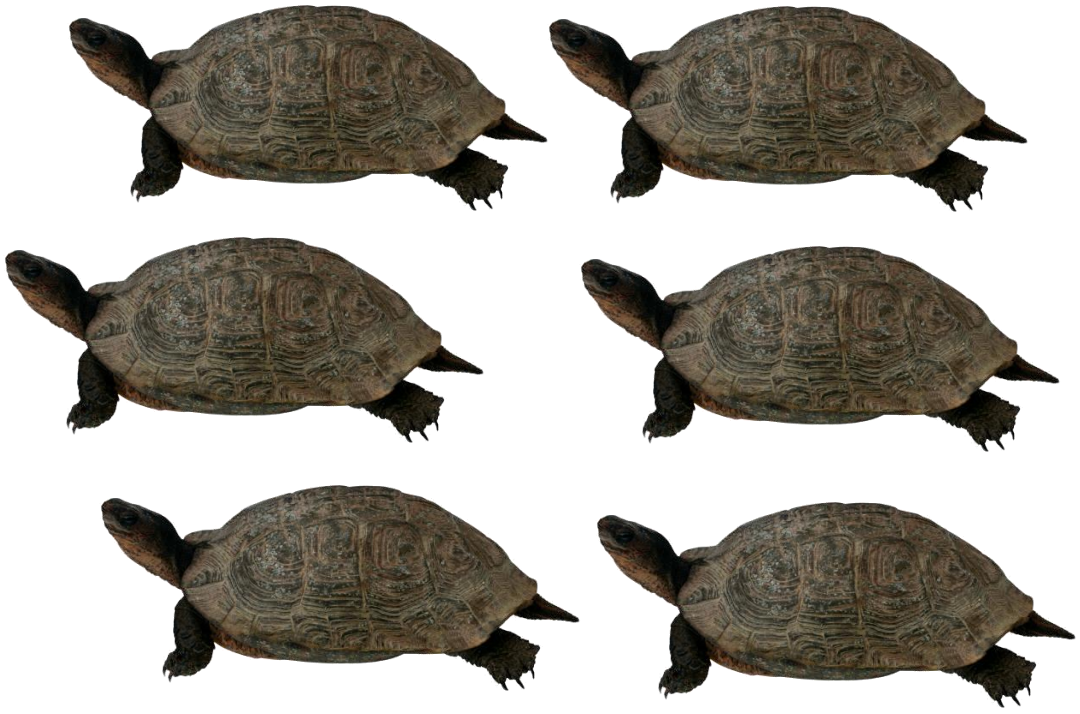
Statistically-disabled (2/2)

In other words, right-handed people (explicitly or implicitly) are constantly inducing disabilities to the left-handed, the extent & severity of which is regularly expanding, along with the continuously growing number of manmade objects in this world...

Statistically-disabled v.2 (1/3)

Exception

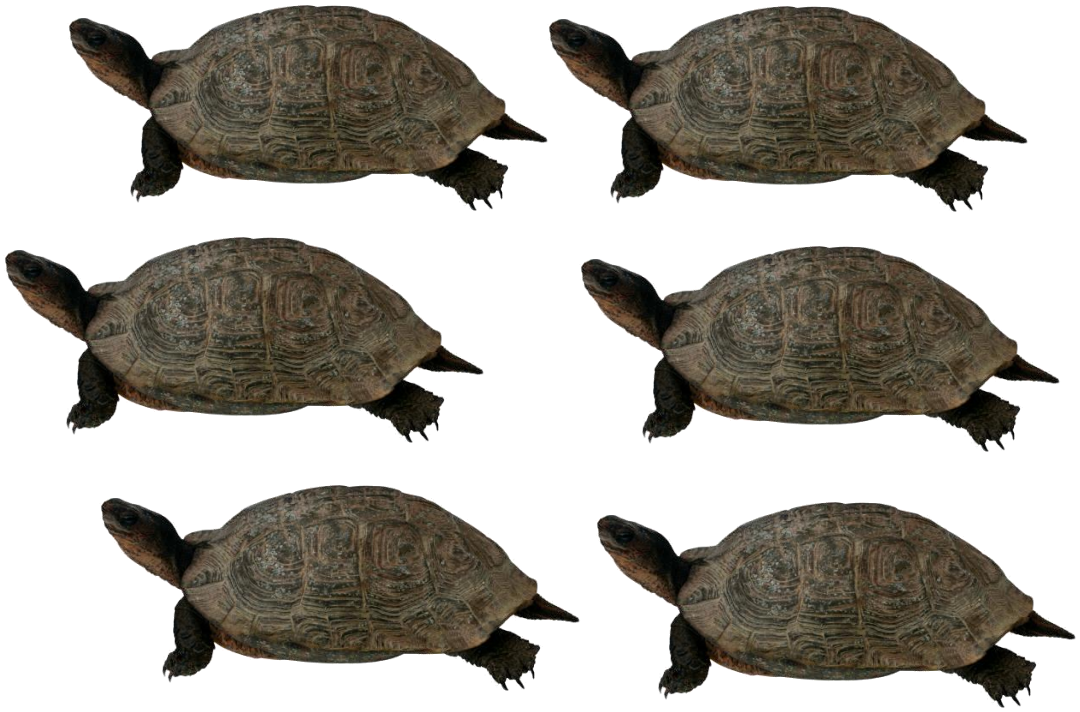
The crowd…



Statistically-disabled v.2 (2/3)

Exception

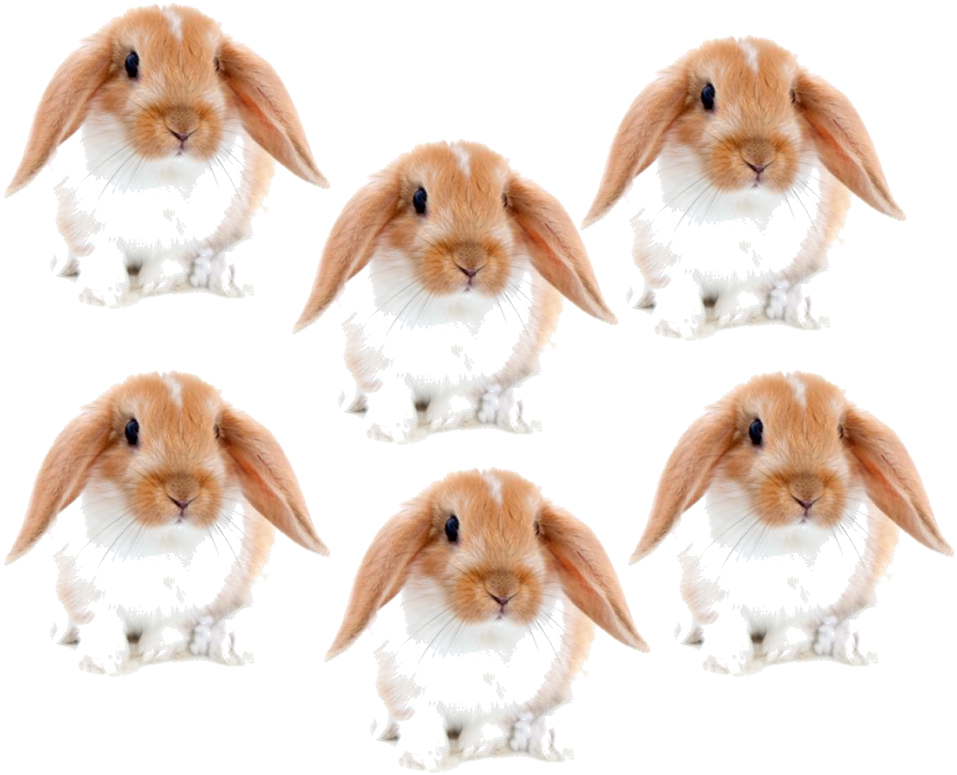
The crowd…



In a world full of tortoises, a rabbit would probably be considered as a glorious exception – an all-star athlete maybe, or something similar…

Statistically-disabled v.2 (3/3)

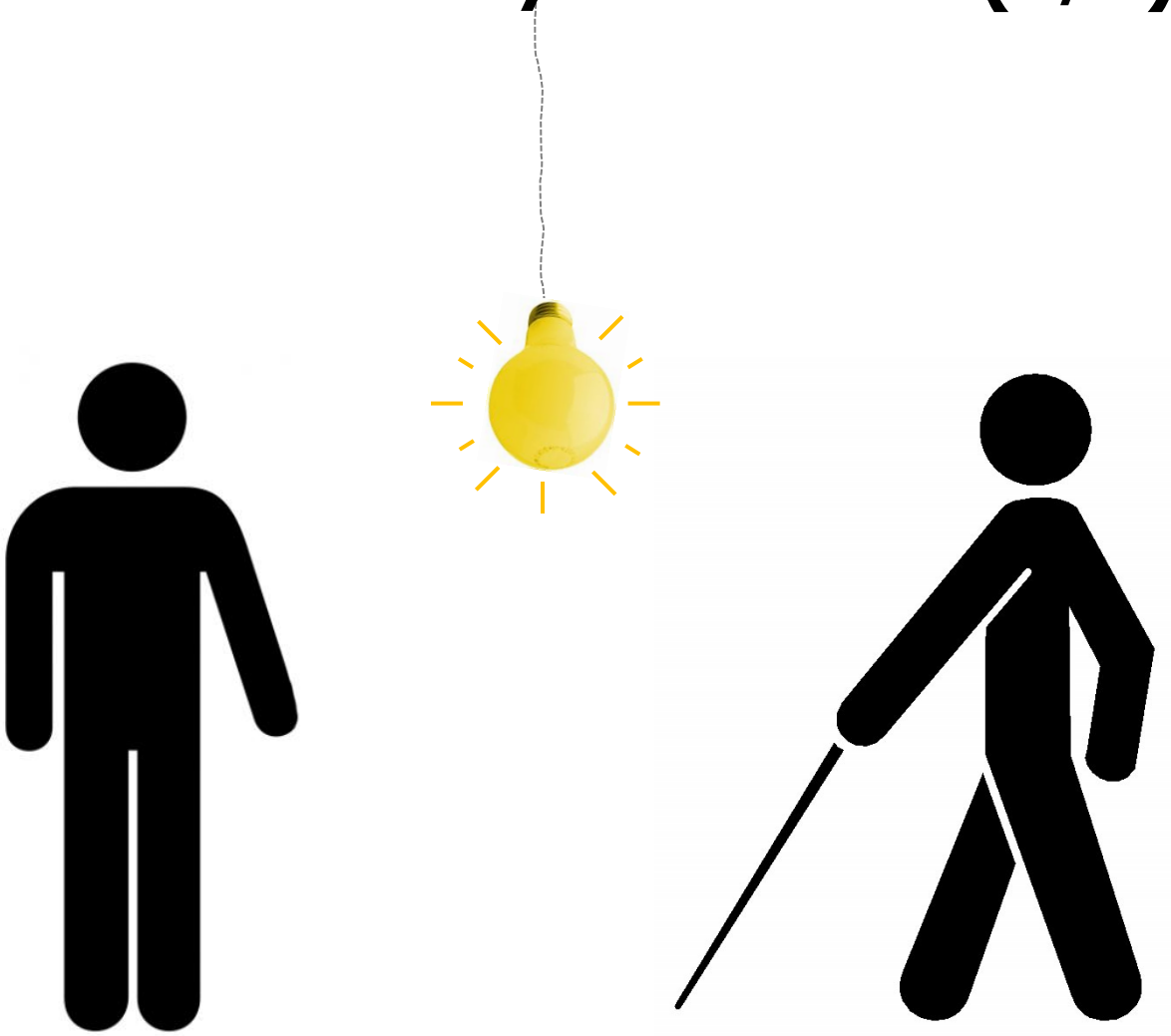
The crowd…



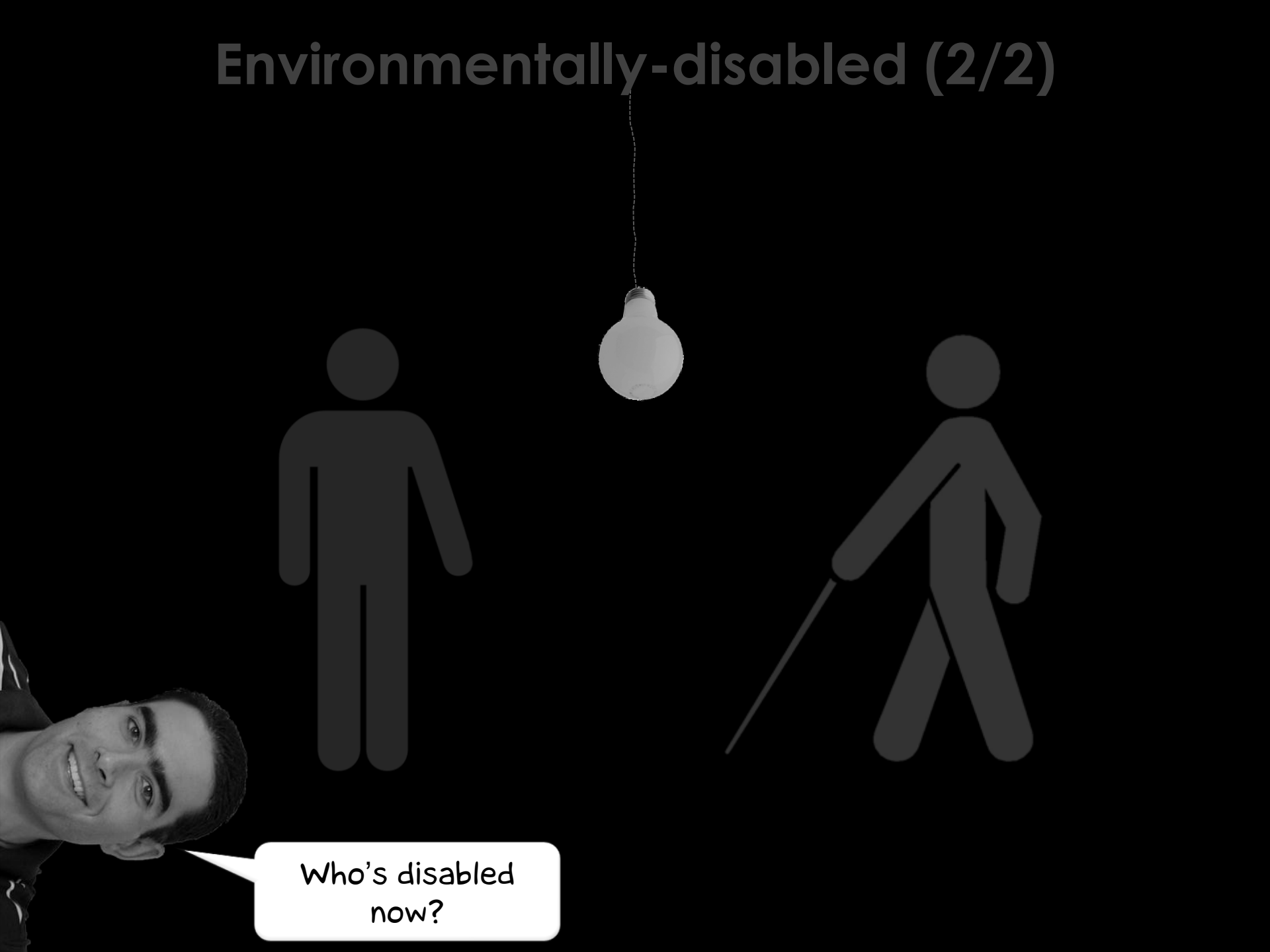
Exception

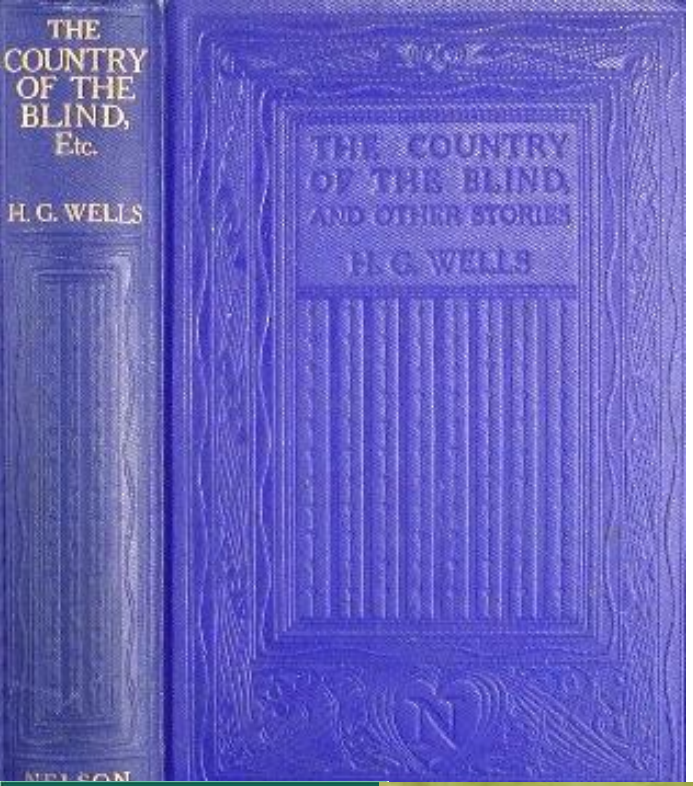
On the other hand, in a world full of rabbits, a tortoise would most likely be considered as a "speed-disabled" individual

Environmentally-disabled (1/2)



Environmentally-disabled (2/2)

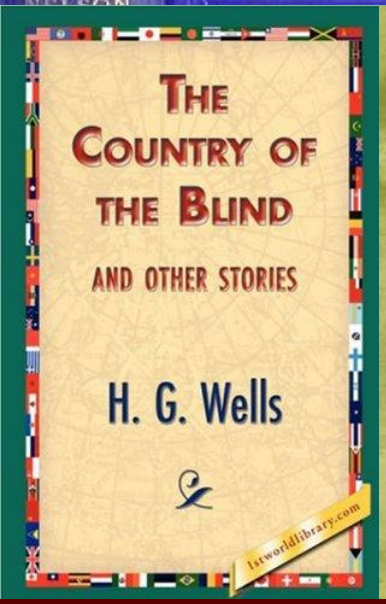


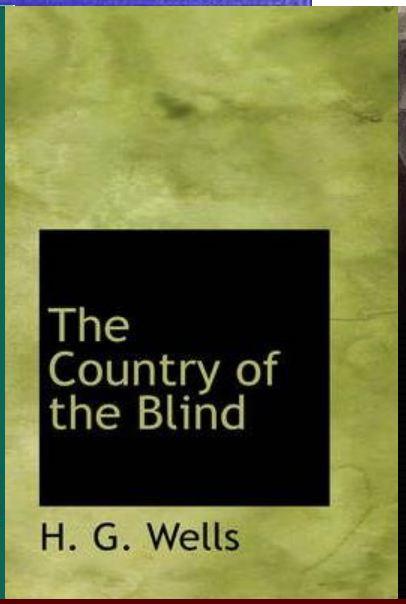


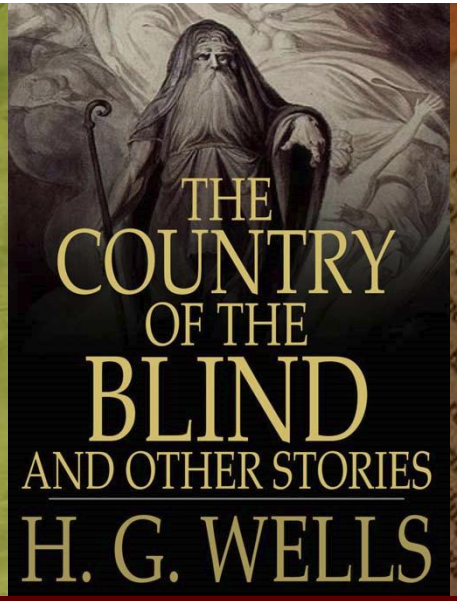
You can also read…

The Country of the Blind

by Herbert George Wells







http://en.wikipedia.org/wiki/The_Country_of_the_Blind_and_Other_Stories

Let's take one step back…

Do people with disabilities play video games anyway?

Oh, yes, they do!

And for many of them, games are a key resource for entertainment & socialization

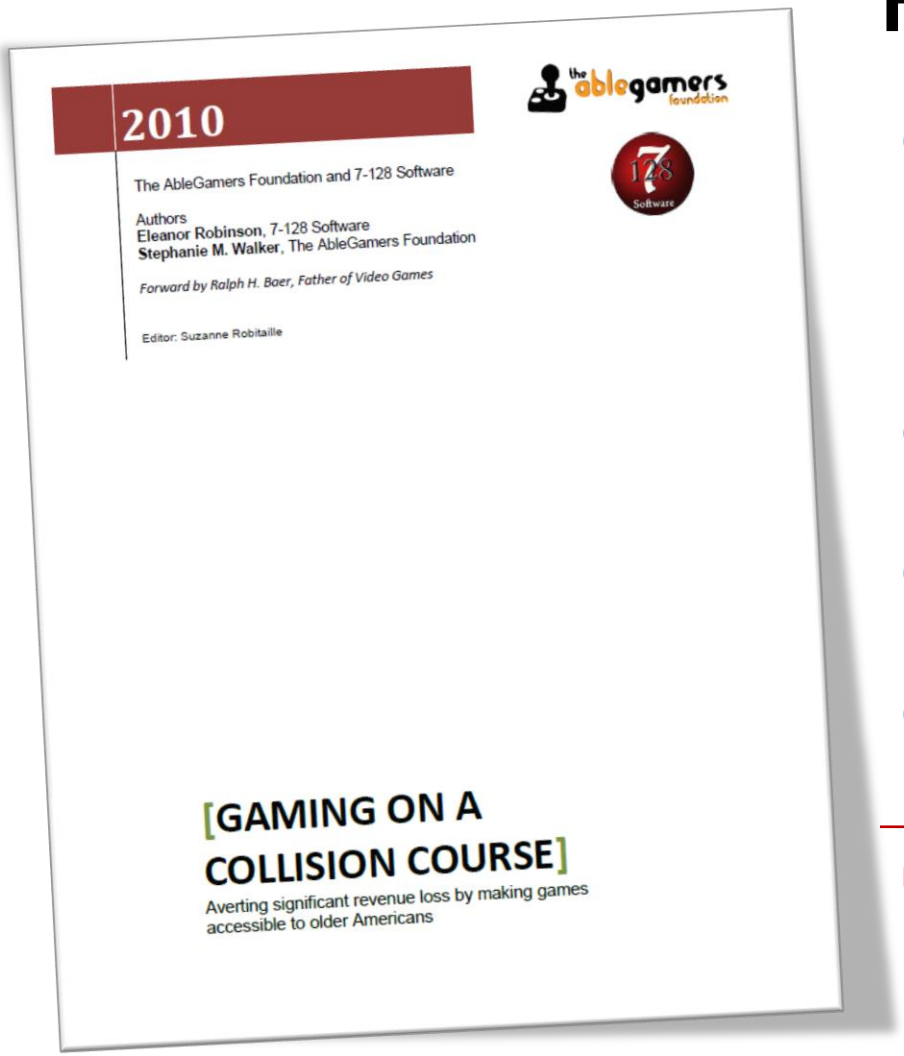
How many people with disabilities play video games?

Definitely a lot,
but no one
actually knows …

The real question

How many people
(with disabilities or not)
would
play games ?

