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Supporting motor-impaired gamers

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http://www.ics.forth.gr/hci/ua-games

Physical disabilities

- Paralysis
  - Caused by damage to the brain or the spinal cord
  - Muscles are not signaled by the nerves
  - Limited ability to move the affected parts of the body

- Neurological
  - Certain neurological disorders such as Amyotrophic Lateral Sclerosis (ALS) affect motor skills

- Repetitive stress injury
  - Result of repeated motions over a long period of time
  - Treatable but recurring & painful

- Age related issues
  - Natural loss of dexterity
  - Arthritis

Barriers for motor impaired gamers

- Inability to use many buttons

  – Modern games use buttons in abundance

- Inability to use common input devices

  – Mouse usage is prohibitive under certain disabilities

  – Most controllers require the use of both hands

- Not good hand-eye coordination

  – Slow response time – poor reflexes

  – Modern games are getting increasingly complex

Examples of input devices

Big Red (Don Johnston Inc.)
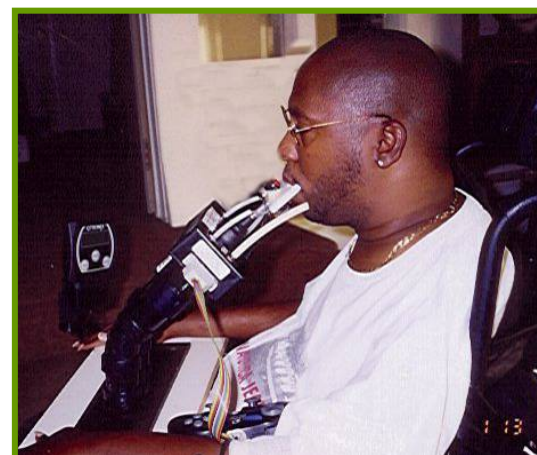http://www.donjohnston.com/

Ascii Grip V2 Controller for PS
http://www.consolesandgadgets.com

SmartNAV EG (NaturalPoint)
http://www.naturalpoint.com/smartnav/

Cyberlink (Brain Actuated Technologies, Inc.)
http://www.brainfingers.com

Mouth Controller for Playstation®   2 Video Games (KY Enterprises)
http://www.quadcontrol.com/joystick.htm

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Overview of Accessibility Solutions

Devices that are suitable for, or compensate to some extent for a specific disability