(if they were more accessible)



Figures for the US (2010)

- Blind and Vision Impaired
  - 1.3 million Americans legally blind
  - 25 million have significant vision loss
  - 1.8 million affected by age-related macular degeneration
- Deaf and Hearing Impaired
  - 28 million
- Motion impaired
  - 8.2% of the population has a physical disability
- Cognitively Impaired
  - 4.8% of the population has a mental disability

➡ 32.5 million gamers have some disability that weighs into their game purchasing decisions

✓ **$3 billion of potential revenue**

Gaming on a Collision Course: Averting significant revenue loss by making games accessible to older Americans (2010)
Eleanor Robinson, 7-128 Software
Stephanie M. Walker, The AbleGamers Foundation
http://ablegamers.org/publications/Gaming_on_a_Collision_Course-AGF-7128.pdf

Disabilities affecting GA

- Vision
- Motion
- Hearing
- Cognitive
- Speech
- Illiteracy

- Age-related disabilities are frequently referred to as a separate category
  - all related problems fall within some of the above categories

Disabilities affecting GA

- Vision
- Motion
- Hearing
- Cognitive
- Speech
- Illiteracy

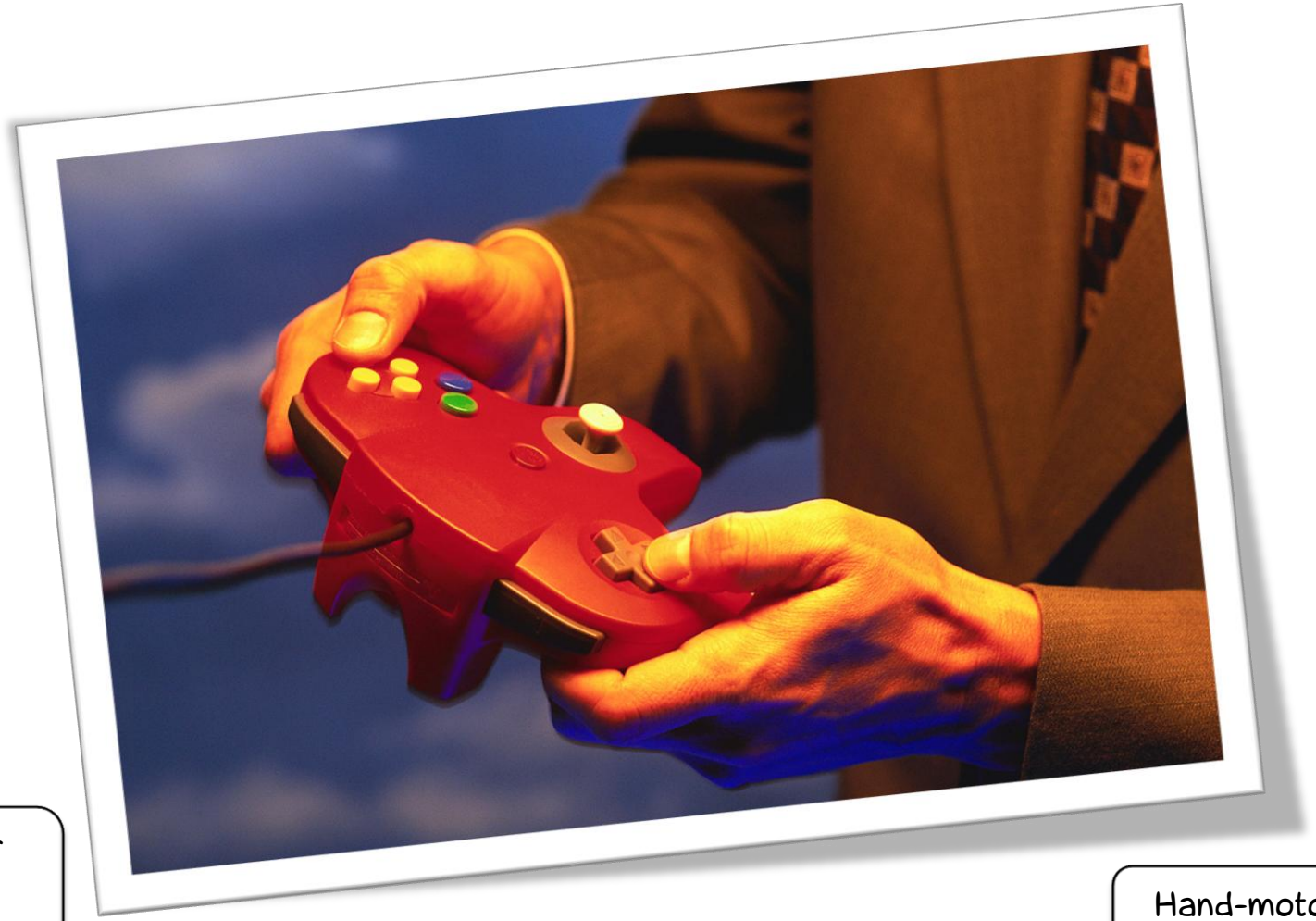
Although illiteracy is not a physical disability per se, it can have considerable impact on game accessibility

Typical GA problems

- Providing input
- Receiving feedback
  - And properly processing & understanding it…
- Determining what to do

- May range from annoying to making playing impossible

Providing input



Teenager with no disabilities

EASY

Adult

CHALLENGING

Novice player

HARD

Hand-motor impaired

IMPOSSIBLE

Receiving feedback

Perfect vision

EASY

Elderly

CHALLENGING

Low-vision

HARD

Blind

IMPOSSIBLE

Processing & understanding feedback

Perfect vision + using big TV

EASY

Mobile phone

CHALLENGING

Mild cognitive impairments

HARD

Color-blind

IMPOSSIBLE

Determining what to do

Expert strategy games player

EASY

Novice player

CHALLENGING

Me

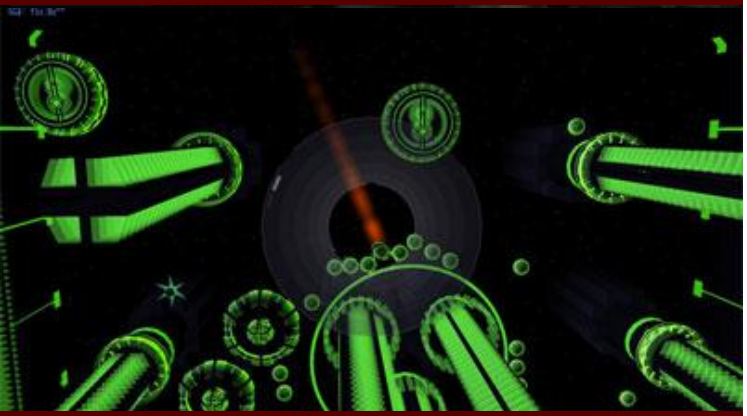
HARD

Cognitive impaired

IMPOSSIBLE

World of Warcraft (Blizzard Entertainment)

Doom3 [CC] mod by Games[CC] for Doom 3 (id Software)



Strange Attractors 2 (Ominous Development)

What kind of games?

- "Mainstream" commercial games
  - PCs, consoles, mobile, on-line, …
  - No particular accessibility considerations – various types of "adaptations" employed
- "Special" games
  - Developed to be accessible by specific user categories
    - One-switch, audio-only, etc.
  - Commercial (usually Indy) or public domain

http://kotaku.com/5082293/handicapped-ps3-owner-builds-frankensteins-controller

http://www.gamesaccessibilityday.org/

http://www.eelke.com/blindhero.html

How?

- Very often, with great difficulty
  - A lot of patience, extraordinary dedication & passion
- "Adaptations"
  - Special devices
    - Commercial
    - Custom- (home)-made
  - Special software
  - Hacking & tricks
  - Help of another person

A. Adapting non-accessible games (1/3)

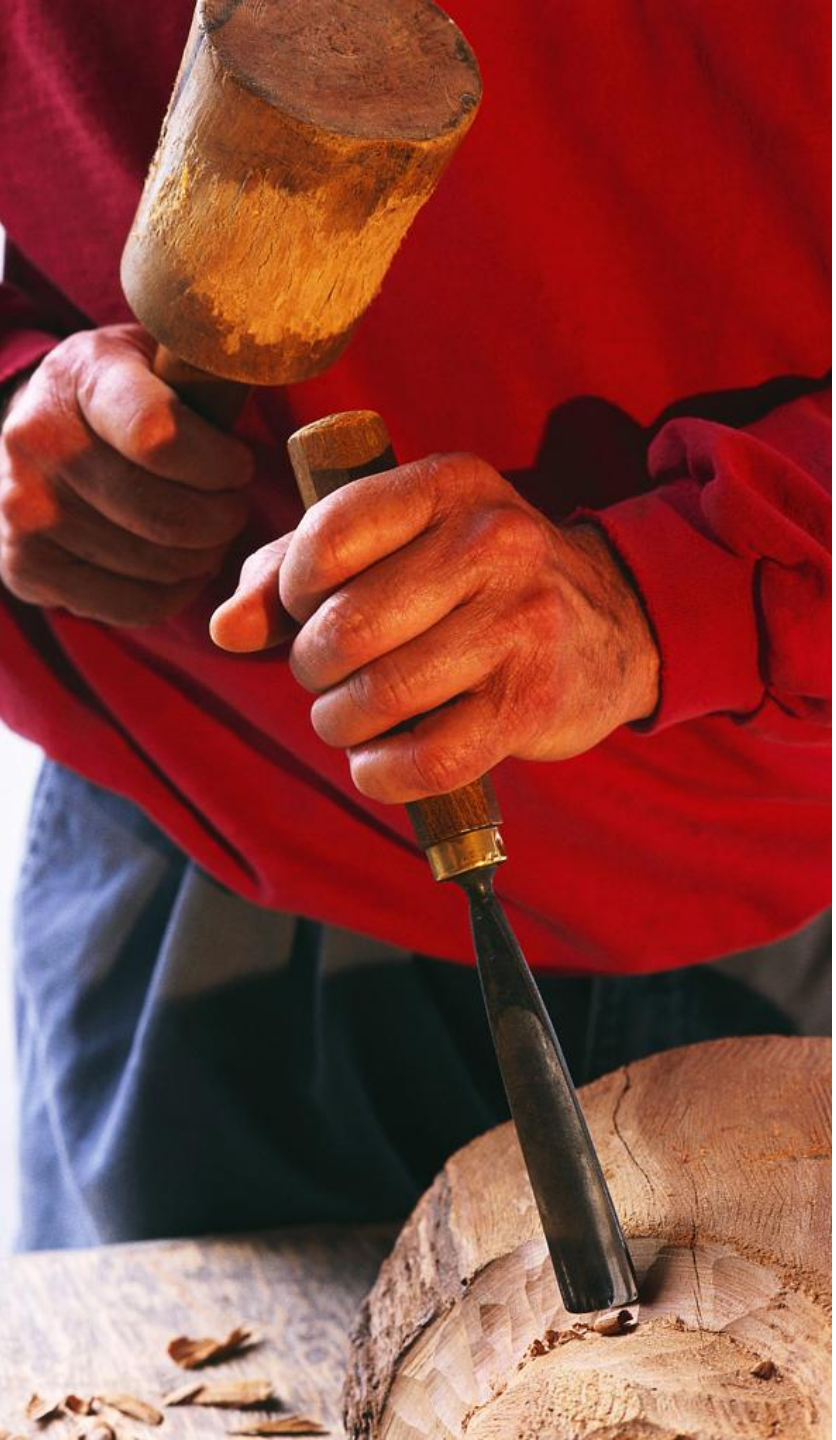
… is a little bit like kissing a frog hoping that it will become a prince.

A. Adapting non-accessible games (2/3)

- Limited accessibility
  - poor interaction quality / usability
- (Often) only part of the functionality accessible
  - e.g., play the game with limitations (only run & shoot)
- Longer interaction times
- No upward compatibility
- Approach limited to reproducing the offered functionality

A. Adapting non-accessible games (3/3)

- If a game is not purposefully designed to be played using "accessibility features"
  - ➡ there is a good chance that it might be accessible, but not fun to play…



B. Creating special games

- Sometimes, the only solution…
- Main drawbacks
  - Cost vs.
    game quality vs.
    return of investment
  - Risk of social exclusion
    - due to segregation between able and disabled gamers
      - Even among disabled gamers

The Video Games Industry

The myth of the "average" player

- Game designers often target a fictitious character
  - With a specific range of characteristics
    - He (yes he is male)
      - can press up to Z buttons
      - can make a selection by holding his hand still at a specific position for exactly T seconds
      - can read Q point-sized fonts from N meters distance (irrespective of the size of his monitor!)
      - can read X words in Y seconds
      - always plays with the sound on
      - etc.
- "One size fits all" game design

Not very uncommon "design" practice

- Build it first & then find what is wrong with it…
  - Often stuck with bad design decisions that cannot change in the future
    - Since it will take or cost too much

The Games Industry Approach (1/5)

The Games Industry Approach (2/5)

If the game industry was a restaurant, then it would be one serving just one type of food; let's say cheeseburger with fries. For everyone - this is it. You cannot have anything else, not even variations of the burger.
And the fries are not optional...

The Games Industry Approach (3/5)

The Games Industry Approach (4/5)

The Games Industry Approach (5/5)

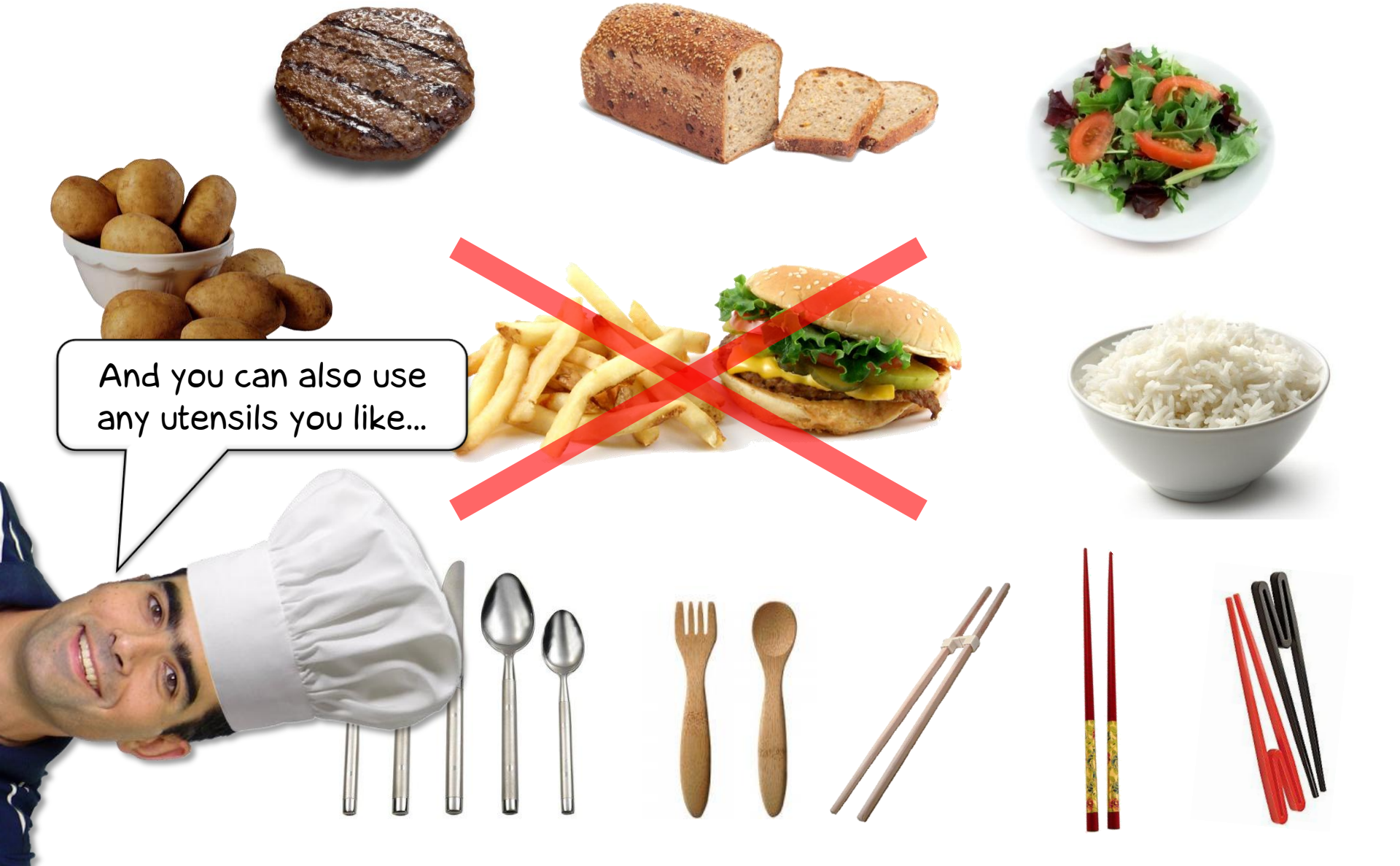
Current GA Approach A: Adaptation

Following the first approach mentioned earlier (i.e., adaptation of non-accessible games), some people come and say: "Unfortunately we cannot do something about the food, but we can provide you with a larger variety of utensils that better fit your needs."

Current GA Approach B: Specialization (1/2)

The second approach (development of "special" games), goes: "We cannot cook something as complex as a cheeseburger, but we can use some of its ingredients (or even other) to create simpler plates that are appropriate for your diet, so that at least you will not starve...

Current GA Approach B: Specialization (2/2)



Alternative Approach? (1/3)






But, since we already have all these various ingredients & utensils at hand, why can't we follow an alternative approach to cooking?

Alternative Approach? (2/3)





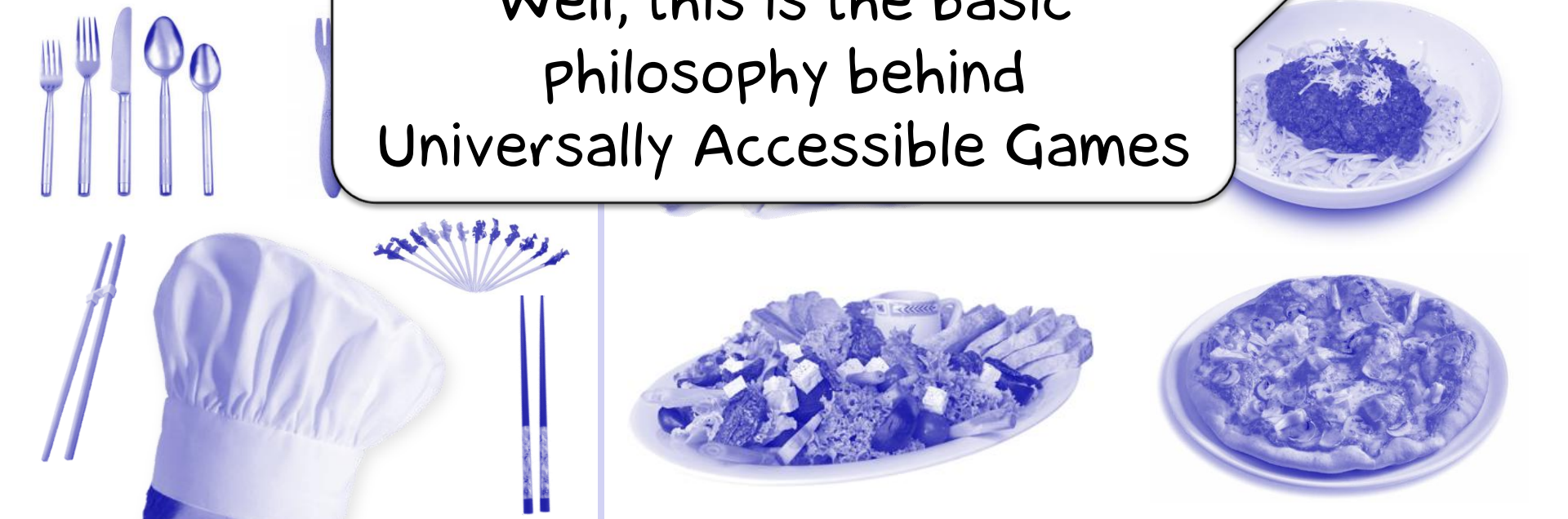





Why not mix ingredients in various ways, so that we can serve a much larger assortment of meals, meeting the needs of as many people as possible?

Alternative Approach? (3/3)

Well, this is the basic philosophy behind Universally Accessible Games



Why not mix ingredients in various ways, so that we can serve a much larger assortment of meals, meeting the needs of as many people as possible?

Universally Accessible Games

UA - Games

Universally Accessible Games

- Follow the principles of Design for All
  - can adapt to different individual gamer characteristics
- Can be concurrently played among people with diverse requirements
  - If possible, even while sharing the same gaming device

Vision

- **All people** will be able to **play** and have fun **together**
  - collaborating, or competing
- On an **equal basis**
  - irrespective of
    - individual characteristics
    - preferences
    - technologies used

Key Characteristic

- A UAG can adapt its:
  - a. interface
  - b. gameplay
  - c. content
- ➡ to best serve the requirements of each gamer
  - ✚ under specific gaming conditions

UA-Games vs. Serious Games

- Serious Games
  - games that, in the broader sense, "educate" (or promote ideas)
- 3 key qualities of education:
  - **Individualization**
    - of content & delivery method
      - learner-centered design
  - **Equality**
    - All learners have the right to access the "same" educational content
      - in terms of both quality & quantity
  - **Social setting**
    - That's where education works best
- The same qualities that UAGs strive for, in computer games

Games & Fun

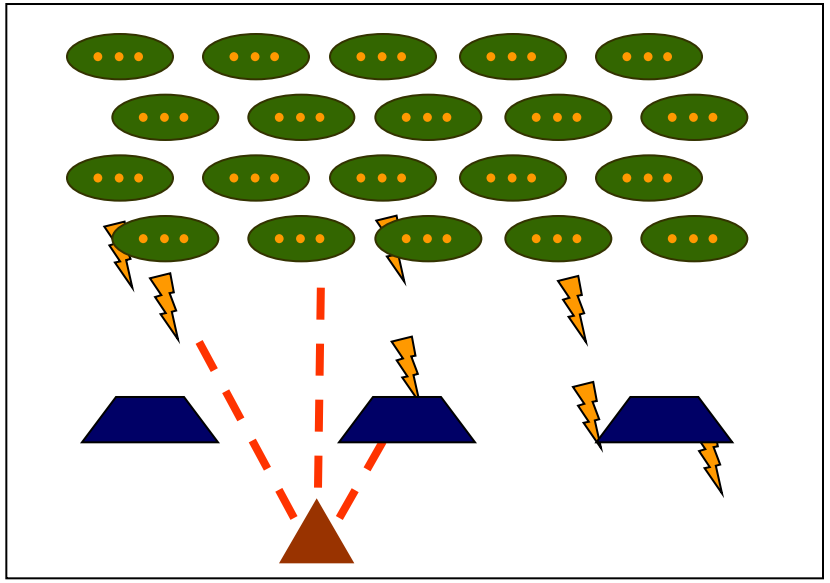
- People most often play games to have fun
- What is "fun"?
  - "what provides amusement or enjoyment"
    - Merriam-Webster
- Important thing about fun
  - It is highly subjective
    - Some people find solitaire fun, while others blasting hordes of gun-packed aliens

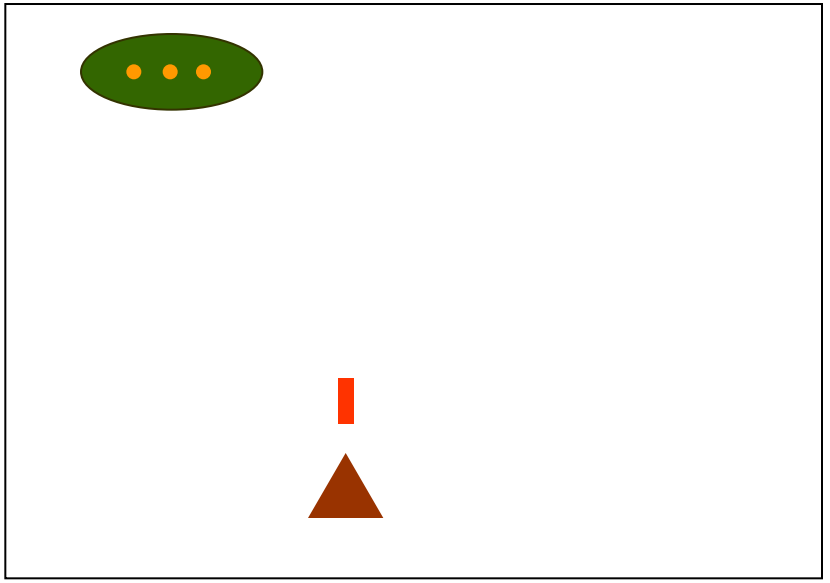
Challenge

- Usually where fun comes from
  - Beating the clock, gaining money, capturing the flag, shooting the aliens, eating the dots, …
  - Each and every game has one or more challenges
    - Mental, physical, or both
    - May range from trivial to impossible
- As with fun, what is a challenge is highly subjective
  - When designing UAGs, alternative levels (& types) of challenge should be supported

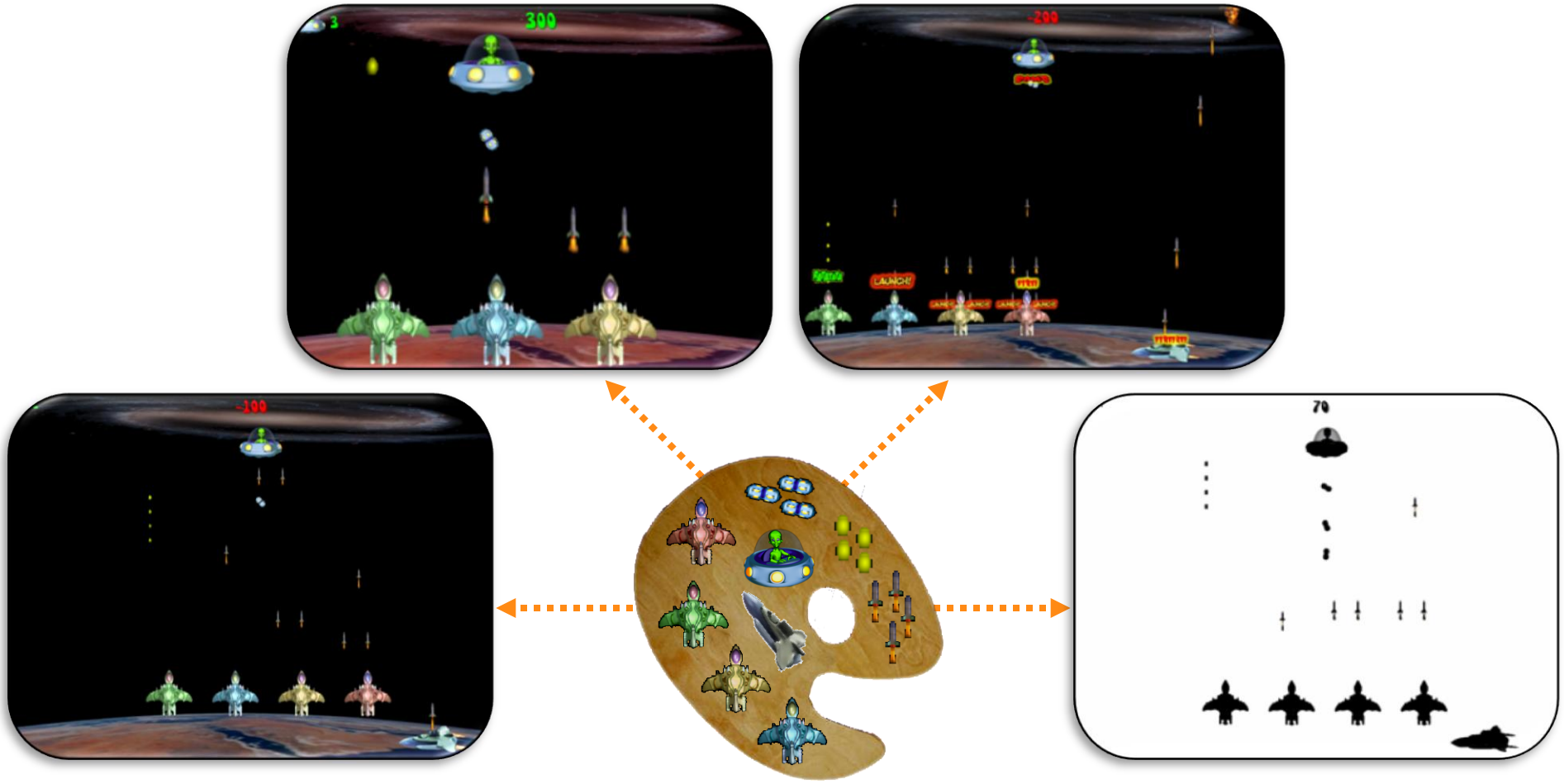
Diversity in game challenge example

Different people may have a different view on what is a challenging game and what not





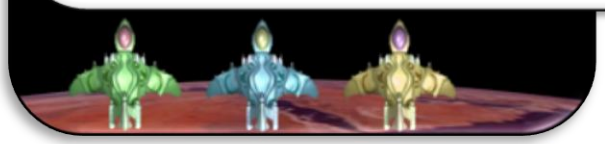
Design Philosophy (1/2)

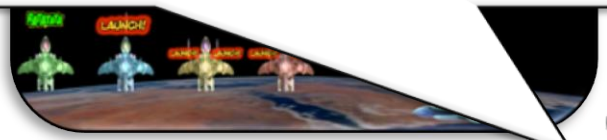


Design Philosophy (2/2)

Instead of creating a monolithic game for everyone, we employ a "palette" comprising all game elements.

Then, depending on the current player, we selectively pick the most suitable elements, also appropriately adapting their attributes, in order to render a fully personalized version of the game.





Overview of GA Solutions (1/5)

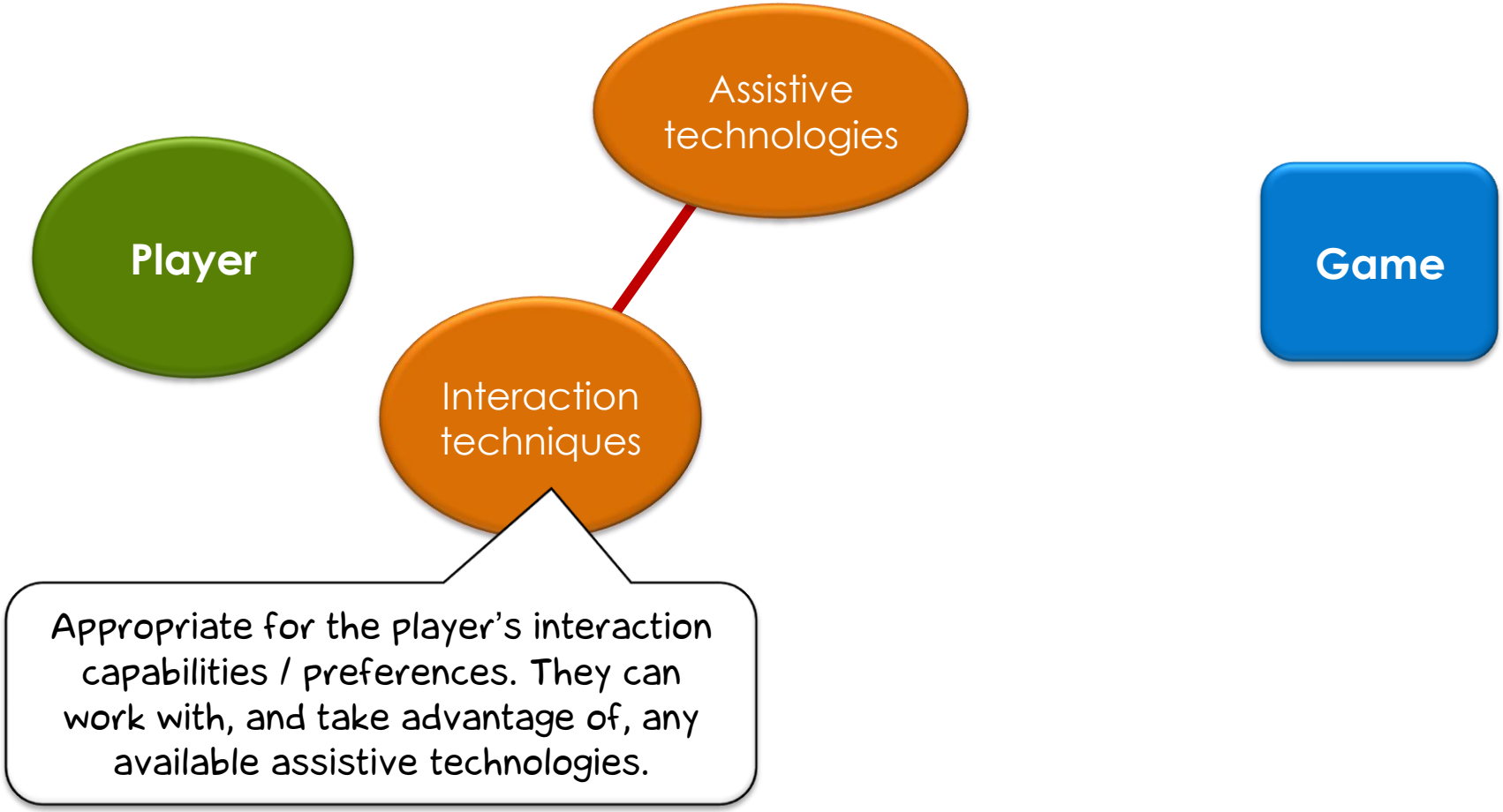
As a designer, there are 3 complementary tools that you have at hand, when you want to make a game accessible to a specific player.

Player

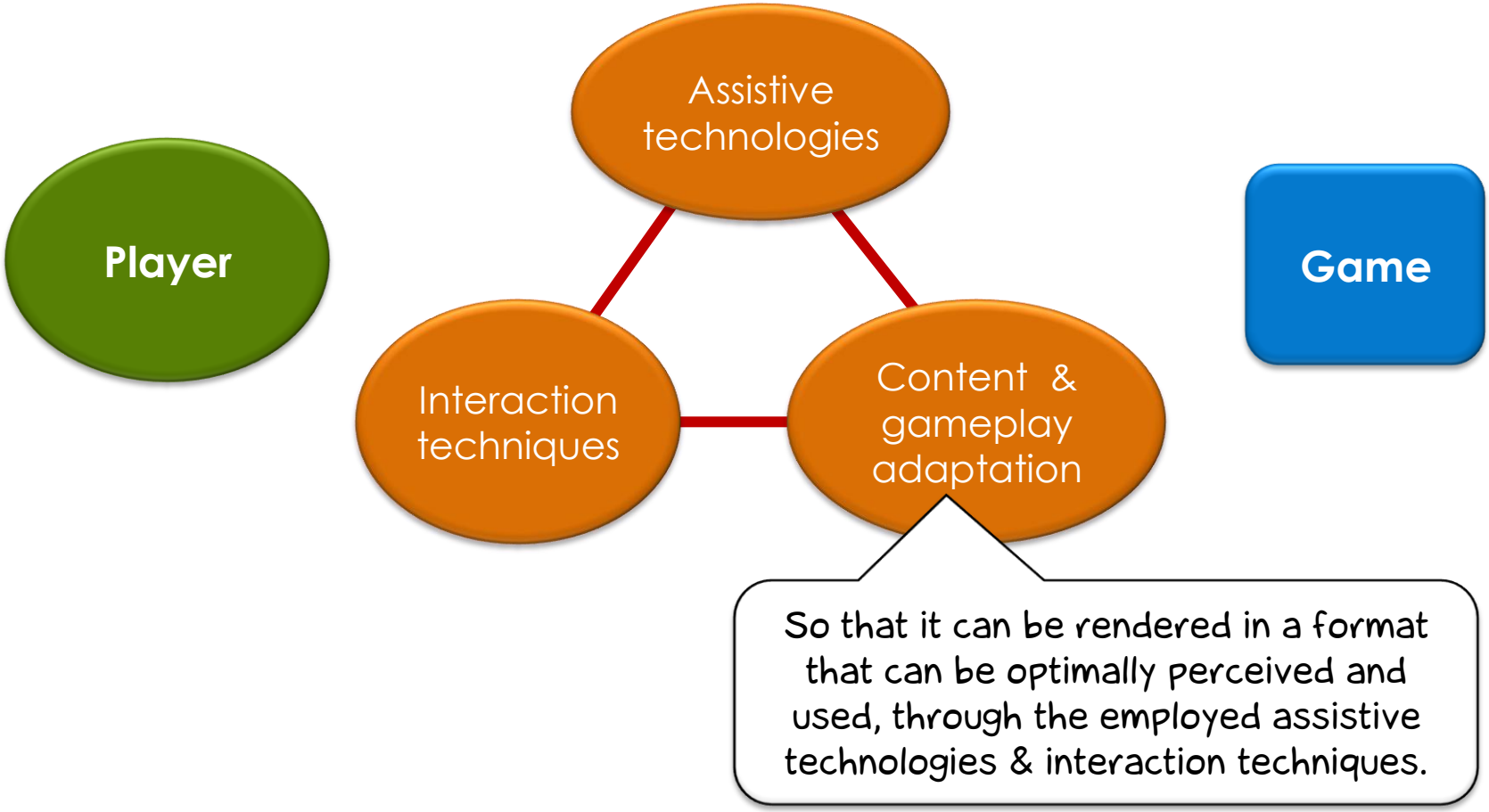
Game

Overview of GA Solutions (2/5)

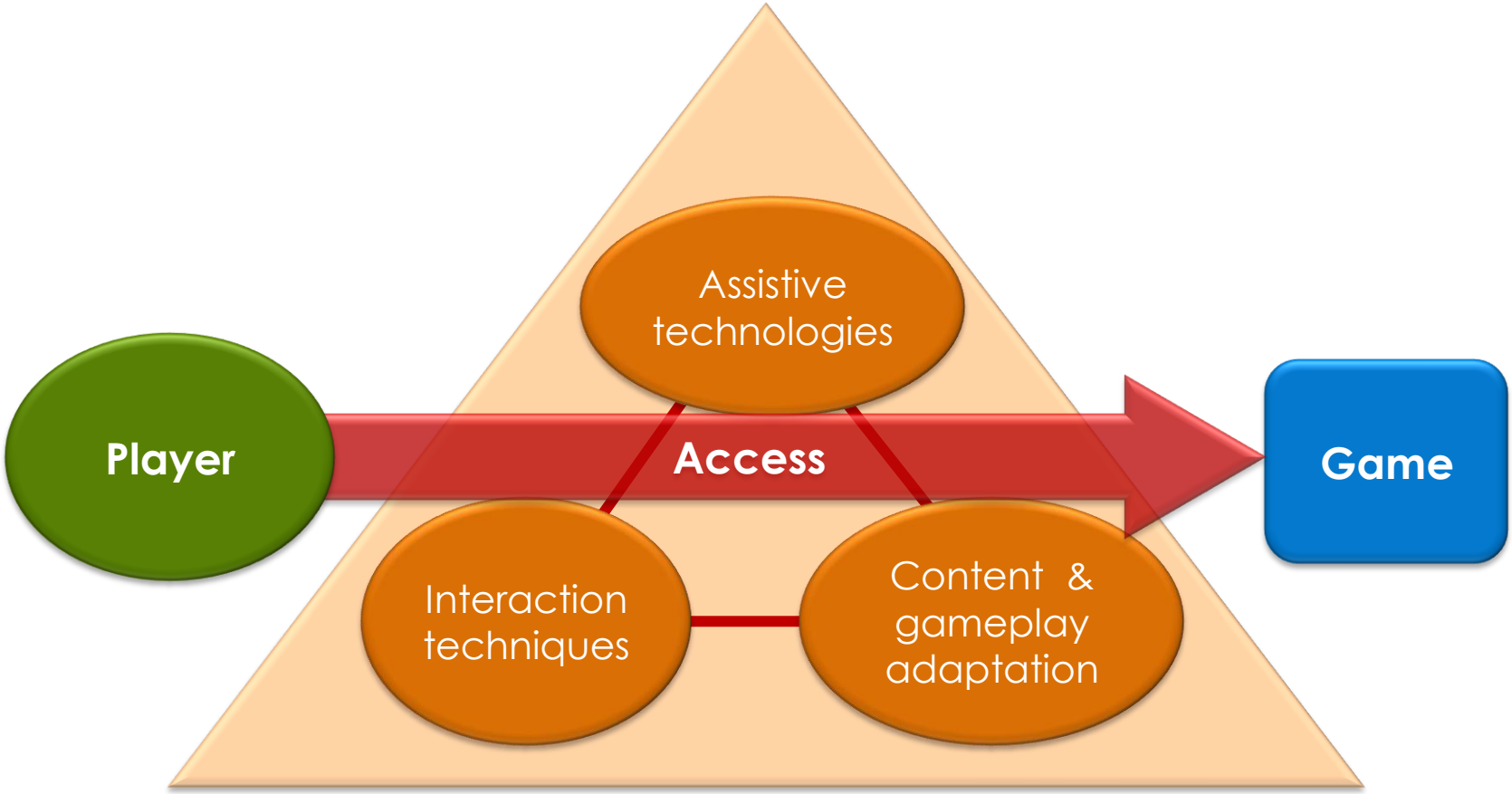
Overview of GA Solutions (3/5)



Overview of GA Solutions (4/5)



Overview of GA Solutions (5/5)



The right mix of these 3 ingredients can potentially solve any accessibility problem.

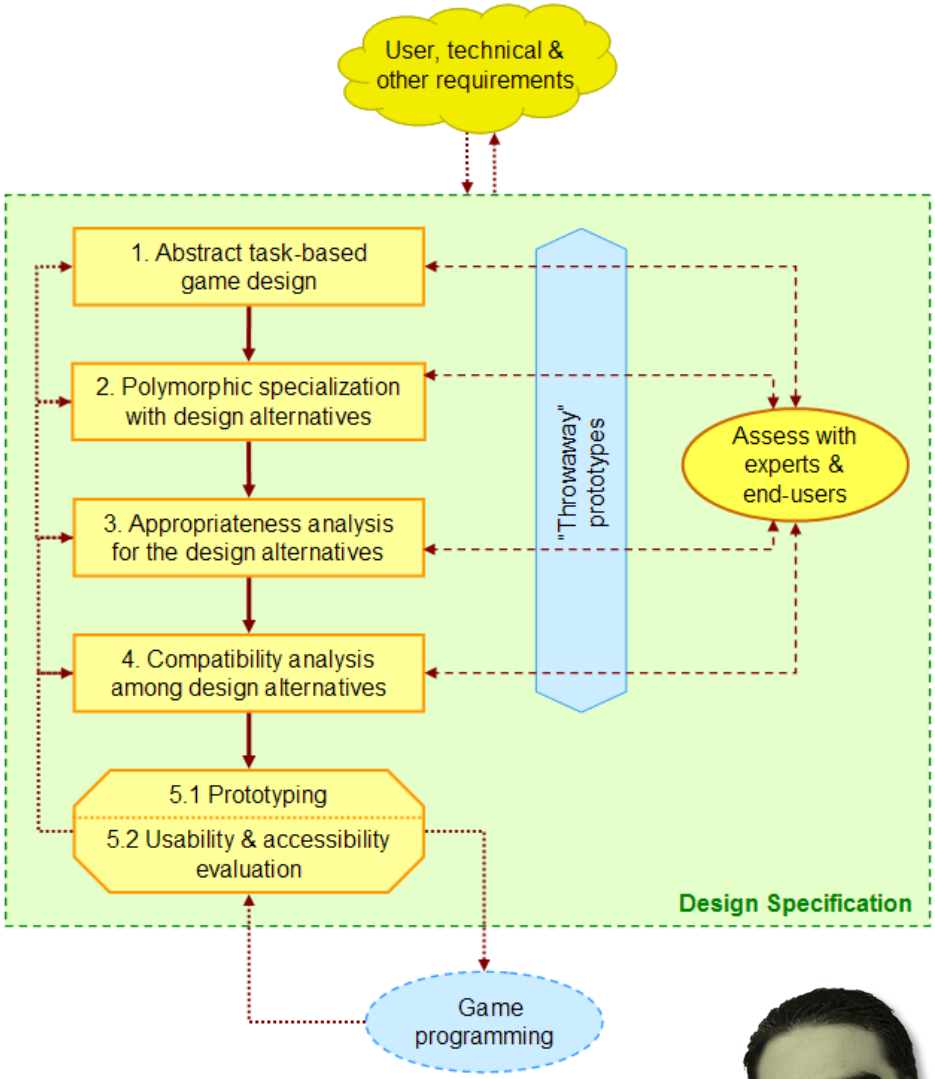
The good news…

- Although there are several different user categories and contexts of use, they share many similarities & requirements
  - a deaf person,
    someone in a noisy place,
    playing with muted sound
- Most of the time, when designing for GA, a single solution is likely to accommodate multiple problems & situations

Like solving a crossword

The more words you fill in correctly, the more additional ones are “automatically” revealed…

Unified Design Method



See also: Unified Design of Universally Accessible Games (Say What?)
http://www.gamasutra.com/features/20061207/grammenos_01.shtml

Simple Design Example

Design Goal

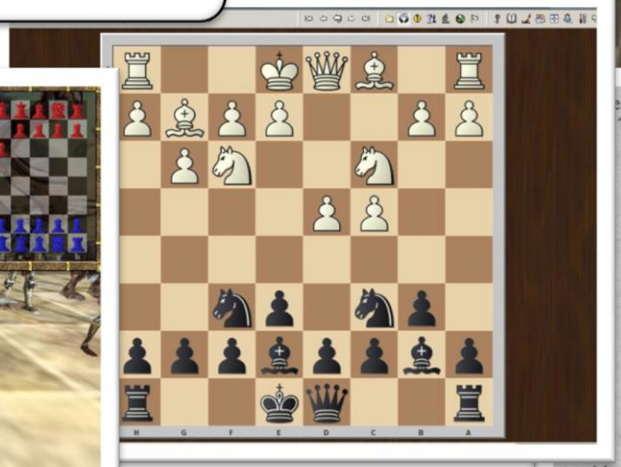
- Create a computer-based chess game accessible by people with a profile that combines any of the following
  - Vision
    - Full, low, blind
  - Hand-Motor
    - No impairments,
      can use multiple switches,
      can use single switch
  - Cognitive
    - No, mild
  - Computer expertise
    - Novice, expert

Chess

This is what most people usually imagine when they think of chess

Forget the way & medium used to play it

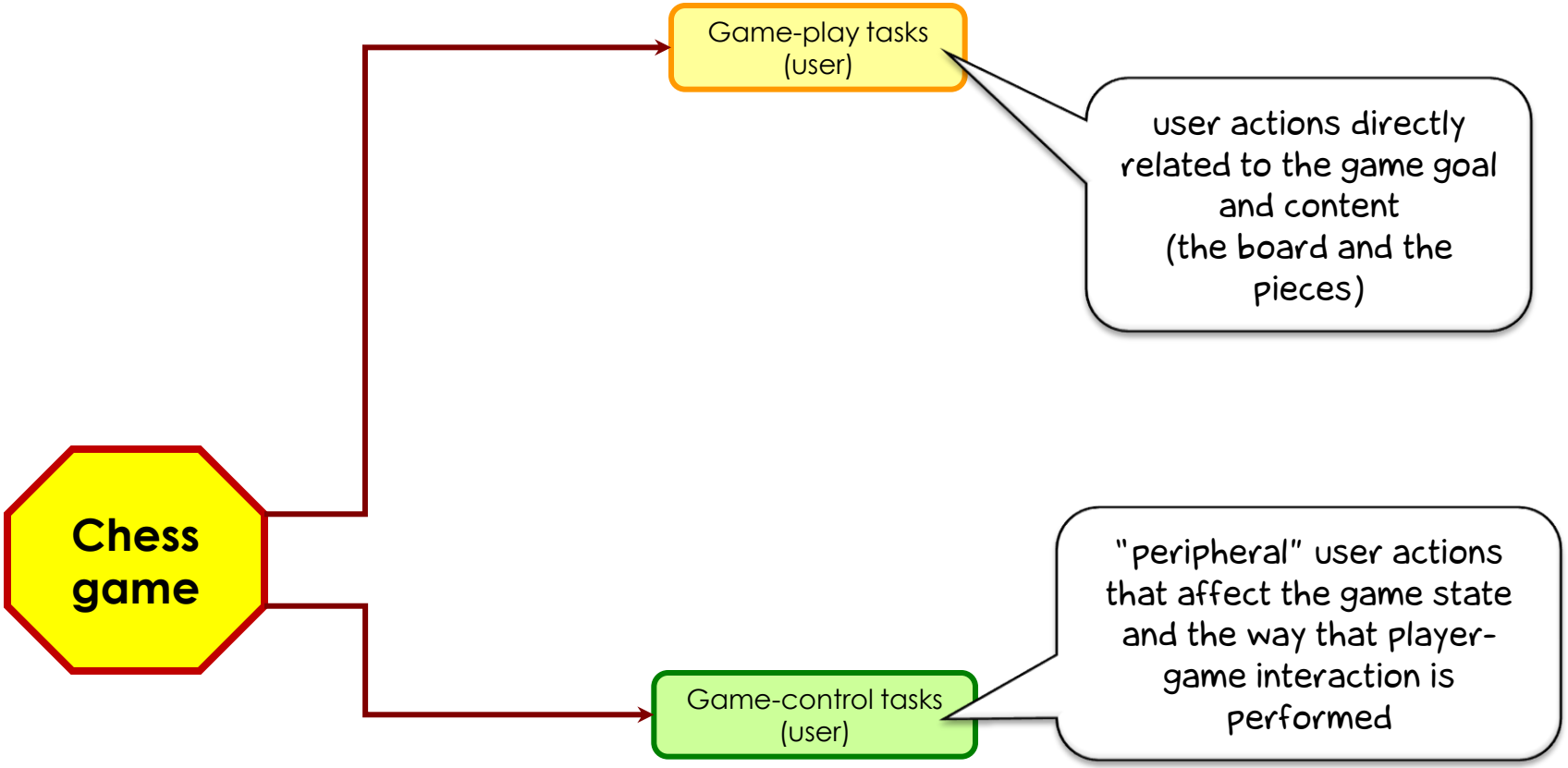
But, all these are alternative forms of chess too....



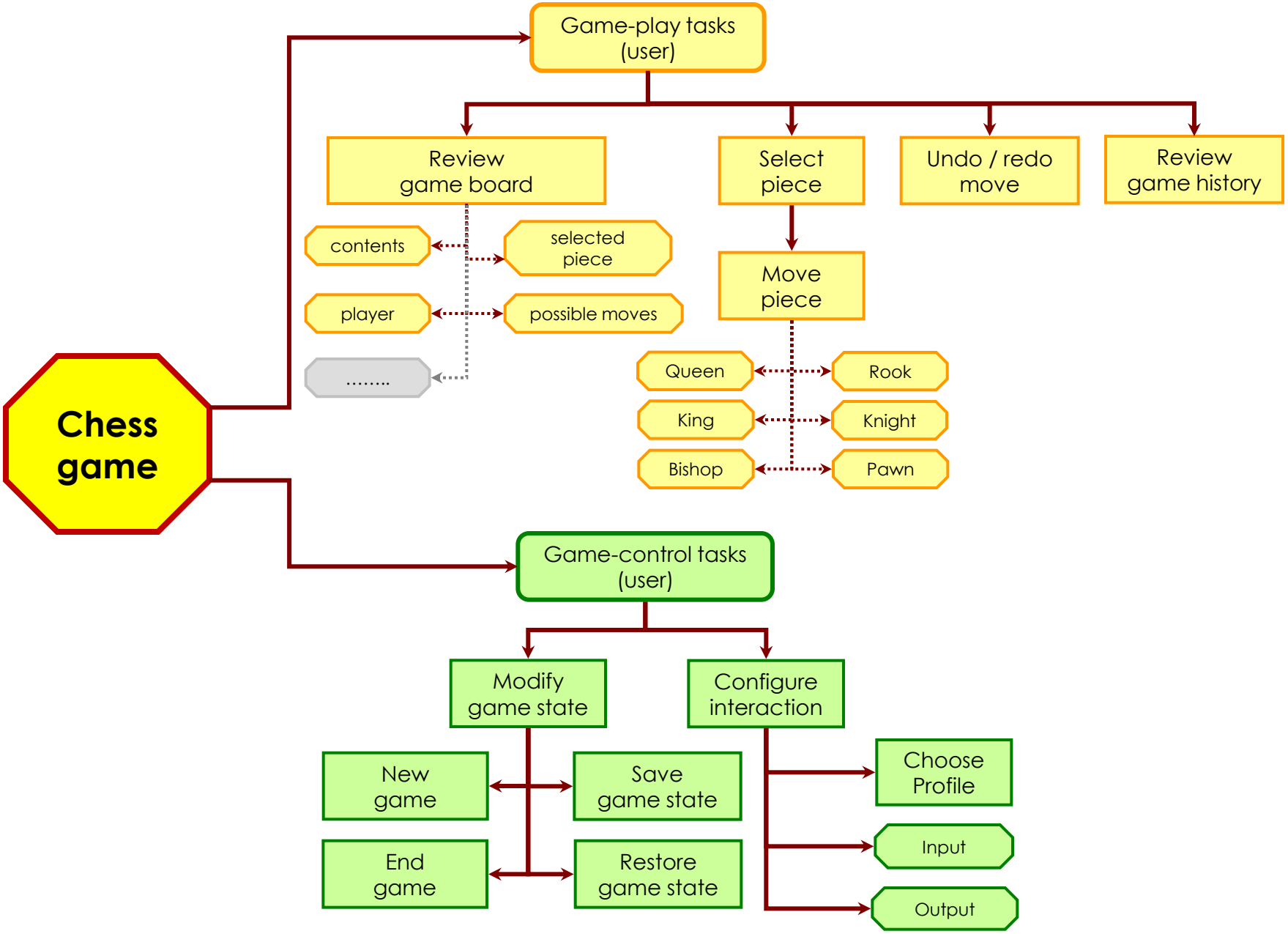
Step 1: Abstract task-based game design

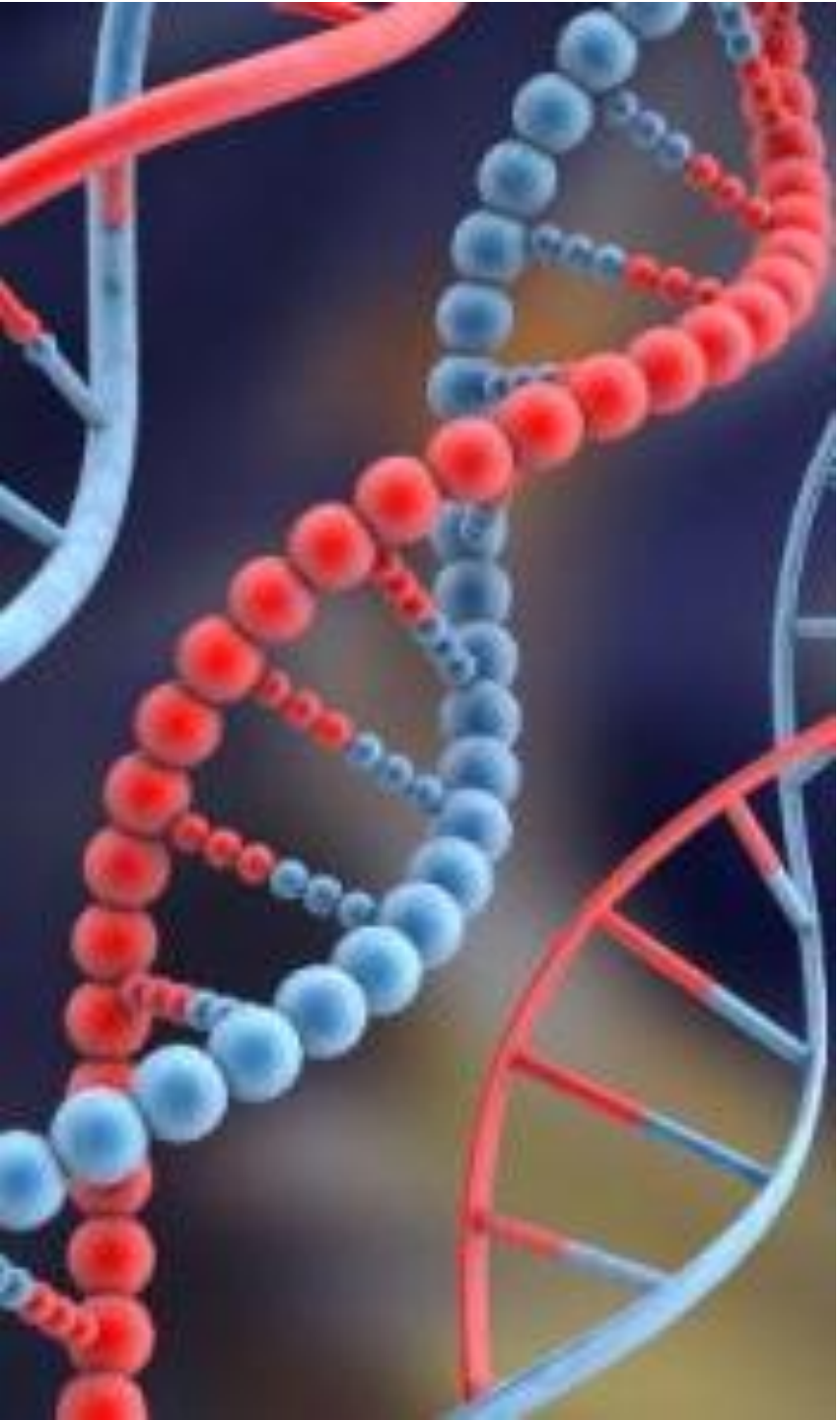
- Breakdown the high-level tasks performed by people when playing the particular game
  - the things they do
  - the things they act on
  - the things they need to know
  - irrespectively of the medium they use to play it

Step 1: Abstract task-based game design (1/2)



Step 1: Abstract task-based game design (2/2)

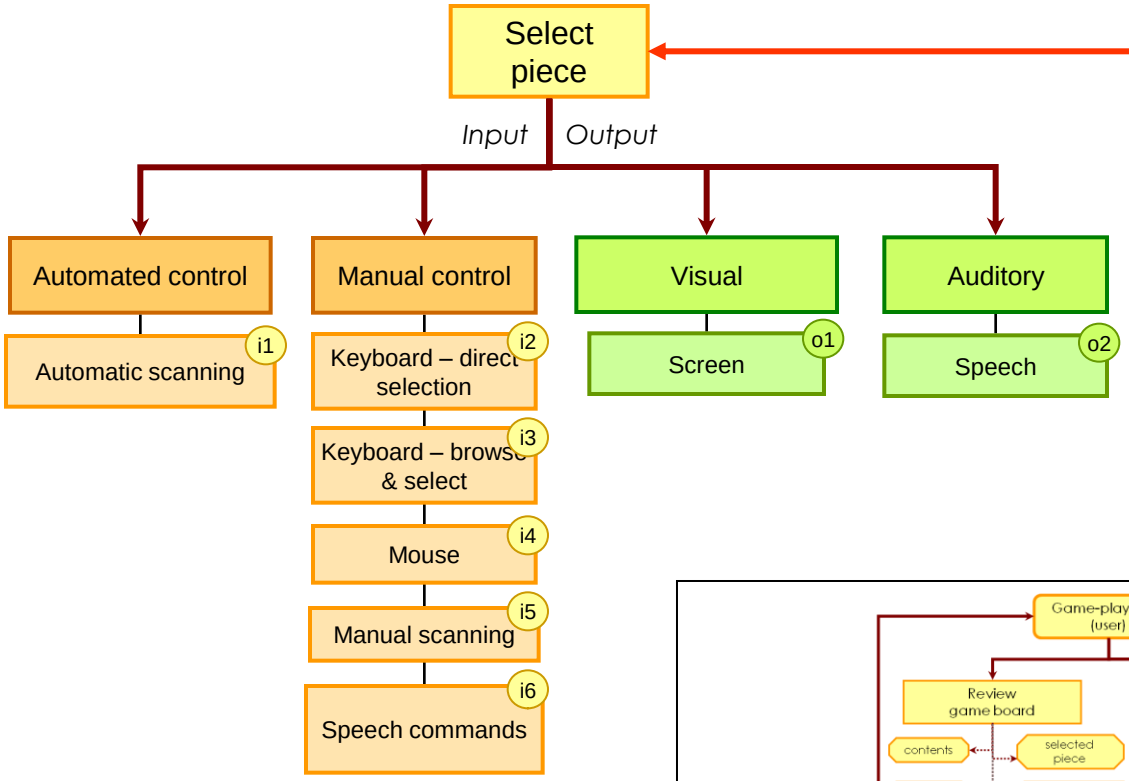


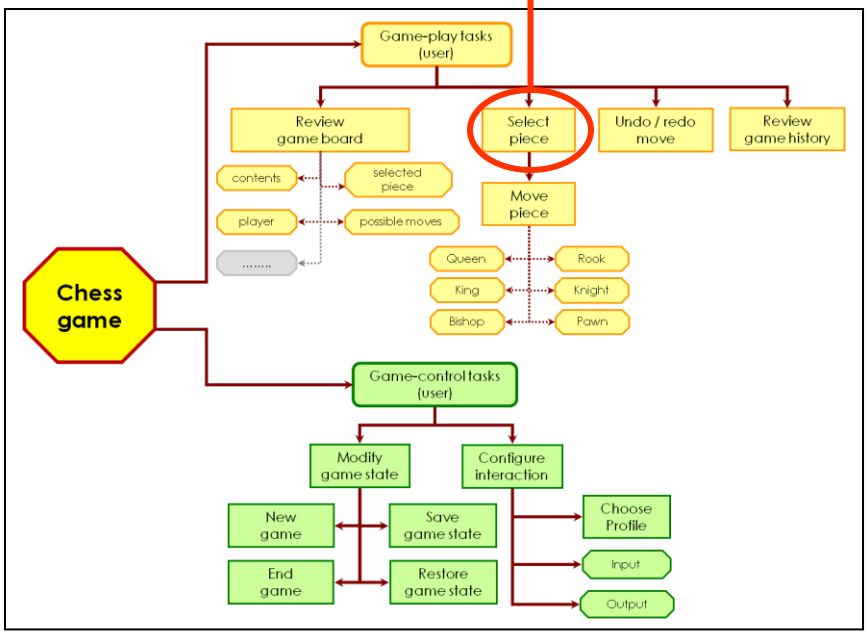


Step 2: Polymorphic specialization with design alternatives

- Map tasks resulting from Step 1 to (multiple) low-level, physical alternative interactive designs
- Identify potential accessibility barriers for each task when performed by a particular user group
  - Select suitable alternative interaction methods and modalities

Step 2: Mapping abstract task "Select piece" to alternative low-level, physical, alternative interactive designs

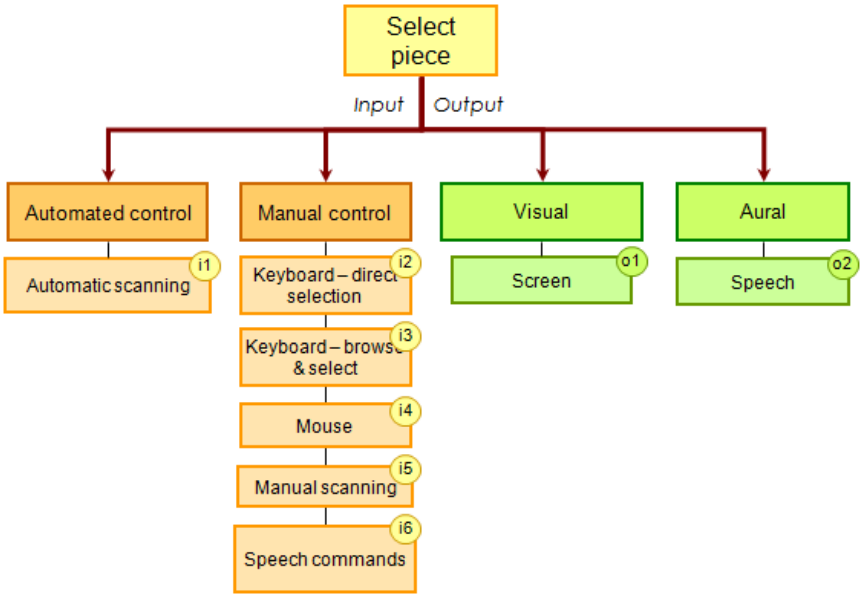




Step 3: Appropriateness analysis for the design alternatives

- Identify the perceived appropriateness of each selected design alternative for every user attribute
- By:
  - reviewing related literature
  - using previous know-how in the field
  - asking domain experts and representatives of the target user groups

Step 3: “Select piece” task appropriateness analysis



	Design alternatives							
User attributes	i1	i2	i3	i4	i5	i6	o1	o2
Full vision	=	=	=	=	=	=	✓	↑
Low vision	↓	↑	↑	↓	↓	✓	↓	✓
Blind	↓	↑	✓	×	↓	✓	×	✓
No hand-motor impairment	↓	✓	↑	✓	×	✓	=	=
Uses multiple switches	↓	×	↓	×	✓	✓	=	↓
Uses single switch	✓	×	×	×	×	✓	=	↓
Mild cognitive impairment	↓	↓	↓	↑	↓	↓	↑	↑
Expert	↓	✓	↓	↑	↓	✓	=	↓
Novice	↓	↓	↑	✓	↓	↑	✓	✓

Symbol	Meaning
✓ (ideal)	Explicitly designed for this user attribute.
↑ (appropriate)	Suitable, but possibly not the best choice.
↓ (could be used)	If nothing else is available, it can be used, though not recommended.
× (inappropriate)	Totally inappropriate, will result in posing an accessibility barrier.
= (neutral)	Does not have any effect on the particular user attribute.

Step 3: Example of specific user profile

low vision, novice player that can use just a single switch

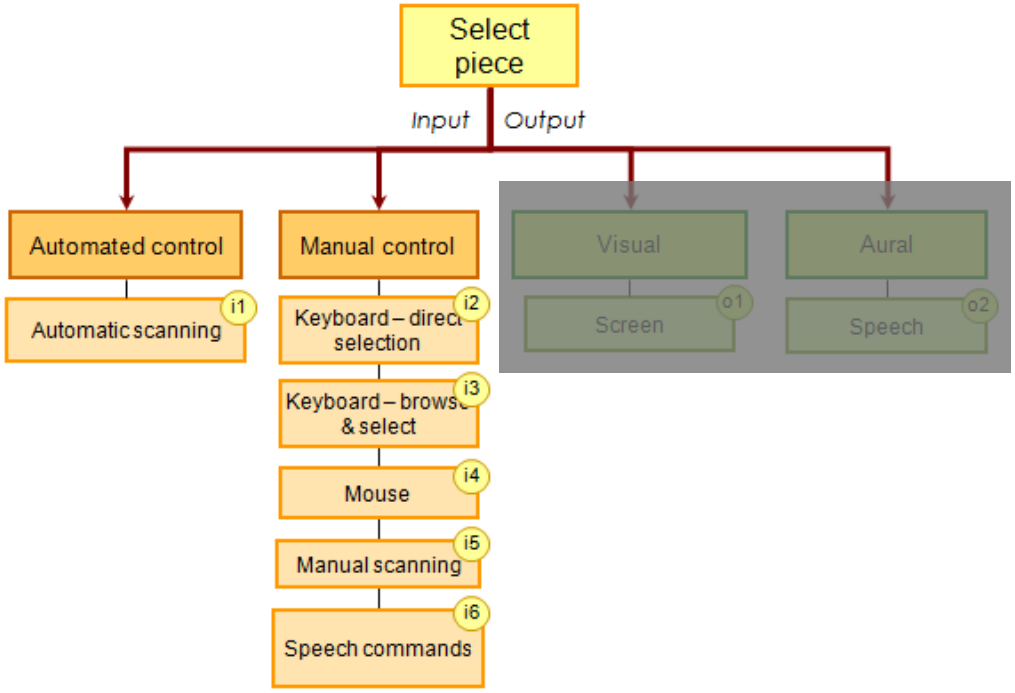
	Design alternatives							
User attributes	**i1**	**i2**	**i3**	**i4**	**i5**	**i6**	**o1**	**o2**
Full vision	=	=	=	=	=	=	✓	↑
Low vision	↓	↑	↑	↓	↓	✓	↓	✓
Blind	↓	↑	✓	×	↓	✓	×	✓
No hand-motor impairment	↓	✓	↑	✓	×	✓	=	=
Uses multiple switches	↓	×	↓	×	✓	✓	=	↓
Uses single switch	✓	×	×	×	×	✓	=	↓
Mild cognitive impairment	↓	↓	↓	↑	↓	↓	↑	↑
Expert	↓	✓	↓	↑	↓	✓	=	↓
Novice	↓	↓	↑	✓	↓	↑	✓	✓

	Design alternatives							
User attributes	**i1**	**i2**	**i3**	**i4**	**i5**	**i6**	**o1**	**o2**
Low vision, novice, single-switch	↓	×	×	×	×	↑	↓	↓

Step 4: Compatibility analysis among design alternatives

- Identify cases where two or more alternatives are mutually incompatible
  - so that they can be avoided

Step 4: Compatibility matrix for alternative input designs of the "select piece" task



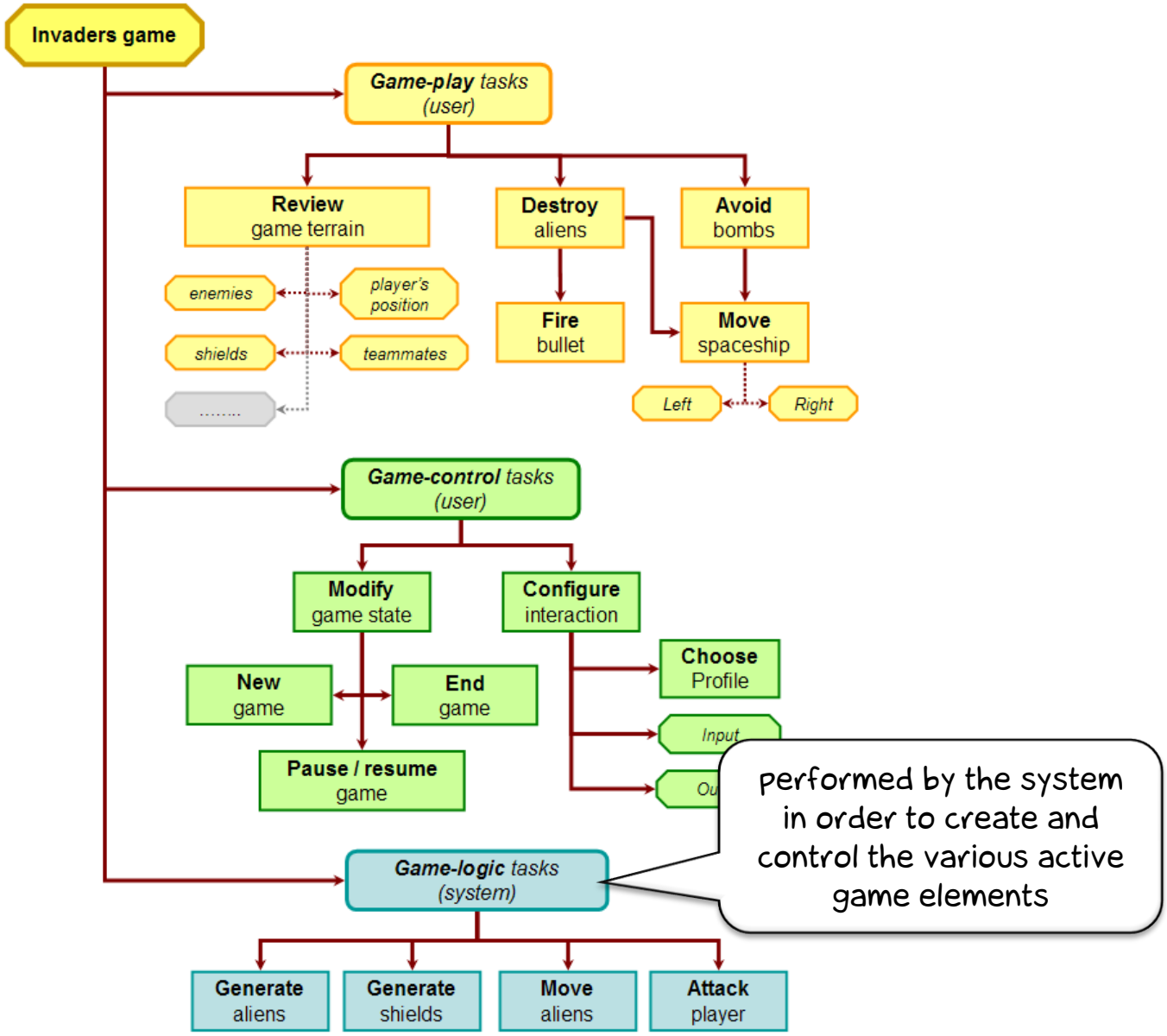
	i1	i2	i3	i4	i5	i6
i1		✓	✗	✓	✗	✓
i2	✓		✓	✓	✓	✓
i3	✗	✓		✓	✗	✓
i4	✓	✓	✓		✓	✓
i5	✗	✓	✗	✓		✓
i6	✓	✓	✓	✓	✓	

✓: compatible ✗: incompatible

What about action games?

- e.g., creating an accessible version of Space Invaders
  - Can change how the player's spaceship is controlled & presented
  - Possible to completely revamp the characteristics of the attacking alien ships
    - e.g., number, speed, firepower, size
    - even the rules of the game
      - e.g., allow the player to destroy any alien, but only a specific alien to destroy the player, change the initial number of the player's "lives"

Abstract task decomposition of a "Space Invaders" type of game



A much more challenging task:
Multiplayer Accessible Games

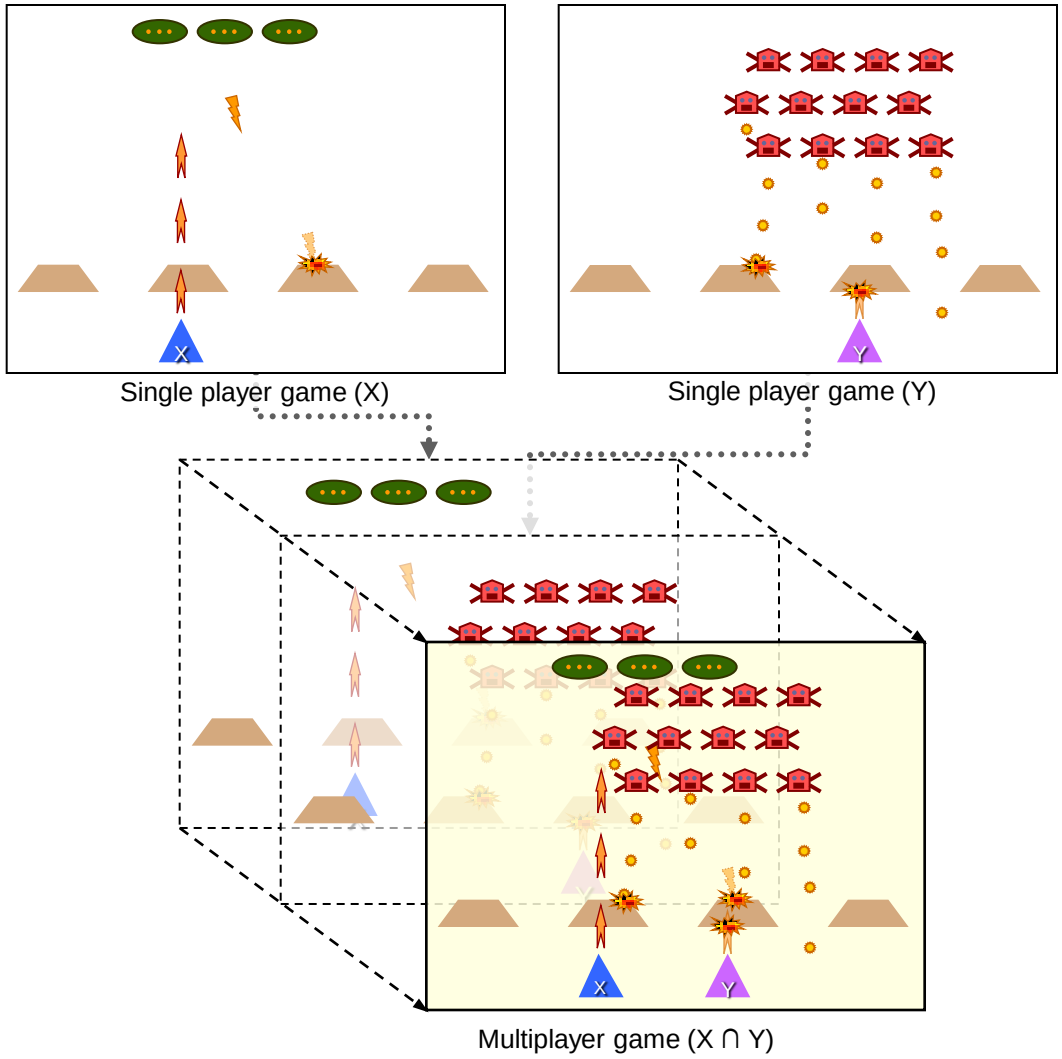
Parallel Game Universes

- Each person plays in a different "game universe"
  - Then *somehow* each universe is projected to the other(s)

- "Game Universe"
  - an instance of the game after it has been adapted to best suit the requirements and needs of a particular gamer playing under particular conditions

See also: The Theory of Parallel Game Universes
http://www.gamasutra.com/features/20060817/grammenos_01.shtml

Parallel Game Universes: Simple Example

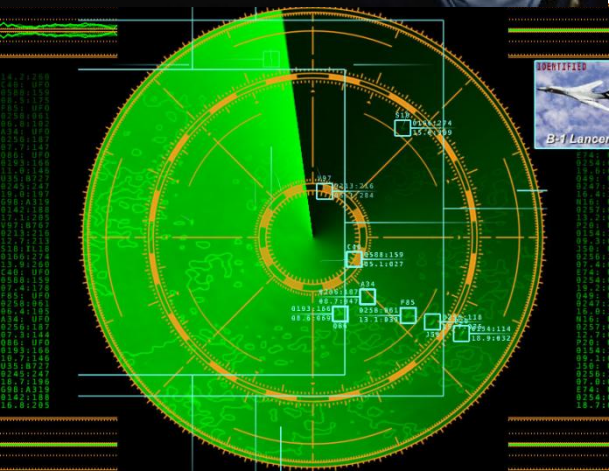


What happens when PGUs have competing requirements?

- PGU of person with deteriorated vision
  - few, large sprites presented
- vs. PGU of person with perfect vision
  - numerous small sprites
- Or, the PGU of a blind vs. a PGU of a sighted player
  - with conflicting requirements for auditory output

What happens when PGUs have competing needs?

- PGUs can still be implemented
  - redundant resources are required
    - e.g., extra sound cards & earphones, multiple computers & monitors
  - a "transition function" is needed
    - for translating the events of one universe to the other
      - in a format suitable & meaningful for that universe
- Important note:
  - The overall objective is not recreating everything that exists or happens in a universe to every other
    - just to communicate enough cues, so that the players can have a good understanding



Transition function example

- Allows a blind player to know that her sighted game partner has still some aliens to destroy
- If the blind player has destroyed all the aliens in her universe, she can lend a helping hand
  - ask for some aliens from the sighted player's to be transferred to her universe
    - these aliens will have to conform to the laws of the blind person's universe
      e.g., they will move more slowly, have 3D sound output, etc

PGUs & game elements

- Game elements may concurrently co-exist in several universes
  - through distinct instantiations
    - that maybe radically different
- "Shared" game element destroyed in one universe
  - all its incarnations in any other universes are destroyed

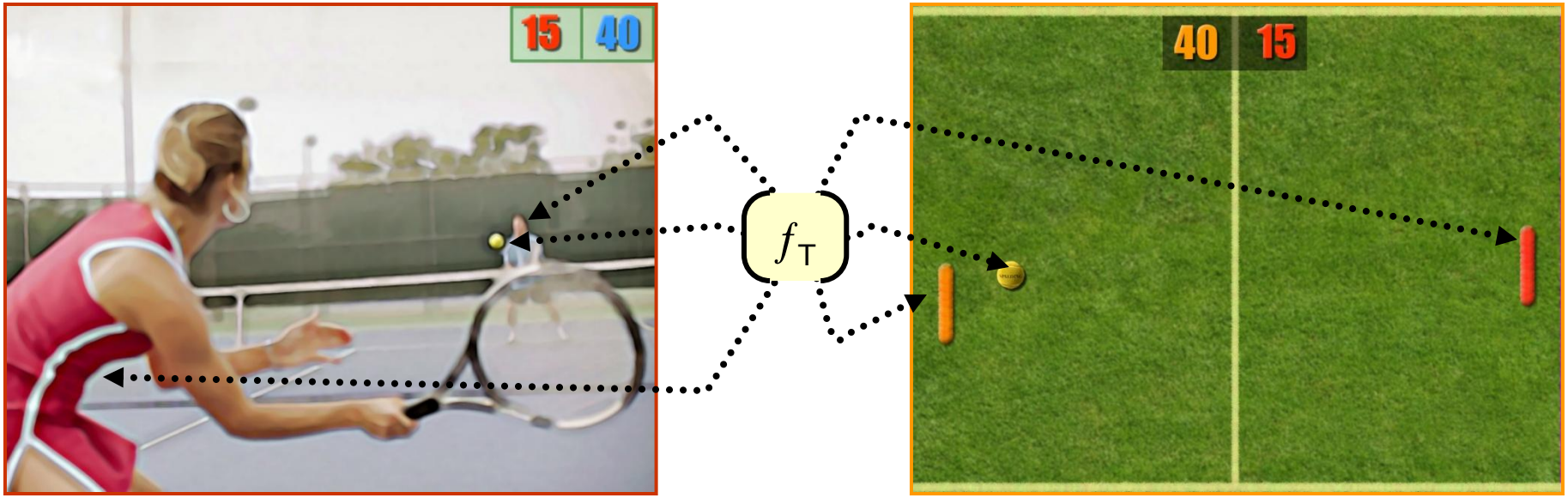
PGUs & Competitive multiplayer gaming

- Key accessibility problem
  - how to make the game fair
    - i.e., compensate for players' weaknesses

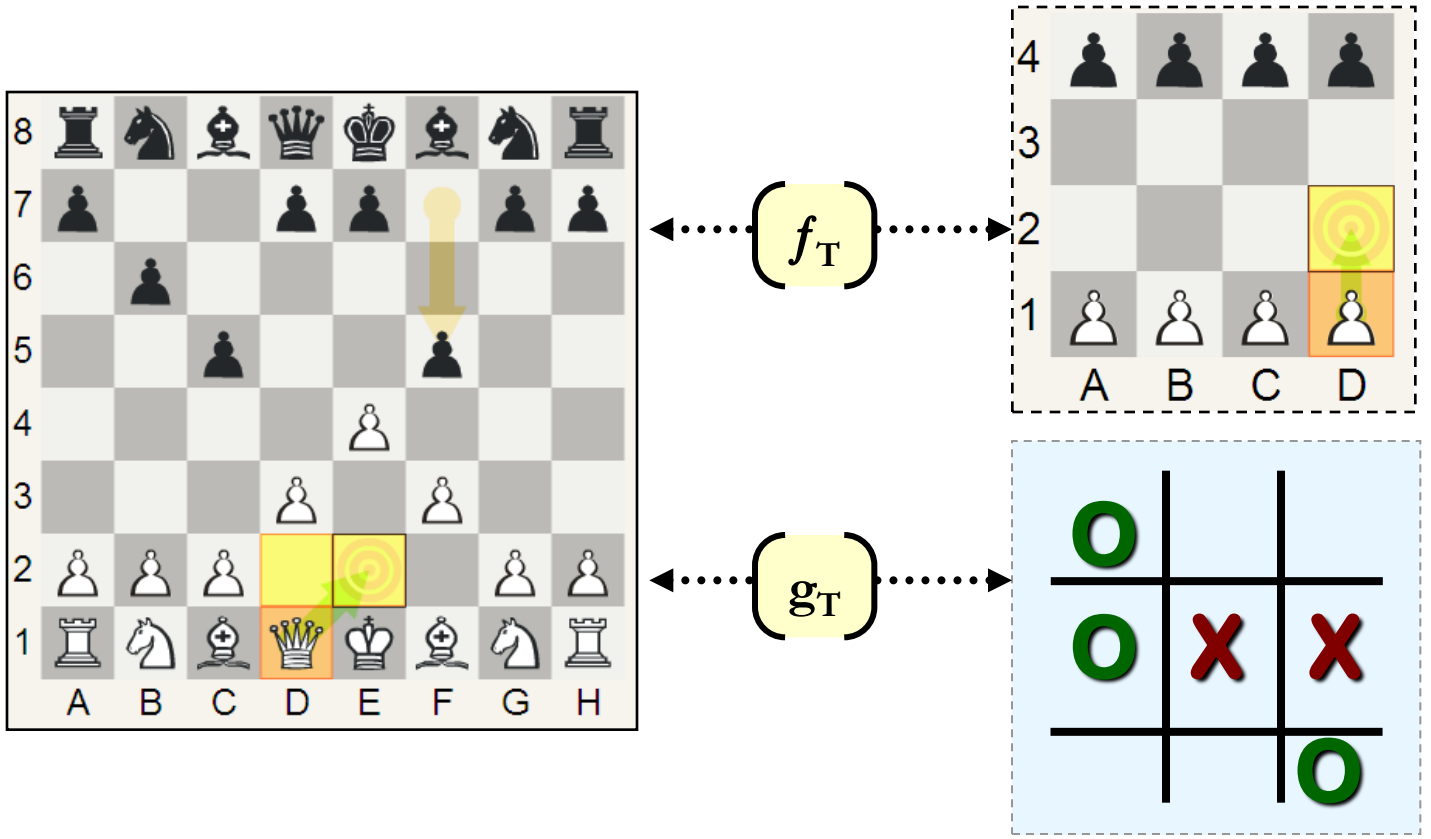
a) Collaborative gaming
  - 2 (or more) players acting as one, sharing game control

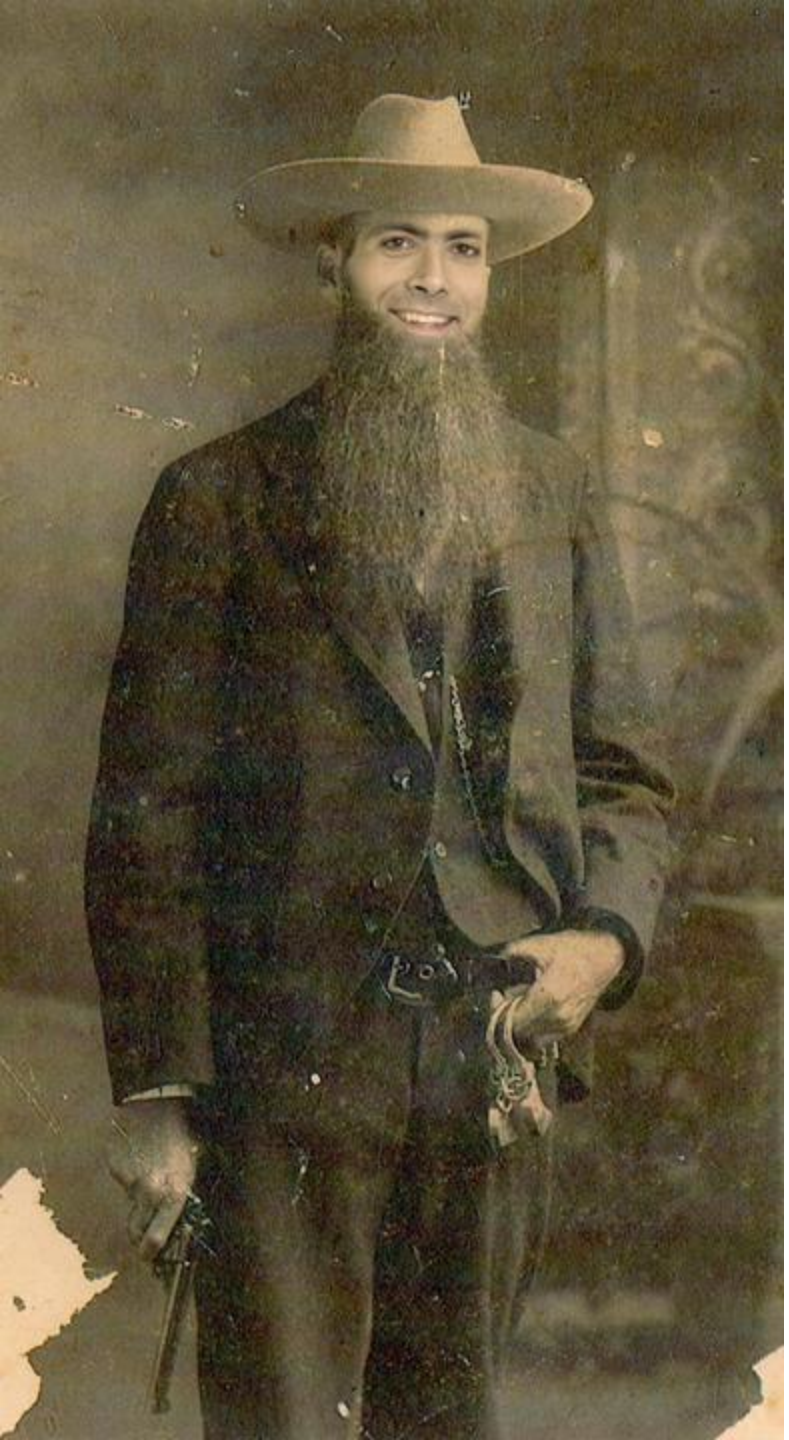
b) AI-supported gaming
  - Works with the player in a synergetic way
    - Can allow to compete against the computer, or any other player, irrespective of individual (dis)abilities, on an equal basis

Competitive Multiplayer Gaming Example



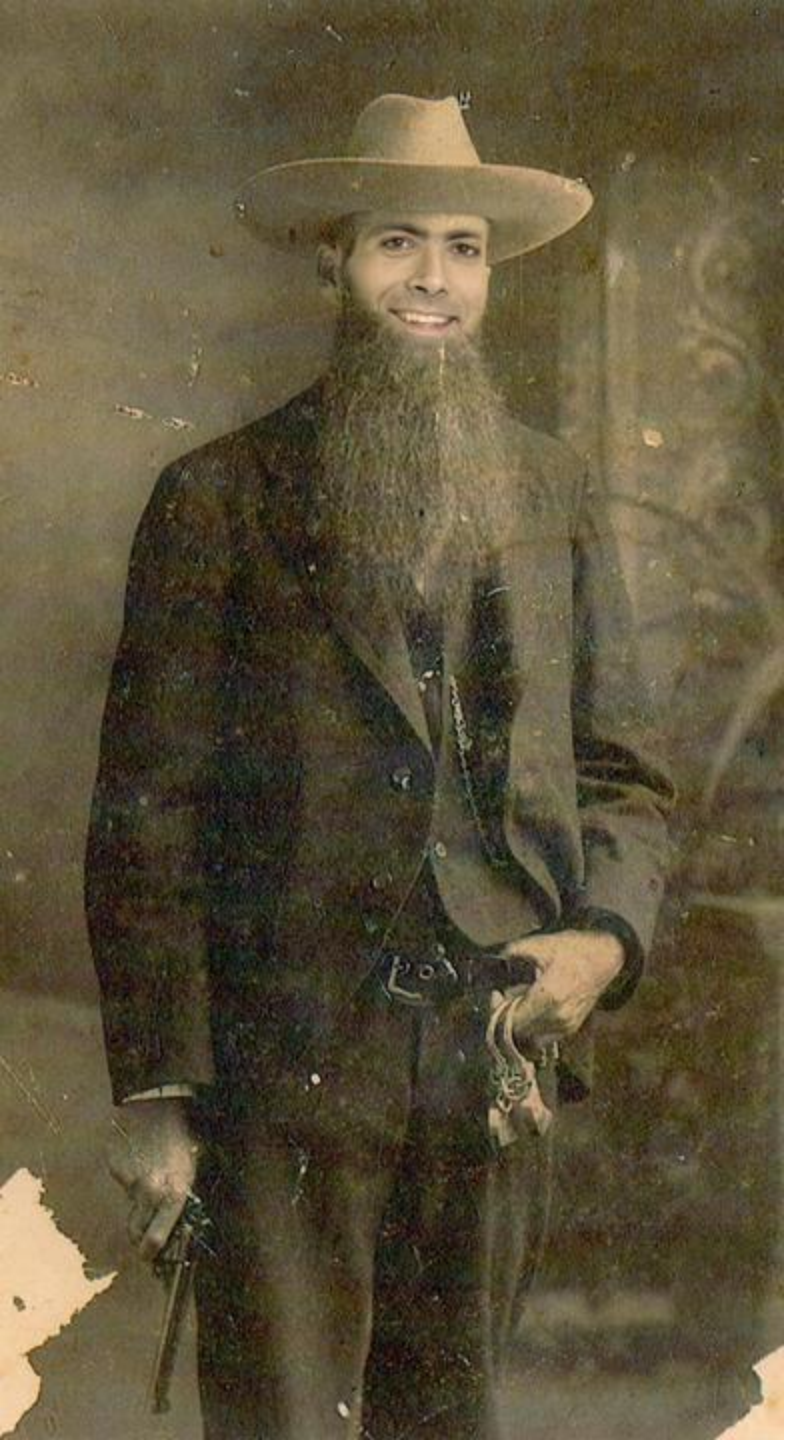
Competitive Multiplayer Gaming Example 2





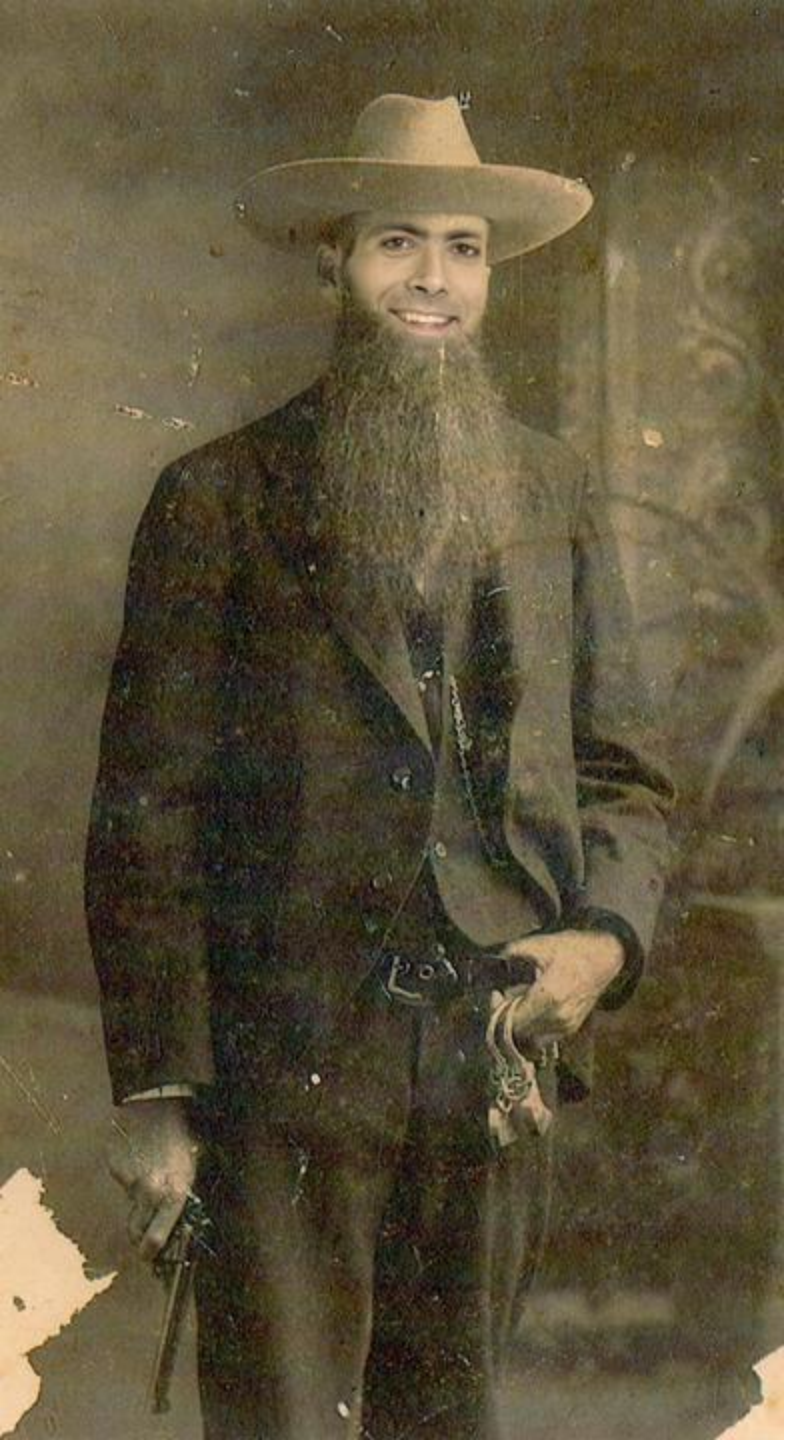
Law #1

- A PGU should always adapt itself to best serve:
  - the needs & preferences of the active player
  - the characteristics of the current context of use
- 3 possible ways to adapt:
  - Pre-game accessibility adaptation
  - Pre-game player profiling
  - In-game player monitoring & dynamic adaptation



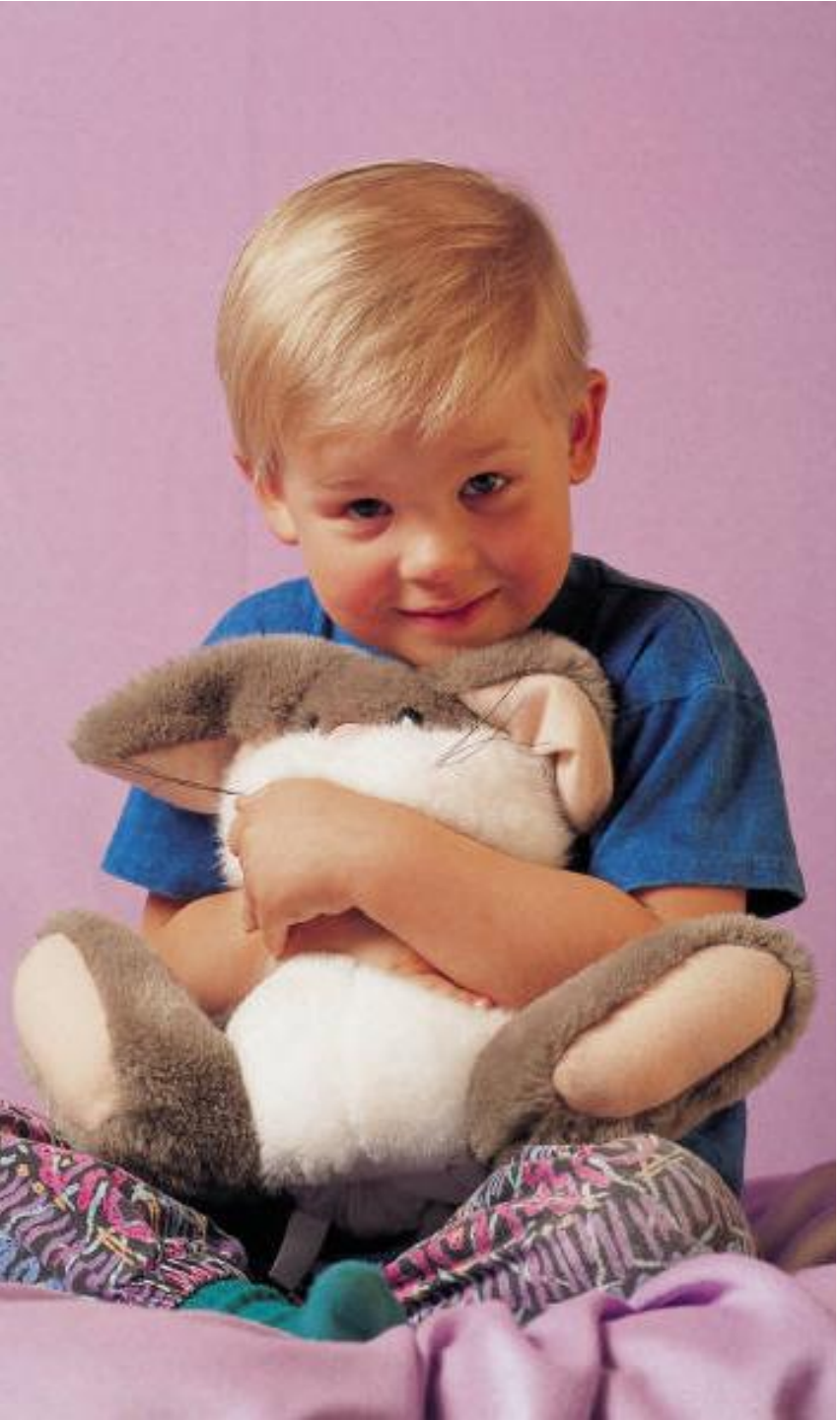
Law #2

- Each distinct PGU is ruled by its own laws
  - Any game element, no matter if user- or computer-controlled, that enters the PGU must conform to these laws



Law #3

- Regarding any two PGUs a game element can be in one of the following states
  - Private
  - Shared
  - Monitored



Private element

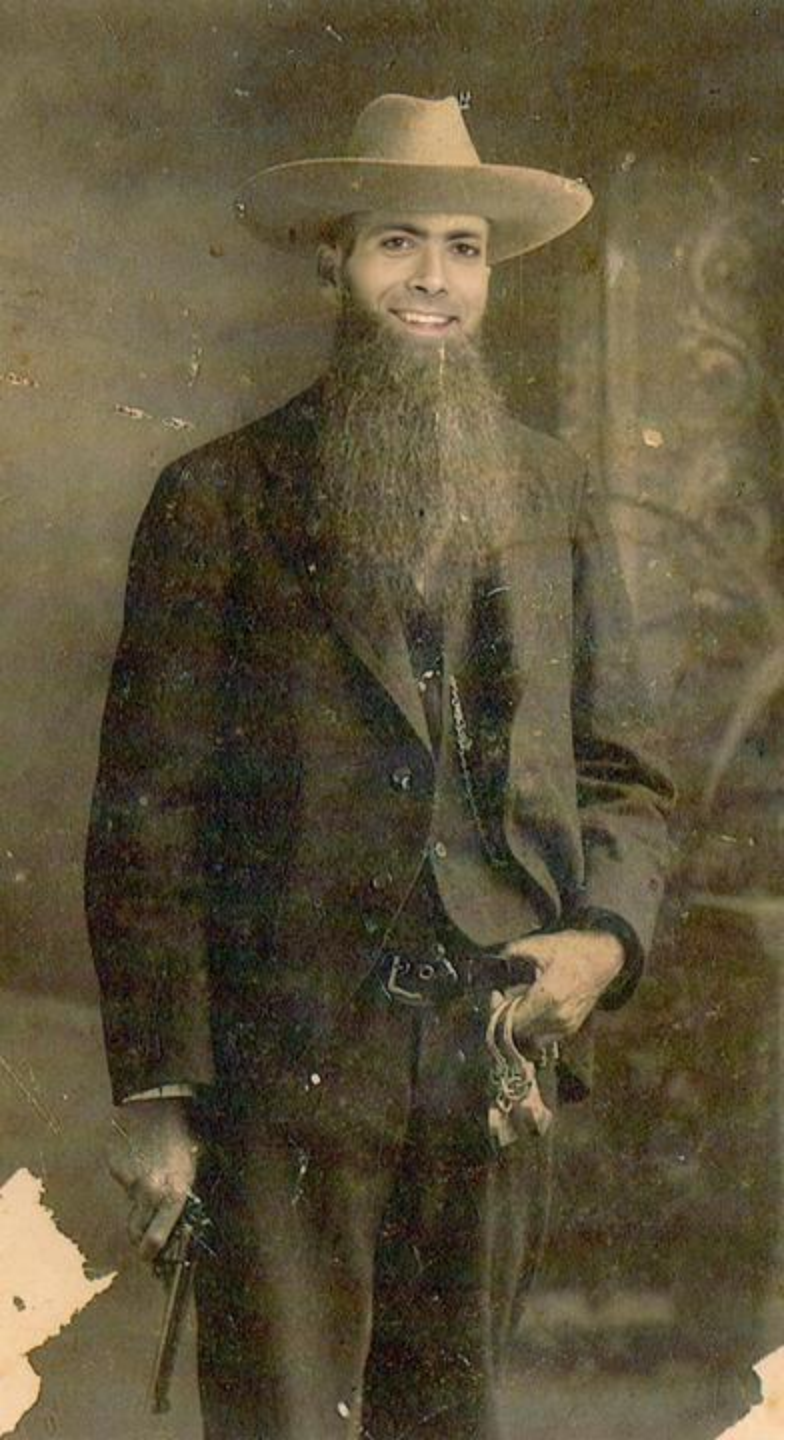
- Exists in just one of the PGUs and can not affect or be perceived in other PGUs
  - e.g., a set of protective shields may be present only in universe A, while their existence is unknown to universe B

Shared element

- Exists in (at least) two PGUs
  - Law#2 should be applied for rendering the element in each universe
    - e.g., a "vicious alien" may be rendered as an ugly, ferocious, monster in universe A, and as a funny, goofball, cartoon character in universe B
- If a shared element is destroyed in a PGU, then it must be automatically destroyed in all others
  - "loose consistency"

Monitored element

- Exists in and can affect only one of the universes
  - can also be perceived in the others, but without any effect
  - e.g., in universe A, a blind player hears very loud & clear the sound of the single alien she is competing against
    - but in the distance she can hear the sounds of a battle where another player is fighting in universe B against a horde of aliens

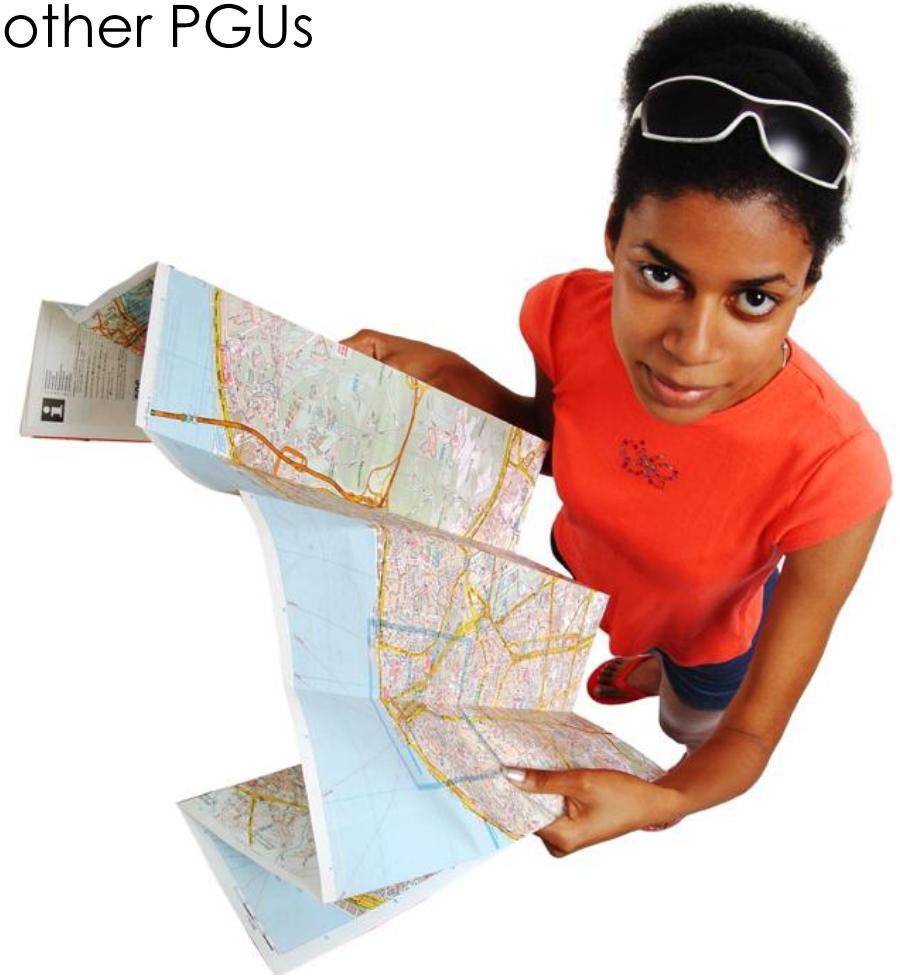


Law #4

- The state (private, monitored, shared) of any interactive element can dynamically change at anytime (by its own will or by force), as well as the PGU it is located in
  - e.g., if a player has destroyed all the aliens in her PGU, she can lend a helping hand to a player in another PGU by asking to send over some more aliens
    - the "transferred" aliens can either move or be shared between the two universes

Law #4, cont.

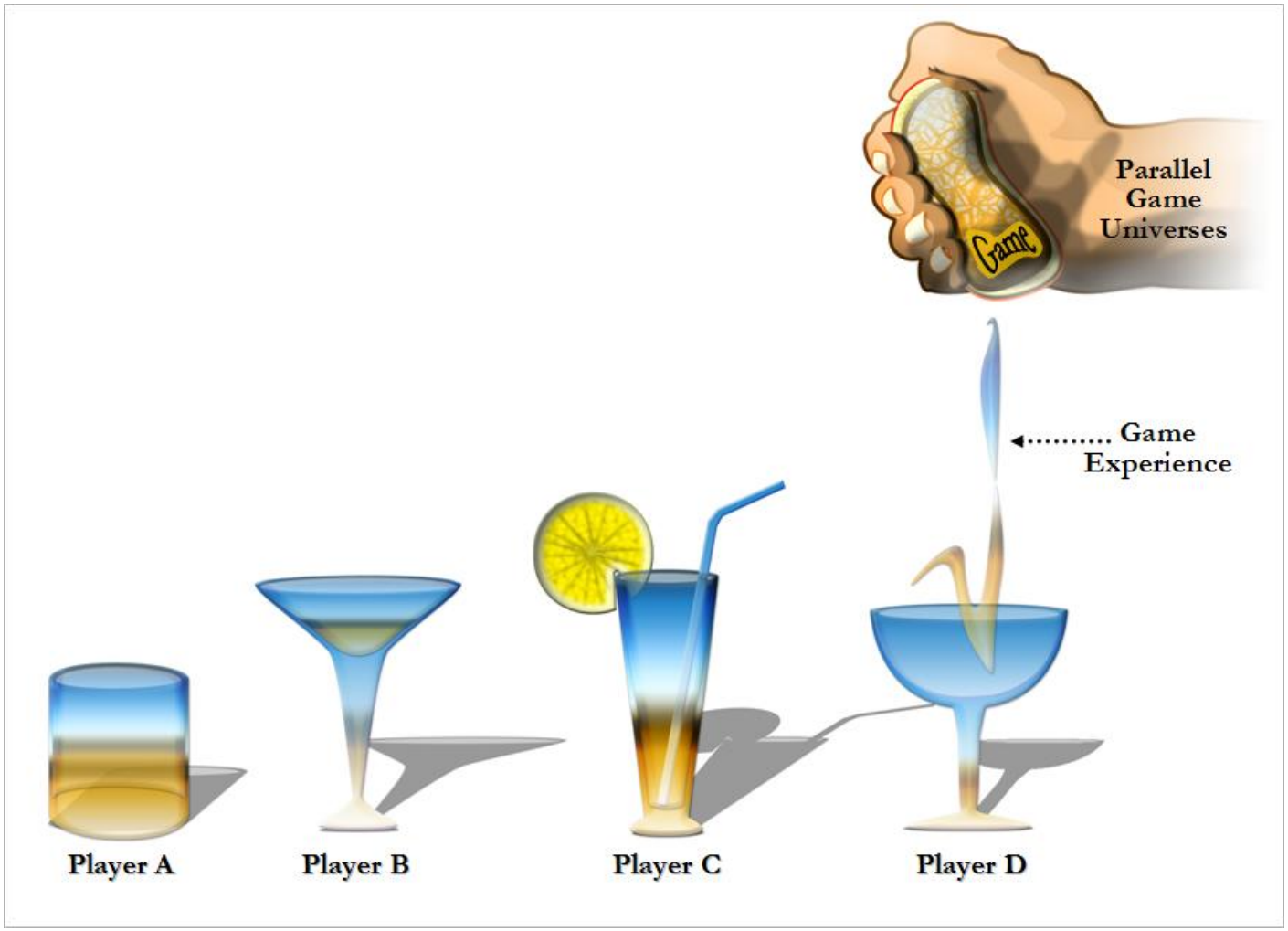
- The aliens may also move among PGUs
  - if they are having a hard time in a PGU, they may ask for reinforcements from other PGUs
    - if this does not break Law #1
- A player may decide to leave one PGU for another
  - to escape from an inevitable fatal situation
  - to play the game from a different perspective



Real-life example

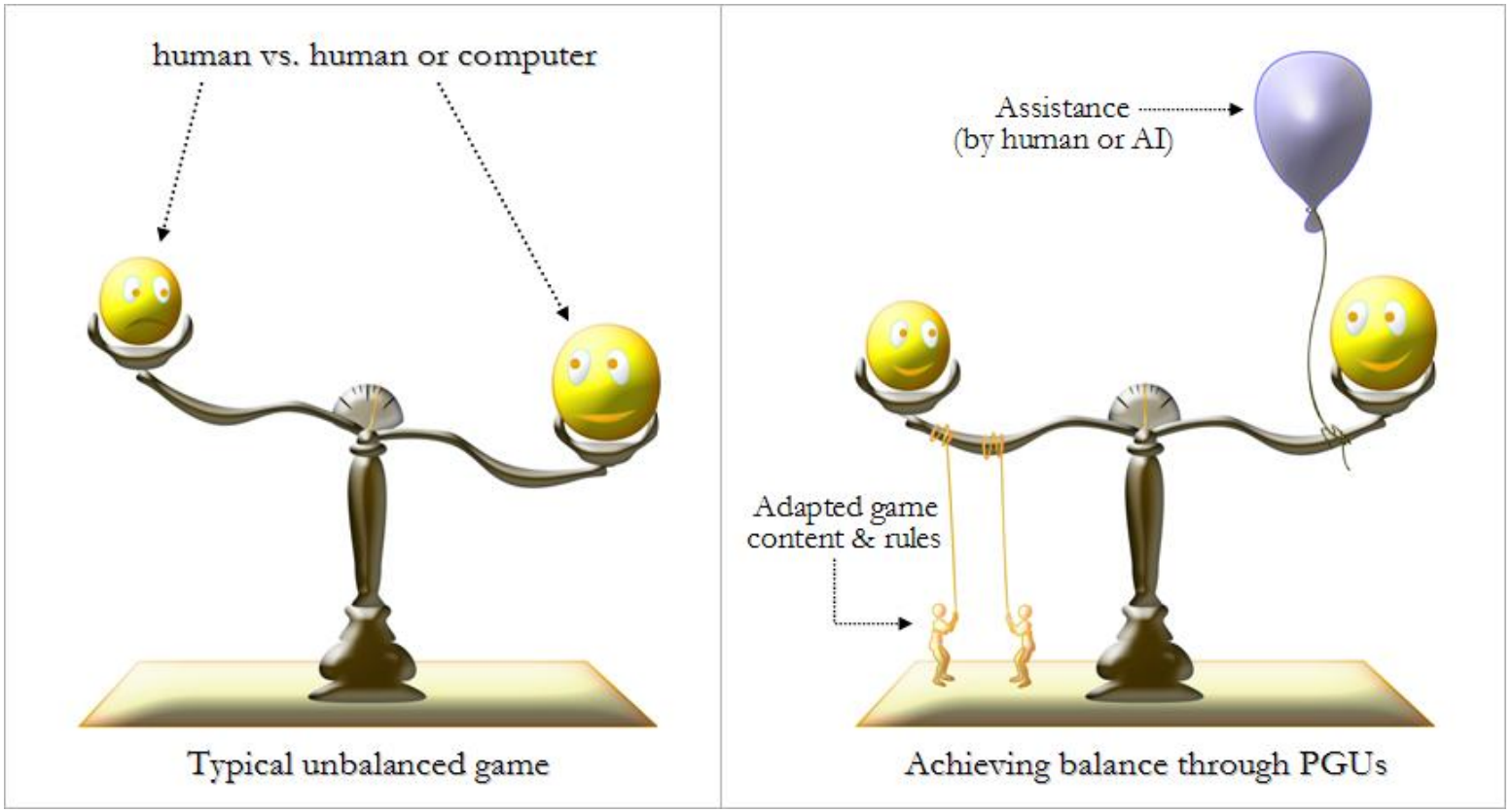
- Pelican Hill golf course, Newport Beach, California
  - August 18, 2000
- People with quadriplegia & paraplegia golfed side-by-side with able-bodied players
  - People with disabilities made their shots virtually & then followed the path of their virtual ball on the actual course
    - wheelchair-mounted computer
    - Madentec's assistive technology
    - Microsoft's Links golf software
      - With detailed model of the course

PGU Key Property: Individualization



PGUs support individualization by extracting the pure essence of games, which is game experience, and offering it to the individual players according to their needs and preferences

PGU Key Property: Balance



PGUs strive for balance by compensating for individual player weaknesses & challenging player strengths, ensuring that opposing forces (player vs. player, or player vs. computer) are matched

Designing a PGU like translation of literature

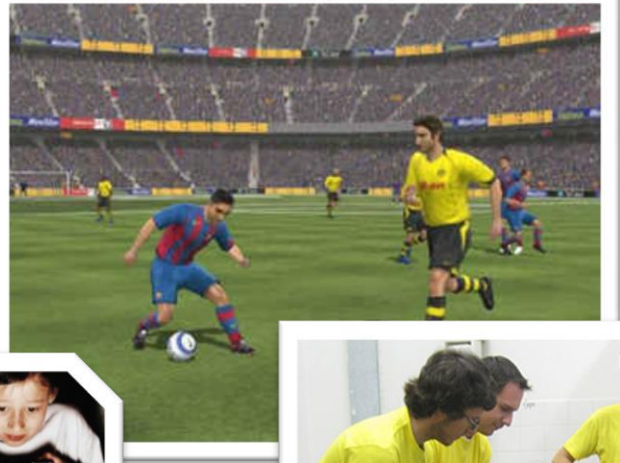
- When designing a PGU, the game is "translated" to each player's "language"

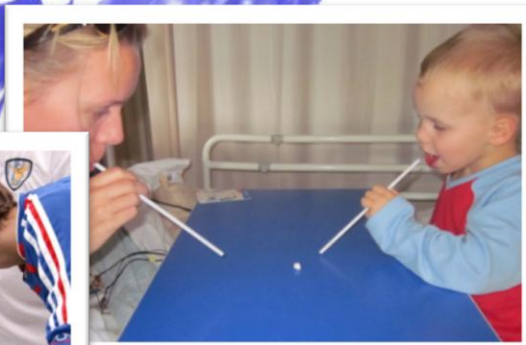
➡ Like translating literature (or, even better, poetry)

- Not done word-by-word
- Try to reproduce the ambience, feelings, images, etc., described by the author
  - Render the essence of the work, not the actual words used

But, are people then playing
the very same game?

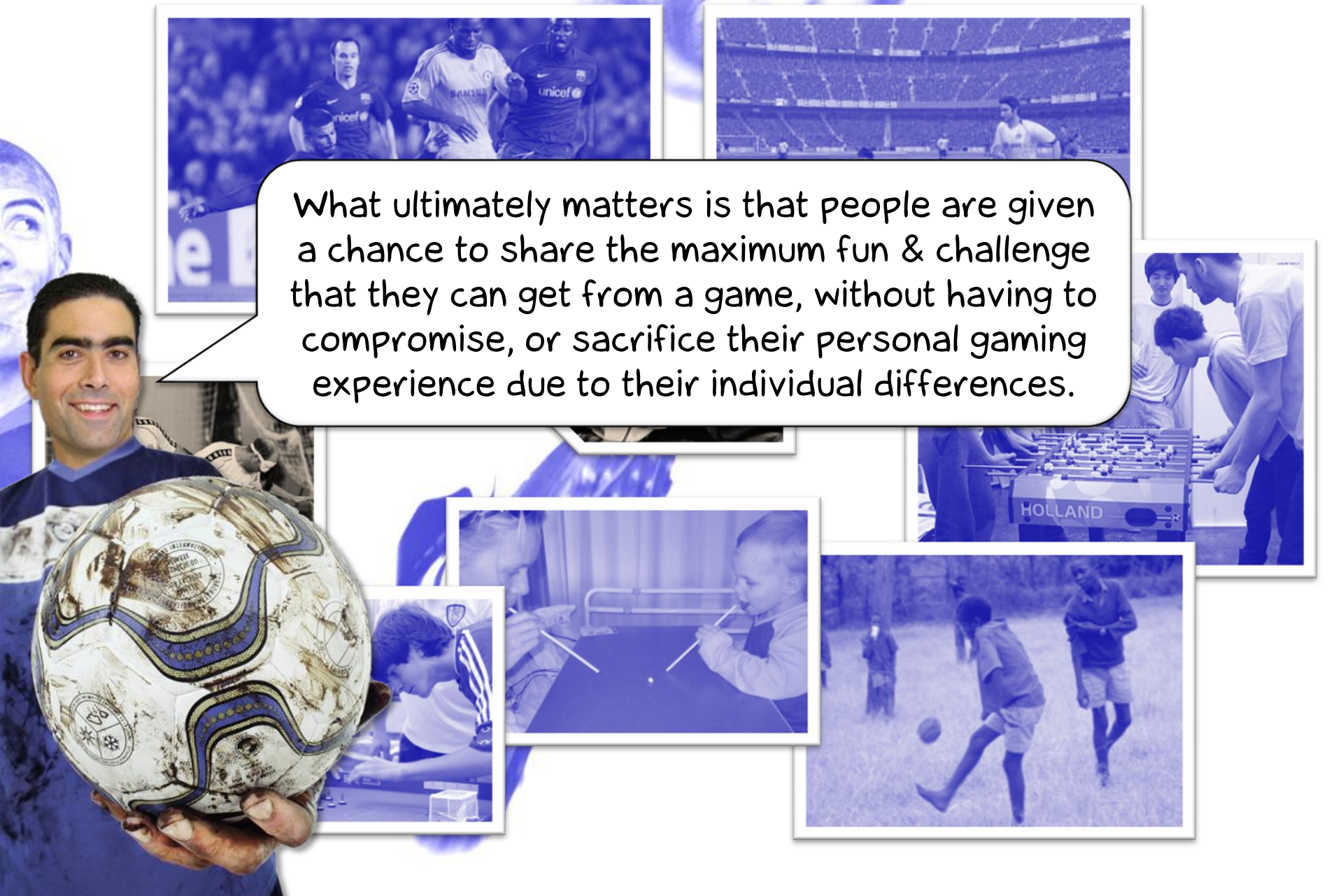
Just playing football… (1/3)





Just playing football… (2/3)

Just playing football… (3/3)



In defense of cheating (?)

- A typical form of criticism (usually by hardcore gamers) regarding PGUs is that the proposed mechanisms can also be used for cheating
  - Especially in competitive on-line games
- This can be easily remedied
  - Activated "game-aids" are visible to all players
    - e.g., auto-shoot, extra health, AI-support
  - Players have the option not to compete against others who have specific aids activated
    - e.g., they are invisible (or invulnerable) to each other


Examples

UA-Chess (2004)

- Can be played through a Web browser
- Alternative I/O modalities & interaction techniques
- Customizable player profiles
- Fully accessible through:
  - the mouse
  - the keyboard
  - 1-3 switches
  - speech recognition
- Built-in screen reader

Award

CERTIFICATE

rewarding excellence in Design for All and Assistive Technology

D/A:AT European Awards

AT AWARD 2004

12 November 2004, Düsseldorf/Germany

This is to certify that

Foundation for Research and Technology - Hellas (FORTH)

has participated in the European Design for All and Assistive Technology Awards. The entry

'UA-Chess (Universally Accessible Chess)'

was

nominated for the final jury decision

in the category

AT/Culture, Leisure and Sport

Wallis Goelen
European Commission, Head of Unit
'Integration of people with disabilities'

Harry Knops
Chairman AT Jury
Manager Strategy of iRv/Netherlands

An Initiative of the European Commission

- Nominated for the final jury decision of the European Design for All Awards set by the European Commission
  - in the category "AT/Culture, Leisure and Sport"

Access Invaders (2005)

- Accessible remake of the classic Space Invaders game
  - Highly customizable
  - Creation & use of unlimited user profiles
- Each game parameter can be adapted based on the player's profile and the current game level
- Multi-player games
  - Unlimited number of concurrent players
    - Each player can be using a different profile

Experimental input techniques

- Musical input
  - e.g., whistling
- Vision-based gesture recognition
  - In cooperation with the Computational Vision and Robotics Laboratory of ICS-FORTH

Terrestrial Invaders (2007)

- Multiple GA features that can be switched on and off, both off-line and on-the-fly:
  - Adjustable game speed
  - Adjustable size of all game graphics
  - Adjustable FX, music and speech volume
  - 2D sound for localizing objects
  - Spatially localized captions using text and / or graphics for visualizing all game sounds
  - Reading aloud & automatic scanning of the game menus
  - 2 high contrast modes
  - 2 types of audio descriptions that verbalize the relative position of game elements
  - The option of using simple shapes to render all graphic elements
  - Game difficulty adjustments
    - extra life, destroy random enemy, activate shield, bomb size, enemy speed, max enemy bullets

Terrestrial Invaders (2007)

- Can be played using diverse alternative controls and interaction techniques, such as:
  - Multiple keyboard keys
    - or switches
  - A single key
    - i.e., one-switch game
  - The mouse
  - By typing keywords
    - e.g., “left” to go left, etc.
  - By blowing into a microphone
- MS-Windows, Linux & Mac OS X

Game Over! (2007)

- The first universally **in**accessible game in the world!
  - Meant to be used as an educational "tool" for disseminating, understanding & learning about GA guidelines
- Comprises 21 levels
  - Each one breaks a basic GA guideline
- MS-Windows, Linux & Mac OS X

People's Choice Award

- Arcademy Games Awards
  - Montreal, Canada (2008)
  - sponsored by Festival Arcadia

VIDÉOTRON
PRÉSENTE
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TELEFILM CANADA
PROSIS

FUTURE PLAY
RESEARCH. PLAY. SHARE.

Game Over! vs. Terrestrial Invaders

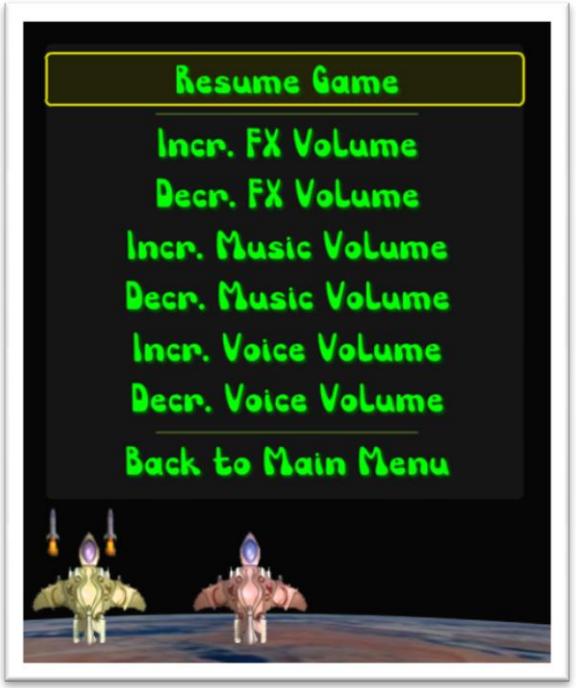
- The same game!
  - Actionscript 3.0 (preview version)
    - Adobe Flash® Professional 9 Public Alpha
- Entire game & all game parameters loaded from XML files
  - Levels, lives, speed, difficulty, controls, sounds, captions, colors, graphics, firepower, ...
- Extendable graphics & sounds through external Flash libraries (.swf)

Game stage

```
<Stage width="1024" height="768"
background="background1" playAnimations="true" animationsInterval="300"
maxFXVolume="0.9" musicVolume="0.3" voiceVolume="1"
defaultSpeed="30" globalScale="1" useMovieClips="true"
contrast="NORMAL" highContrastArray="5, 5, 5, 5, 0, 5, 5, 5, 5"
highContrastInvertArray="-3, -3, -3, -3, 20, -3, -3, -3, -3"/>
```

Menu dialogue

```
<menu id="pause" scanning="false" scanDelay="60" readMe="true" maxChars="22">

    <background color="0x111111" alpha="0.9"/>
    <highlight color="0xFFFF00" alpha="0.9" width="2" backgroundColor="0x22222200" backgroundAlpha="0.8"/>
    <font size="30 " color="0x00FF00" shadowColor="0x006600" alpha="1"/>
    <separator color="0x669933" alpha="0.5" width="2"/>

    <item rank="01" action="UNPAUSE">Resume Game</item>
    <item rank="02" action="INCREASE_FX_VOLUME" separator="true">Incr. FX Volume</item>
    <item rank="03" action="DECREASE_FX_VOLUME">Decr. FX Volume</item>
    <item rank="04" action="INCREASE_MUSIC_VOLUME">Incr. Music Volume</item>
    <item rank="05" action="DECREASE_MUSIC_VOLUME">Decr. Music Volume</item>
    <item rank="06" action="INCREASE_VOICE_VOLUME">Incr. Voice Volume</item>
    <item rank="07" action="DECREASE_VOICE_VOLUME">Decr. Voice Volume</item>
    <item rank="08" action="LOAD_LEVEL" playerID="main menu" separator="true">Back to Main Menu</item>

    <soundEffect id="Back to Main Menu" soundName="back_to_main_menu"/>
    <soundEffect id="Resume Game" soundName="resume"/>
    <soundEffect id="Incr. FX Volume" soundName="increase_fx_volume"/>
    <soundEffect id="Decr. FX Volume" soundName="decrease_fx_volume"/>
    <soundEffect id="Incr. Music Volume" soundName="increase_music_volume"/>
    <soundEffect id="Decr. Music Volume" soundName="decrease_music_volume"/>
    <soundEffect id="Incr. Voice Volume" soundName="increase_voice_volume"/>
    <soundEffect id="Decr. Voice Volume" soundName="decrease_voice_volume"/>

</menu>
```

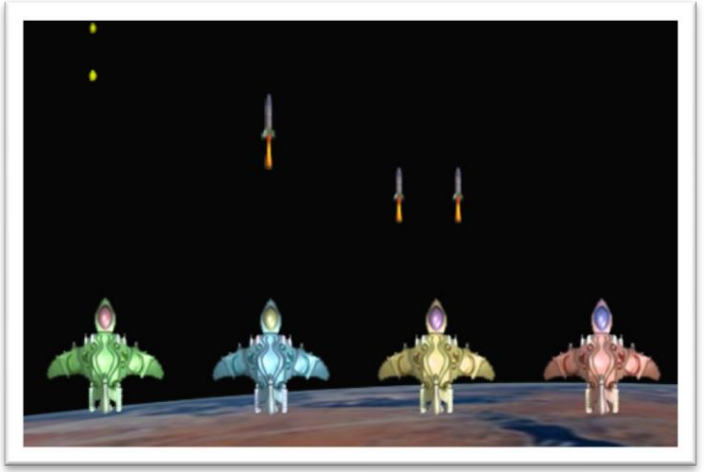


Player

```
<player id="player1" lives="3" mc="player" scale="1" points="100" dist2move="20" moveDelay="1"
        fireDelay="5" sound2D="true" immunityPeriod="200 "
        width="90" height="60" color="0x0099FF" shape="ellipse">

    <bullet color="0xFF6600" width="35" height="30"dist2move="10" moveDelay="1" shape="ellipse"
            concurrentlyActiveBullets="3" mc="playerBullet" scale="1" >

        <soundEffect id="onFire" soundName="fire">
            <caption mc="bomb_cap" scale="1" framesCount="10" dx="0" dy="20">BomB
                <border show="true" line="true" color="0xFF0000" alpha="0.4" width="1"/>
                <font size="20" color="0xFF0000" shadowColor="0x660000"  alpha="0.9"/>
            </caption>
        </soundEffect>

        <soundEffect id="onDestroyed" soundName="bomb_explosion"/>
        <soundLoop id="mySound" soundName="loop1"/>

    </bullet>

    <soundEffect id="onDestroyed" soundName="explosion">
        <caption mc="boom" scale="1" dy="-30" framesCount="30">BOOM
            <border show="true" line="true" color="0xFF0000" alpha="0.4" />
            <font size="26" color="0xFF0000" shadowColor="0x330000" alpha="1"/>
        </caption>
    </soundEffect>

    <scoreFont size="30"/>
    <livesFont size="18" color="0xFFFF00" mc="life"/>

    <canDestroyAliensGroup id="group1"/>
    <canDestroyAliensGroup id="group2"/>

    <automove/>
    <autofire/>

</player>
```

Aliens

```
<alienGroup id="group1" hSpeed="20" vSpeed="40" moveDelay="30" startX="10" startY="600"
vLimit="200" entranceVSpeed="-3">

    <canDestroyPlayer id="player1"/>

    <alien points="5"  mc="greenPlane" scale="1" color="0x33CC44"
    startX="0" startY="0" width="80" height="100" fireDelay="4" >

        <soundEffect id="onDestroyed" soundName="explosion2">
            <caption mc="curse" scale="1" rotate="0" framesCount="20" dx="20" dy="-120">@#&$!
                    <border show="true" line="true" color="0x777777" alpha="0.6" width="3"/>
                    <font size="18" color="0x000000" shadowColor="0x222222" alpha="1"/>
                    <background color="0xFFFFFF" alpha="0.9"/>
            </caption>
        </soundEffect>

        <bullet width="20" height="20" dist2move="-10" color="0x33CC44"
        shape="ellipse" moveDelay="1" concurrentlyActiveBullets = "2" mc="bomb" scale="1">
            <soundEffect id="onFire" soundName="ratata">
                <caption mc="ratata" scale="1" rotate="0" framesCount="6" dx="0" dy="-60">RATATATA
                    <border show="false" line="false" color="0xCC0000" alpha="0.8" />
                    <font size="18" color="0x33FF00" shadowColor="0x506600"  alpha="0.8"/>
                    <background color="0x000000" alpha="0.5"/>
                </caption>
            </soundEffect>
        </bullet>


    </alien>
```



Freeware

UA - Games

Universally Accessible Games

ua-games.gr

Can the UAGs approach be applied to the design of any game?

YES

The concepts, methods & principles presented are not bound to any particular game technology or genre

Examples of Commercial Accessible Games

Strange attractors 1-2 (Ominous)

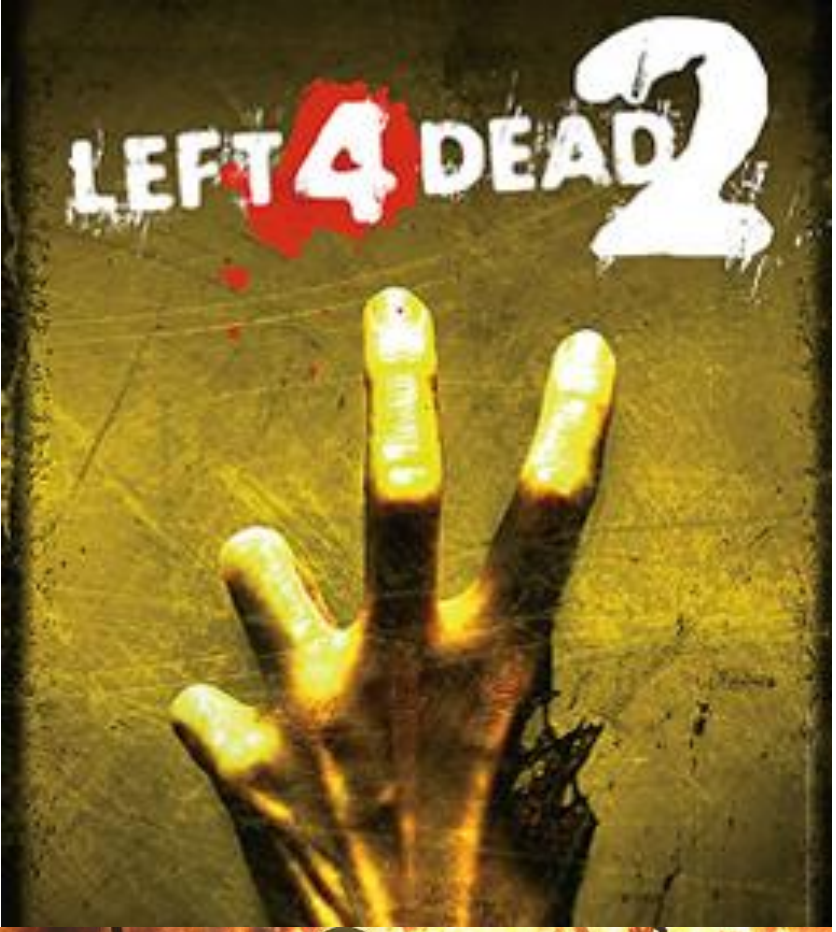
- PC
- Great one-switch game

http://www.ominousdev.com/

Fishie Fishie Fifty (Farbs McFarbs)

- Xbox 360
- Supports 1-52 players on a single Xbox 360
  - Through single button interfaces & controller sharing

http://marketplace.xbox.com/en-GB/Product/Fishie-Fishie-Fifty/66acd000-77fe-1000-9115-d80258550557

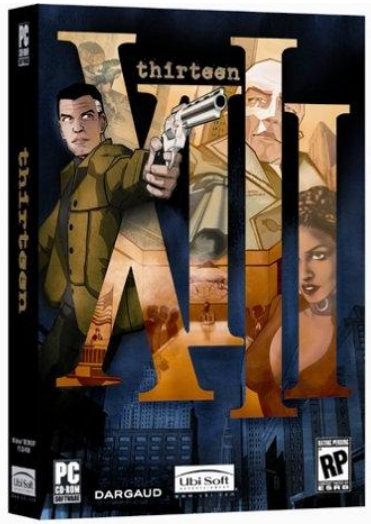


Left 4 Dead 2 (Valve)

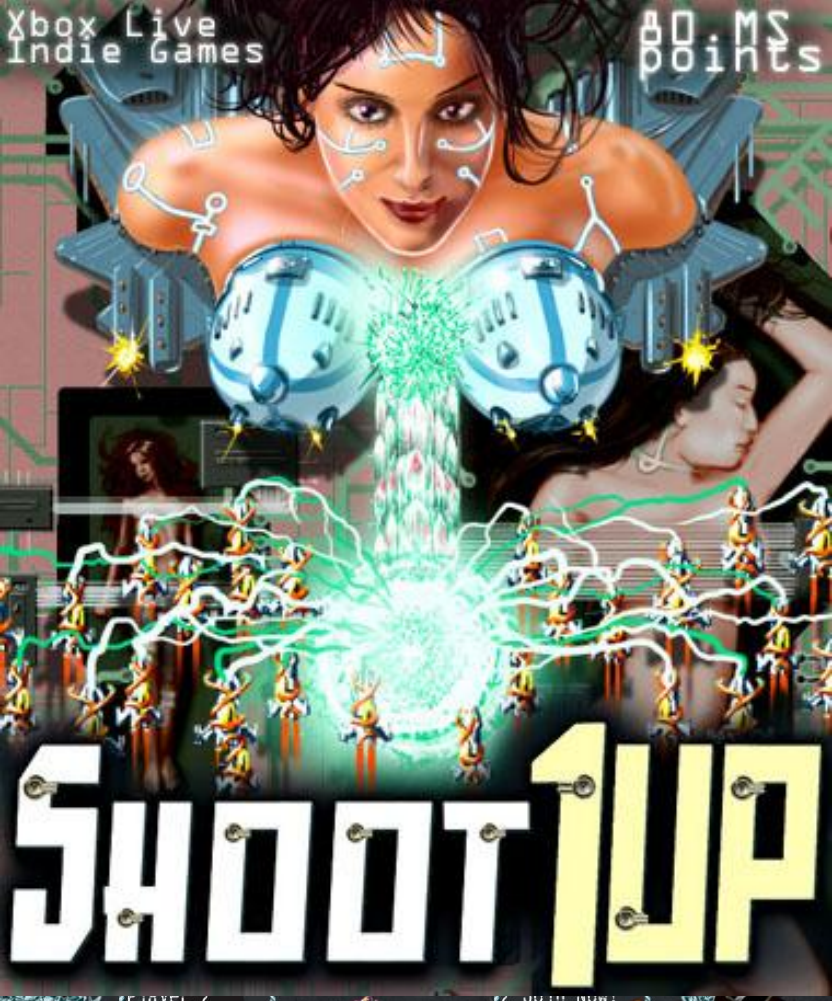
- Closed captions

XIII (Ubisoft)

- PC, Xbox, Playstation 2, Nintendo GameCube
- Transcribes sounds in a comic-like style



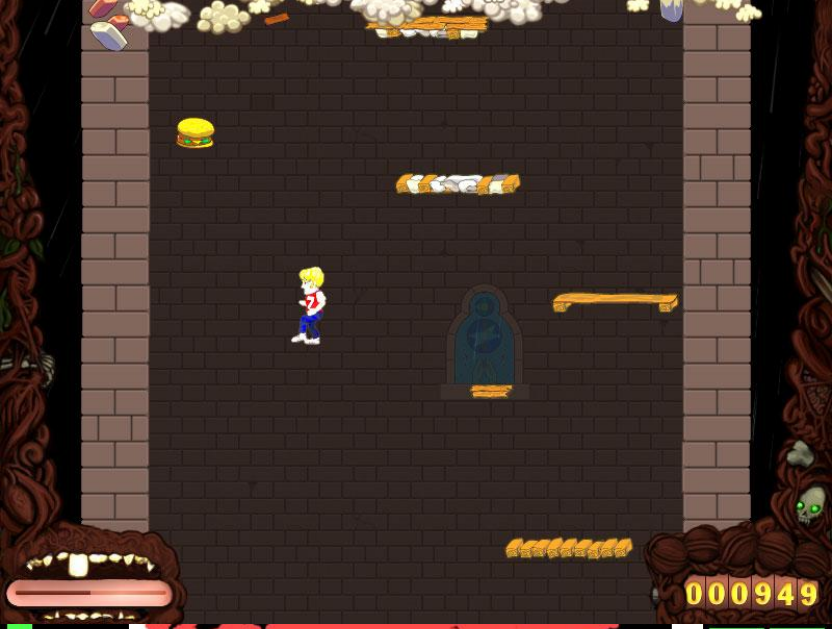
http://www.ubi.com/us/games/info.aspx?pid=39



Shoot 1UP (Mommy's Best Games)

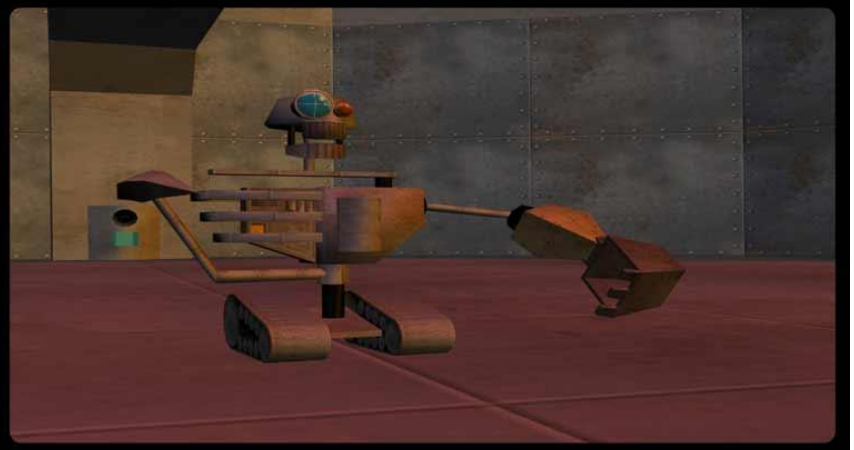
- Xbox 360
- Gameplay speed control
- Button re-mapping
- Single-button mode
  - Auto-fire
  - Auto-formation management
- Visual contrast options

http://mommysbestgames.com/shoot1up.html



To Hell with Johnny (Michi.nu)

- PC & Mac (soon)
- Keyboard, joystick & mouse
  - 3, 2, 1 switch
- Game speed
- Control the appearance & behavior of game elements
- Color schemes & contrast modes
- Spoken interface



Terraformers (Pin Interactive)

- PC
- A visual / audio hybrid 3D game
  - can be played with 3D graphics layer on or off
- Supports players at all degrees of visual ability or impairment
  - sophisticated sound interface

http://www.terraformers.nu/index.php?option=com_content&task=view&id=34&Itemid=29

Audio games

- Tomb Hunter: Mysteries of the Ancients
  (USA Games Interactive)
  http://www.usagamesinteractive.com/products.php
- Entombed (Driftwood Games)
  http://www.blind-games.com/blind.games.download.aspx
- A Time of Conflict
  (GMA Games)
  http://www.gmagames.com/toc.shtml
- V.I. Tennis (V.I. Fit)
  http://www.vifit.org/

See also GameBase TOP10: http://www.gamebase.info/magazine/read/top-10-audio-games_299.html

What else is going on out there?

- IGDA Game Accessibility SIG
  - http://wiki.igda.org/Game_Accessibility_SIG
- citeulike GA Group
  - http://www.citeulike.org/group/8459
- Disability-oriented community sites
  - ablegamers.com
  - gamebase.info
  - audiogames.net
  - oneswitch.org.uk
  - deafgamers.com
  - …

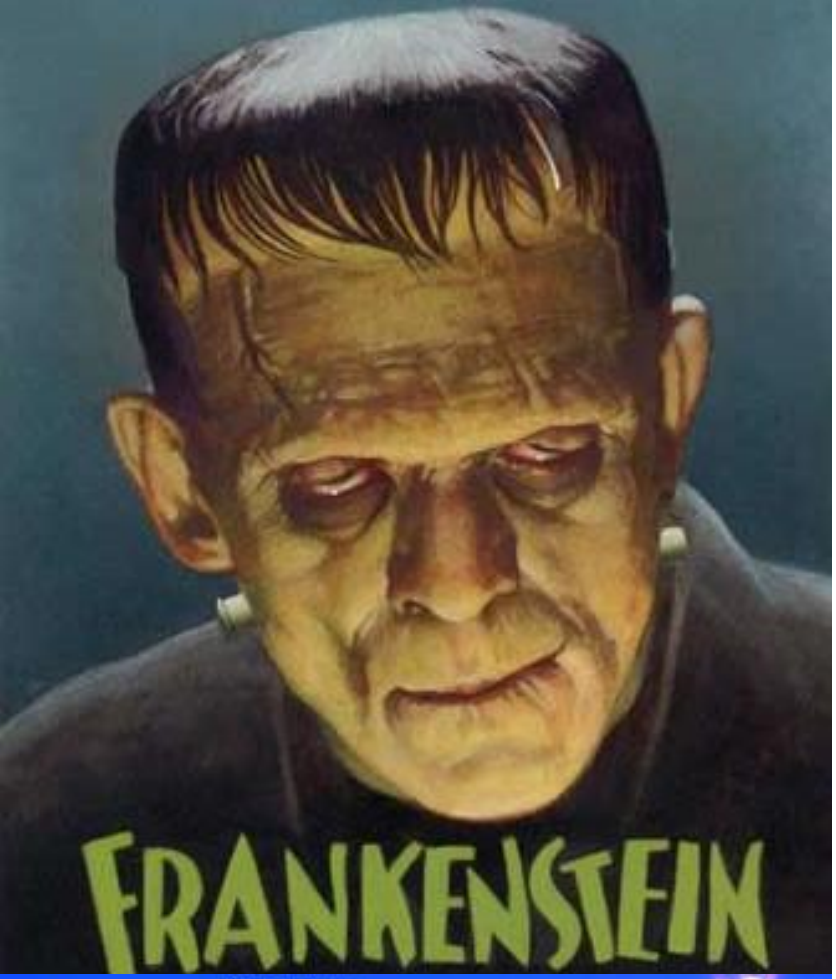
The next big challenge for Game Accessibility

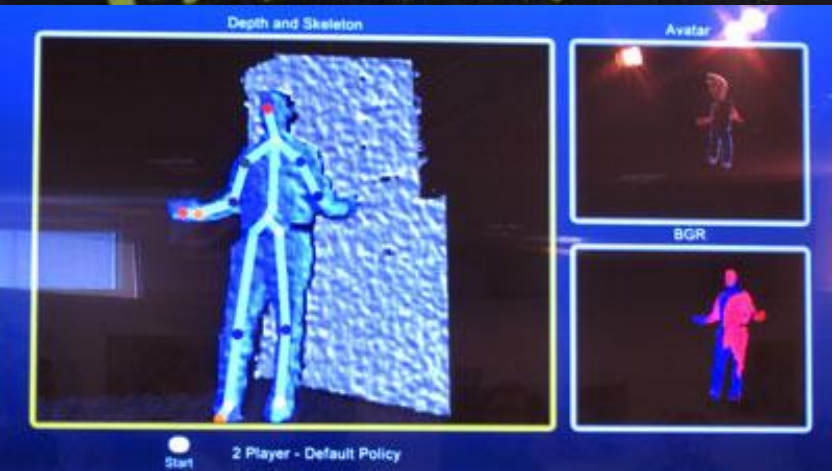
Ambient Intelligence (AmI)

- Information technologies interweaved into "the fabric of everyday life"
  - Can sense & respond to human needs & requirements
- In "intelligent" environments, the way that people perform everyday tasks is expected to radically change
  - Multimodal, direct, "natural" interaction
  - Knowledge about contextual factors such as the user's profile, preferences & location

GA in AmI environments

- AmI Environments effectively combine the real & the digital world
  - Thus, also combining their (game) accessibility problems
- Recent gaming examples
  - Nintendo Wii & MS Kinect
    - Several games that would be 100% accessible if using standard controllers, became inaccessible
      - e.g., people in wheelchairs, people who cannot (or do not want) to employ high physical activity





Idea for increasing Kinect GA

- "Frankenstein" approach
  - "Assemble" a virtual skeleton of a player using the (real) tracked body parts of multiple players, or even AI
    - e.g., one player is the hands, another the legs, game AI the head
  - Can be easily implemented
  - Does not require much CPU
  - Can result in a lot of fun (and social) gaming for everybody!

The goods news

- In AmI Environments, the accessibility problems may fuse…
  - but so do the accessibility solutions!
- This could potentially lead to more accessible everyday life!

Wrapping it up...

The root of all evil

#1 reason for most GA problems is ignorance

- A game can become highly accessible to the vast majority of people simply by:
  - taking the right design decisions
  - avoiding design pitfalls

Some things you can do (1/3)

- Support multiple input devices & techniques
- Customizable "controls"
  - Sensitivity
  - Less/simpler controls
    - Down to 1
  - No simultaneous button pressing
- Adjustable speed & difficulty
  - Automate user actions
    - e.g., shoot, move, pass

Some things you can do (2/3)

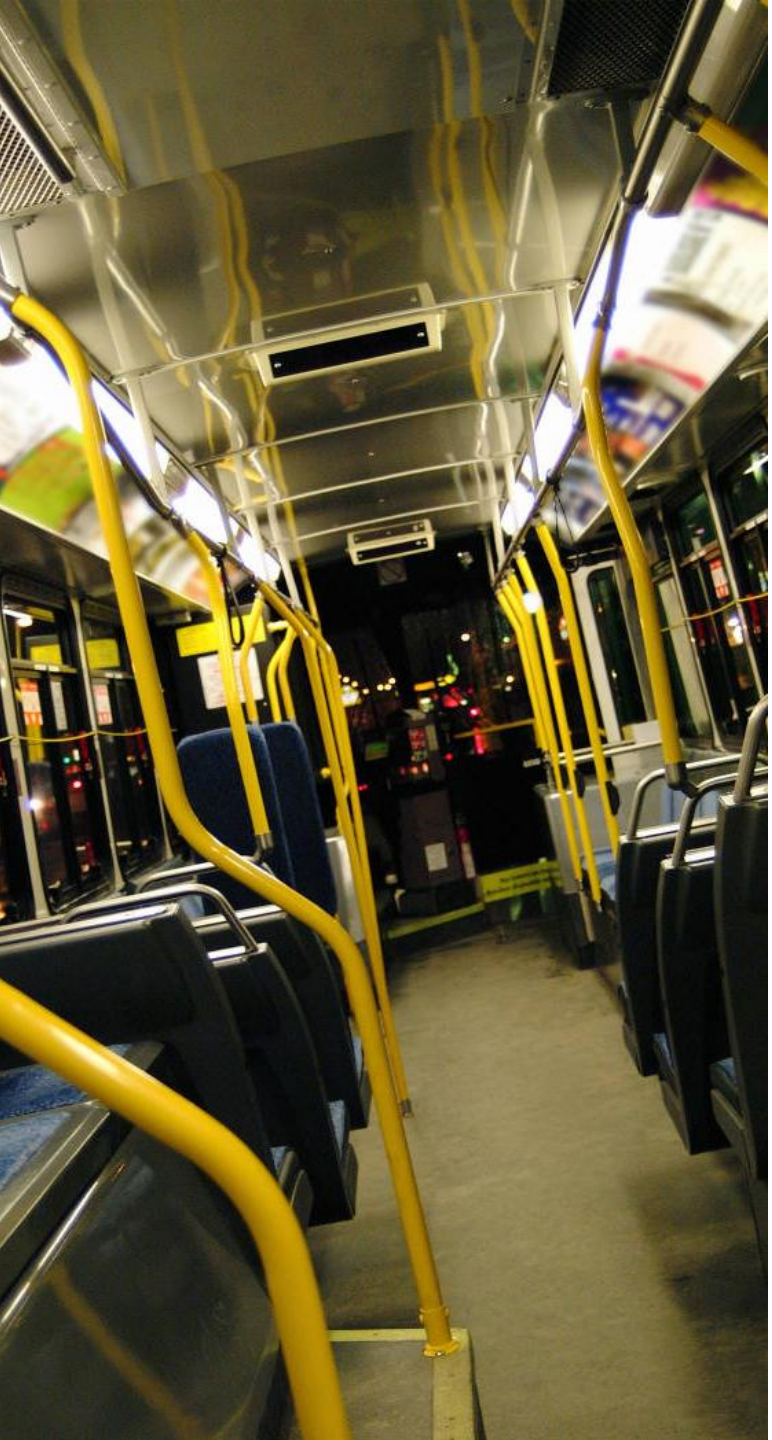
- Scalability of visuals
  - Text, game elements
- Alternative color schemes / contrast modes
- Adjustable visual detail
- Closed captions
  - Sound visualization
- Audio control
  - FX, music, speech (separately)

Some things you can do (3/3)

- Sonification
  - Audio feedback to events
  - Audio descriptions
  - Localised (2D/3D) audio
  - Reading aloud (text, menus)
- Accessible documentation

- Important note:
  - Make sure that the game is still playable & fun after selecting various combinations of the available GA options

See also: GASIG: Top 10 Ways To Improve Game Accessibility: http://wiki.igda.org/Top_Ten



Believing that making games more accessible will only benefit gamers with disabilities….

… is like thinking that seats in buses only benefit pregnant women, or, that salad bars in restaurants are just for vegetarians!

Indicative benefits for all players (1/2)

- Closed captions
  - Non(-native) language speakers, playing in loud / quiet environment
- Customizable “controls”
  - Left-handed / single-handed
- Alternative I/O devices
  - Playing using alternative input devices, such as a Touchpad, non-standard controller, etc.

Indicative benefits for all players (2/2)

- Customizable “controls” & adjustable speed / difficulty
  - Novice / casual / tired / young / old player
- Scalability of visuals
  - Screen too small / very far
- Alternative color schemes / contrast modes
  - Playing in bright environment
- Sonification + simple controls
  - Playing on the move

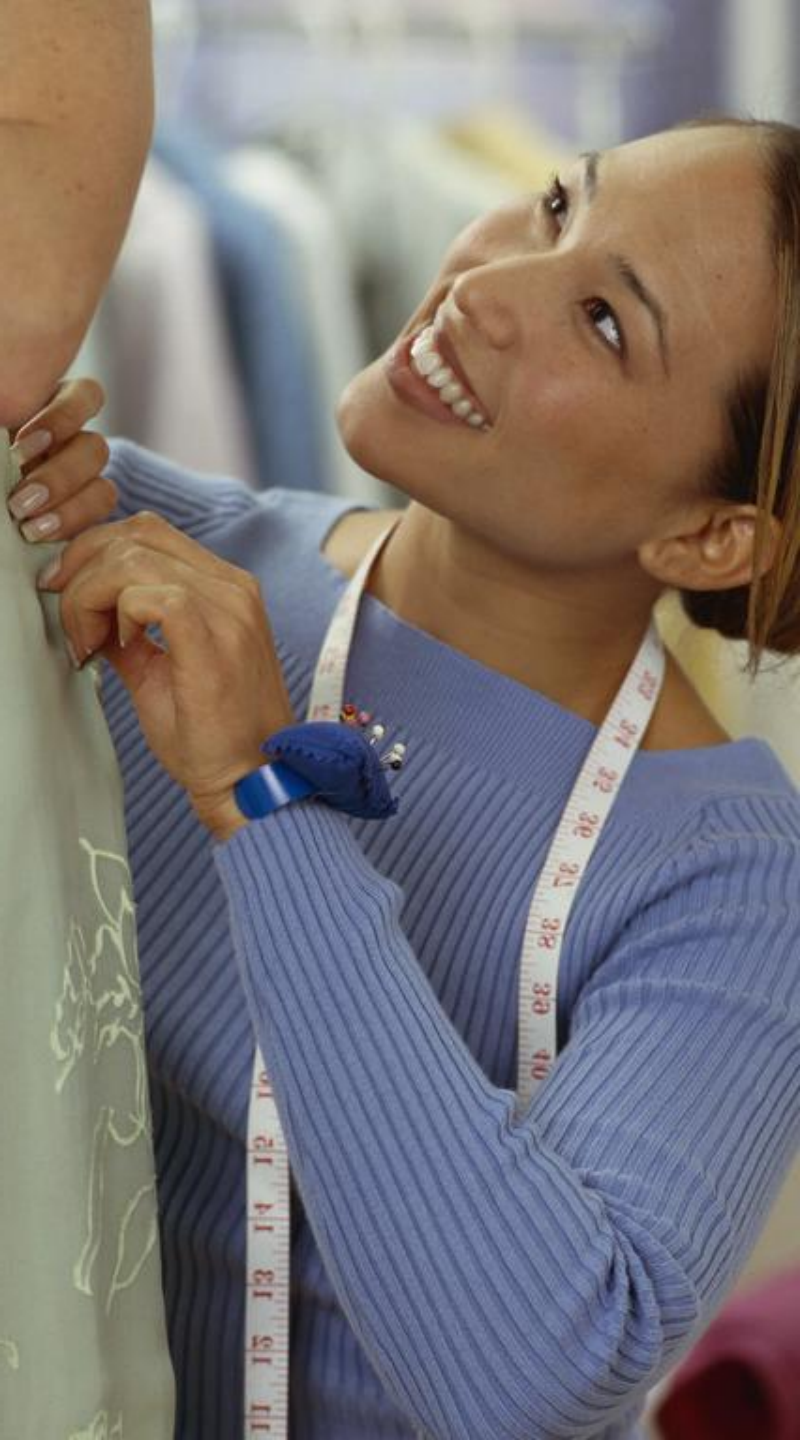
Remember…

Accessibility ≠ Usability

- A game may be accessible but still very hard (or boring) to play
  - e.g., using a virtual keyboard to play a game employing 18 keys – most of which must be simultaneously pressed

Some (harder) things you can do (1/2)

- Understand game accessibility & integrate it in the game design lifecycle
- Design your game at an abstract level first
- Create user interfaces that can support alternative interaction methods & modalities
  - that can co-exist & co-operate



Some (harder) things you can do (2/2)

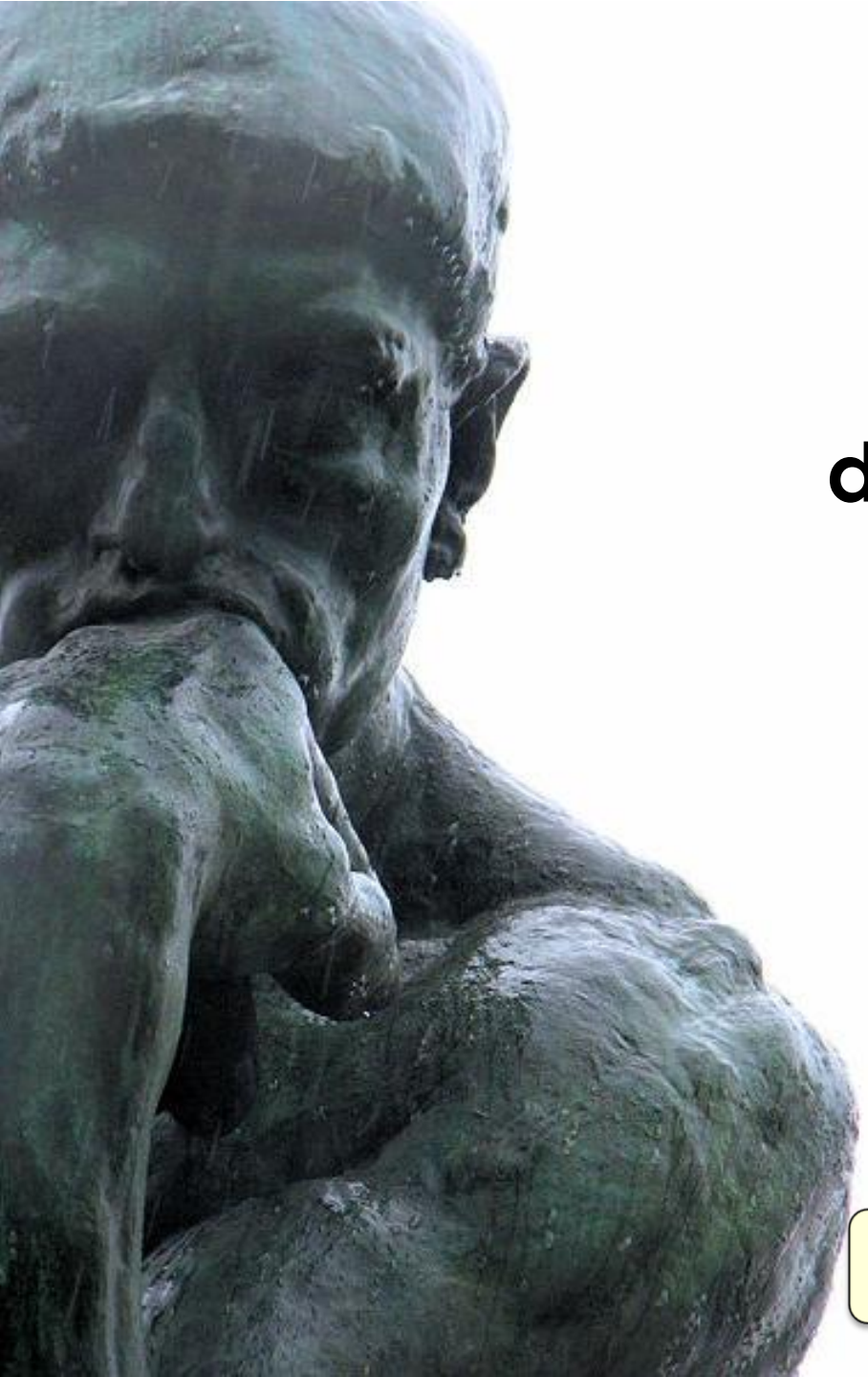
- Create user interfaces able to adapt to alternative user profiles
- Consult players from diverse user groups
- Follow open & extensible interaction design
  - so that, later on, it will be possible to expand the design to cater for more user categories & contexts of use

But, most importantly…

Learn about
Game Accessibility…

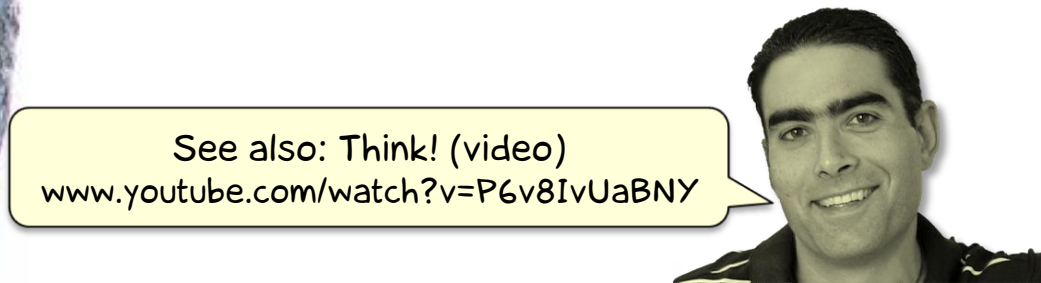
...and help spreading
the word!

Ah, yes!
There's one more thing that you can do...



Before you start developing anything…

…first, think!



Why should I do it, anyway? (egocentric view)

a) You are different, just like anybody else….
   - You can have games that match your skills & preferences

b) You are not getting any younger
   - Age comes with GA problems

c) Disability is not an exotic disease
   - Permanent or temporary, can happen to you, or the ones you love, anytime, any day
     - You will still wanna play, right?

Why should I do it, anyway? (exocentric view)

a) Your games will be better for ALL players

b) You can broaden your target market = mak$ (mor$) mon$y

c) You can make a lot of people happier :-)

d) Simply, because you can!

See also: Game Accessibility - Why Bother?
http://www.gamasutra.com/php-bin/news_index.php?story=13650

The ∀-factor (1/2)

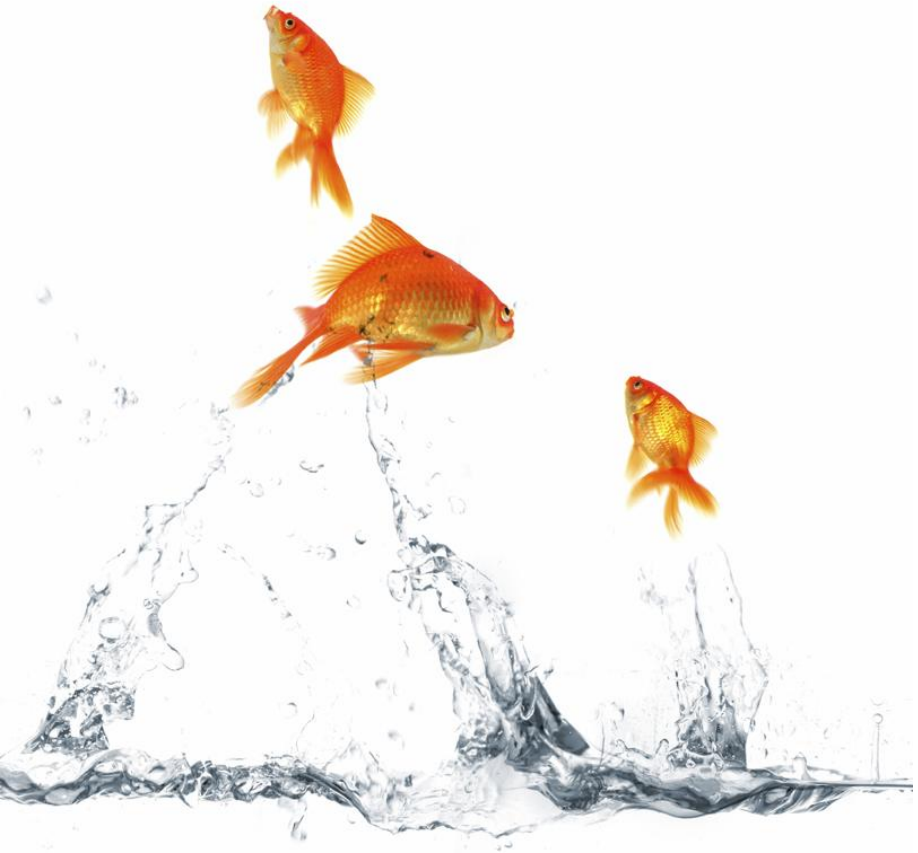
For many years, game companies have been pole-fishing in the same pond of gamers, mostly competing through improving their baits...

But:

(a) Their bags of tricks are getting more and more similar

(b) As the number of fishes is limited, in order to catch more, they have to steal it from each other

The ∀-factor (2/2)



A viable alternative is to turn to the open sea. But, in order to do so, you need more than just fancy baits – you have to use new fishing tools, as well as appropriately adapted methods & techniques

And, currently, the game companies' biggest handicap (no pun intended) is that they are missing the ∀-factor (where '∀' stands for Accessibility for All – *see the Addendum*)

Bottom line...

(Universal) Game Accessibility

- ✖ Is not a bug to be fixed…

(Universal) Game Accessibility

- ✖ Is not an afterwards thought, or an add-on

(Universal) Game Accessibility

- Is a design philosophy
  - can introduce great innovations
  - can lead to groundbreaking games

(Universal) Game Accessibility

- Requires & forces "out-of-the-box" thinking
  - focusing on the players, rather than the technology

(Universal) Game Accessibility

- Supports game democratization
  - everyone able to play with (or against) anyone

(Universal) Game Accessibility

- ✖ Is not about people with disabilities…
- It is about **PEOPLE**

After all...

It does not take extraordinary technology to make extraordinary games…

… just extraordinary thinking!


This is your last chance.
After this, there is no turning back...

The End

Addendum
(Yes there's more)

Designing a game accessibility logo

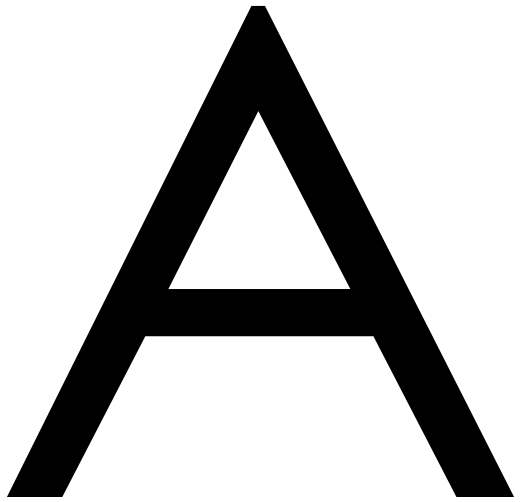
Analysis

G is for Game

G is for Game

G

A is for Accessibility



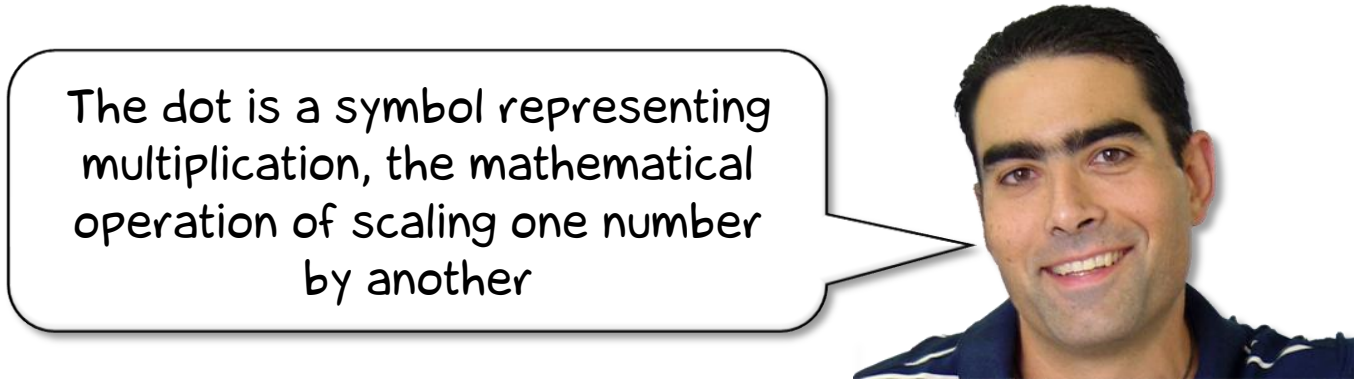
A is for Accessibility

∀

Interestingly, if we turn A upside down, we get ∀, which is a mathematical symbol called "the universal quantifier" and is usually read as "for all", "for any" or "for each"

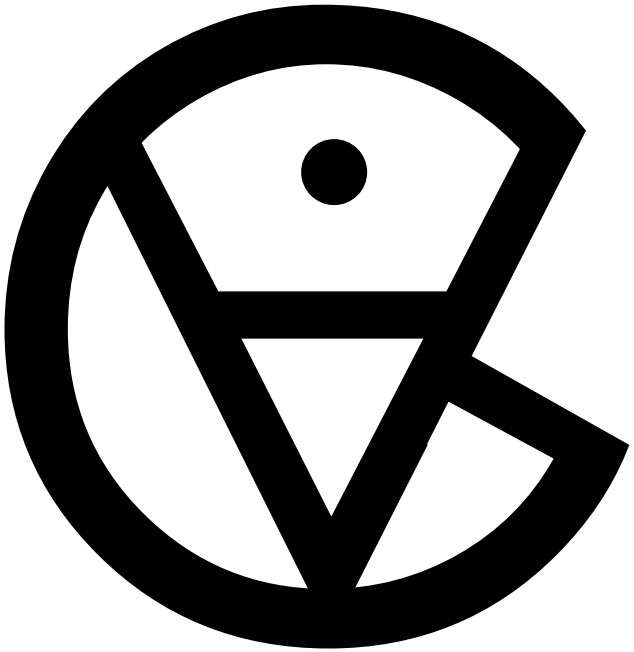
‘•’ (dot) is for multiplication

•

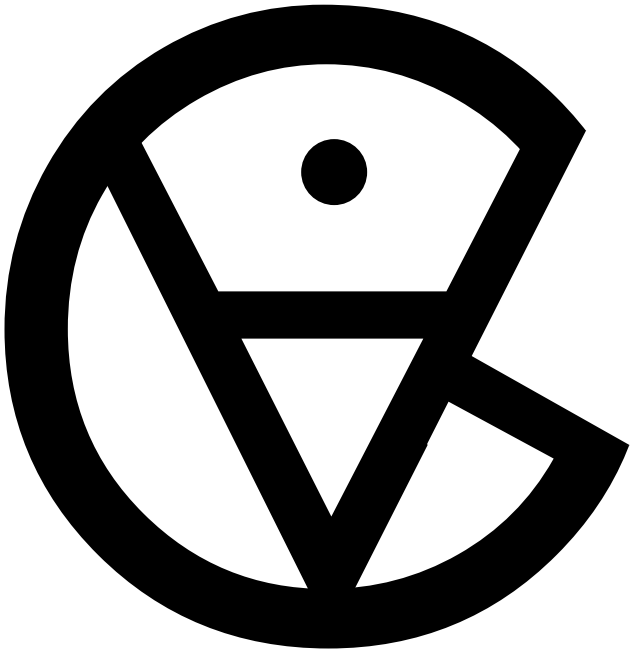


Synthesis

Game Accessibility Logo (?)



So, this is the product of
Game *multiplied by* Accessibility for All
- which kinda looks like a Maori Pacman -



GOME PLAY

Now, this is The End

(or maybe just the beginning?)

About Me...

Institute of Computer Science (ICS)
Foundation for Research & Technology – Hellas (FORTH)

FORTH

- Established in 1983
- Major national research centre
  - Partly funded by the General Secretariat for Research & Technology of the Hellenic Ministry of Education, Lifelong Learning & Religious Affairs

ICS-FORTH

- Research Laboratories
  - Biomedical Informatics Laboratory
  - Computer Architecture and VLSI Systems Laboratory
  - Computational Vision and Robotics Laboratory
  - Distributed Computing Systems Laboratory
  - **Human-Computer Interaction Laboratory**
  - Information Systems Laboratory
  - Telecommunications and Networks Laboratory
- > 350 people
  - Researchers, technical staff, students, …

Me & Game Accessibility

- Interaction designer (16 years)
  - specialized in Universal Design, Universal Access & Ambient Intelligence Environments
- Since 2004, in charge of UA-Games Activity
- IGDA GA SIG member since 2004
- GA-related Awards
  - European Design 4 All Awards (2004)
    - "UA-Chess" nominated for the final jury decision
  - Arcademy Games Awards Montreal, Canada (2008)
    - "Game Over!" won the People's Choice award

UA - Games

Universally Accessible Games

- Research, design & develop
  - Universally Accessible Games
- Create & test new
  - Concepts
  - Interaction techniques
  - Methods
  - Software tools

Key Results

- Design Method
  - Unified Design for UA-Games
- Concept
  - The Theory of Parallel Game Universes
- Games
  - 2-fold role: proofs of concept + case studies
    - UA-Chess
    - Access Invaders
    - Game Over!
    - Terrestrial Invaders

GA-related publications

- Grammenos, D., Savidis, A., and Stephanidis, C. 2009. Designing universally accessible games. Comput. Entertain. 7, 1 (Feb. 2009), 1-29. DOI= http://doi.acm.org/10.1145/1486508.1486516
- Grammenos, D. 2008. Game over: learning by dying. In Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems (Florence, Italy, April 05 - 10, 2008). CHI '08. ACM, New York, NY, 1443-1452. DOI= http://doi.acm.org/10.1145/1357054.1357281
- Grammenos, D., Savidis, A., and Stephanidis, C. (2007). Unified Design of Universally Accessible Games. In Stephanidis, C. (Ed.), Universal Access in Human-Computer Interaction. Applications and Services, Proceedings (Part III) of the 4th International Conference on Universal Access in Human-Computer Interaction (pp. 607-616). Berlin Heidelberg, Germany: Springer. URL: http://dx.doi.org/10.1007/978-3-540-73283-9_67
- Grammenos, D.(2007). Game Over. Usability Professionals' Association User Experience Magazine: Volume 6, Issue 3, 2007
- Grammenos, D. (2007). Game Accessibility - Why Bother?. Gamasutra Opinion article, April 24, 2007. Available on-line at: http://www.gamasutra.com/php-bin/news_index.php?story=13650
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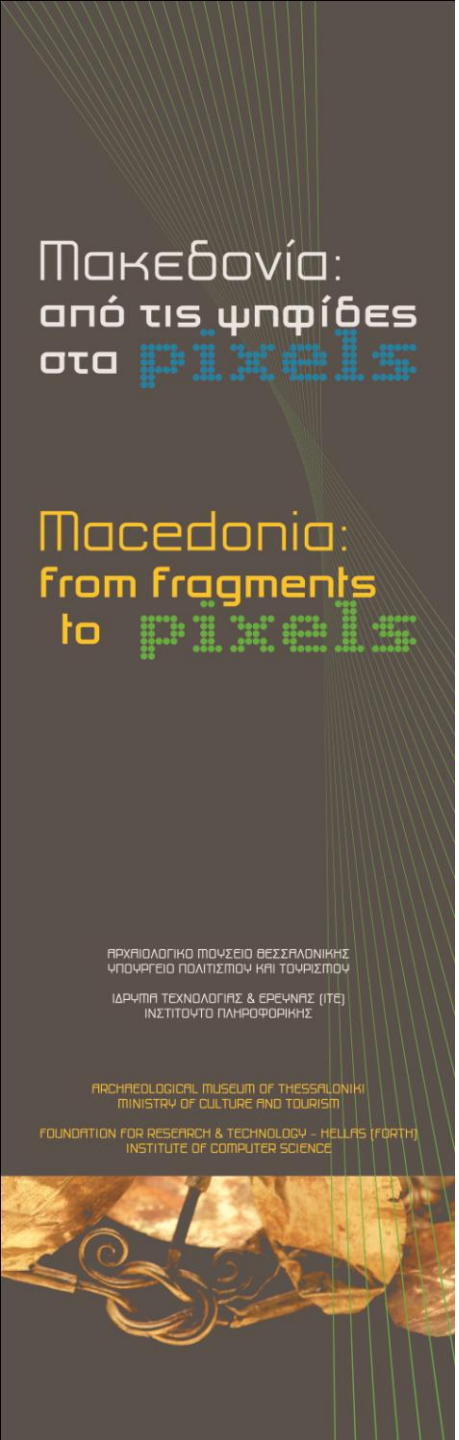
- Grammenos, D. (2006). The Theory of Parallel Game Universes: A Paradigm Shift in Multiplayer Gaming and Game Accessibility. Gamasutra Feature article, August 17, 2006. Available on-line at: http://www.gamasutra.com/features/20060817/grammenos_01.shtml
- Grammenos, D., Savidis, A., Georgalis, Y., & Stephanidis, C. (2006). Access Invaders: Developing a Universally Accessible Action Game. In K. Miesenberger, J. Klaus, W. Zagler, & A. Karshmer (Eds.), Computers Helping People with Special Needs, Proceedings of the 10th International Conference, ICCHP 2006, Linz, Austria, 12 – 14 July (pp. 388–395). Berlin Heidelberg, Germany: Springer. URL: http://dx.doi.org/10.1007/11788713_58
- Grammenos, D., Savidis, A., Stephanidis C. (2005). UA-Chess: A Universally Accessible Board Game. In Proceedings of the 3rd International Conference on Universal Access in Human-Computer Interaction. G. Salvendy (ed.). Las Vegas, Nevada, USA, July 2005. Lawrence Erlbaum.

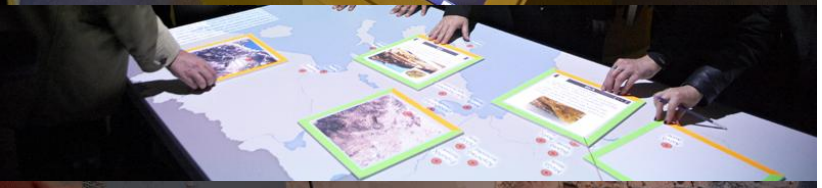


More recent work:
Macedonia: from fragments to pixels

- Innovative interactive exhibition
  - Archaeological Museum of Thessaloniki(AMTh)
- Interactive museum exhibits developed in the context of ICS-FORTH's AmI Programme in cooperation with AMTh
  - Objects from the rich collection of AMTh & other museums
    - Many of them are not accessible to the public due to their location or their fragility

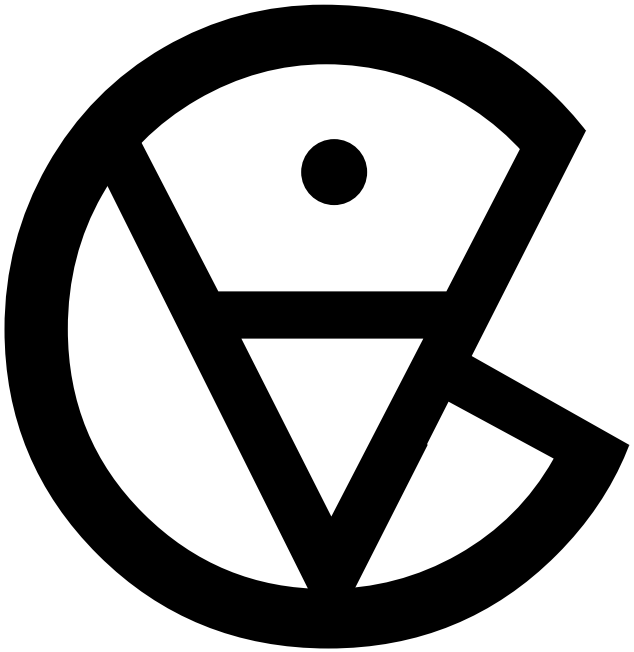
➡ **www.makedonopixels.org**




7 interactive systems

- Panoptes
- Cryptolexon
- Peridexion
- Multimodal Diverse travel
- One day in a farmstead
- Polyapton
- Macrographia



GOME PLAY