Assistive technologies
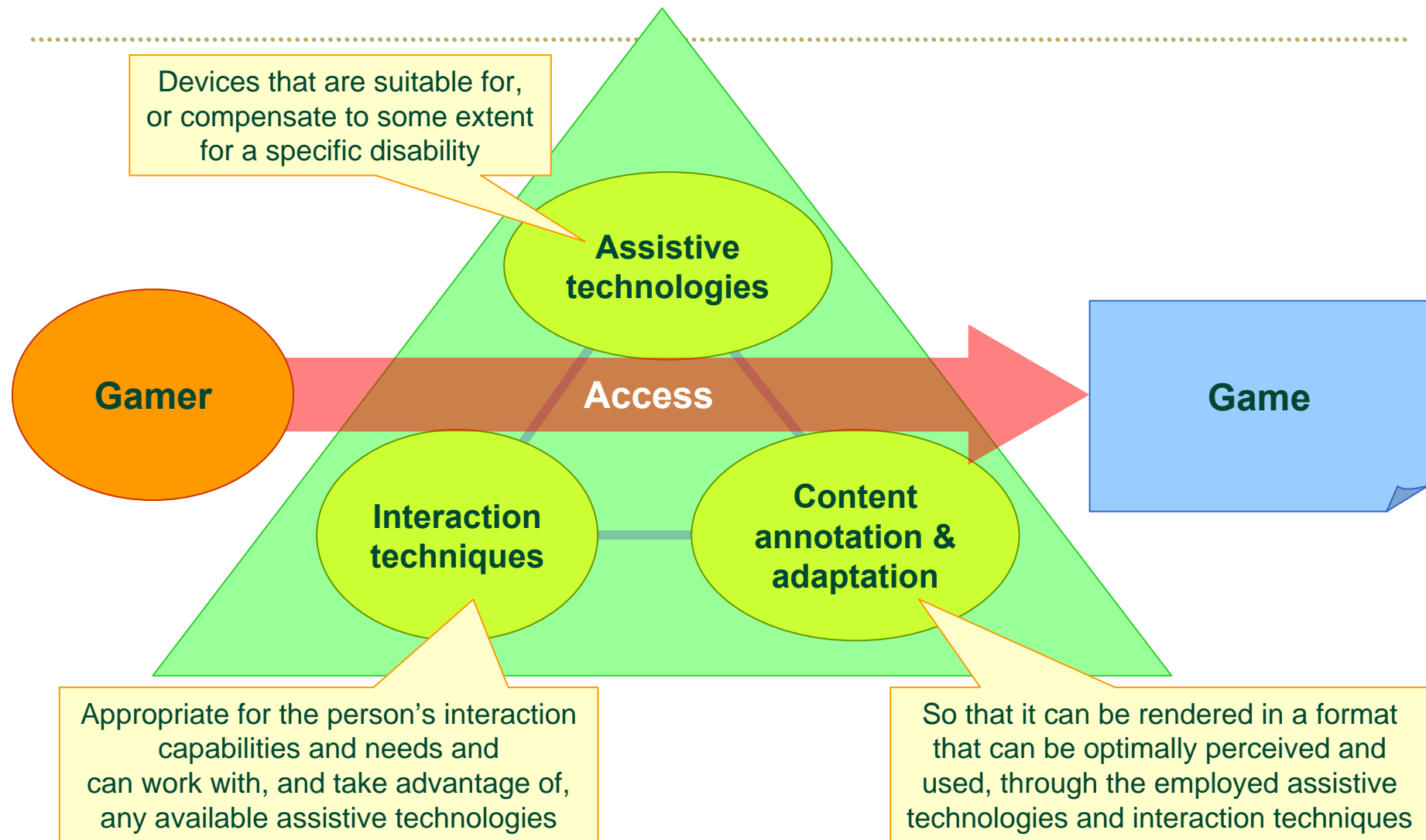
Gamer

Access

Game

Interaction techniques

Content annotation & adaptation

Appropriate for the person's interaction capabilities and needs and can work with, and take advantage of, any available assistive technologies

So that it can be rendered in a format that can be optimally perceived and used, through the employed assistive technologies and interaction techniques

Making a game accessible to motor impaired gamers

- Make the game work through the keyboard

  – All devices simulate the keyboard's scan-codes

- Employ scanning for navigating through the game's objects

  – Embedded in the game (i.e. don't rely on external scanning programs)

- Support reduction of distinct controls to different levels

- Make all the functions of the game that affect its difficulty configurable

- Speech recognition is also an option

  – But…

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Universally Accessible Games

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UA-Games at ICS-FORTH (1/2)

- **Universally Accessible Games** (UA-Games) are games that

  - Follow the principles of Universal Access and Design for All

    - http://www.ics.forth.gr/hci/ua-games/design4all.html

    - http://ui4all.ics.forth.gr/isf_is4all/publications.html#White%20Paper

  - Are proactively designed to optimally fit and adapt to different individual gamer characteristics without the need for further adjustments or developments

  - Can be concurrently played among people with different abilities & disabilities

    - Ideally, also when sharing the same computer

  - Can be played on alternative technological platforms using a large variety of devices

    - Including assistive technologies

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UA-Games at ICS-FORTH (2/2)

- Beyond providing accessibility an important issue, is quality of interaction

  – The extent to which the game meets the real world needs of its intended users and the effectiveness of the support it provides to achieve their particular goals

- Requiring provision of access is not enough, especially in such an interaction-intensive domain as computer games

- When referring to games that are universally accessible, it is meant that these games can be played by all people who can potentially play them but may currently be restrained from it due to design flaws; not by all the people in the world

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UA-Chess

- Fully-functional chess game

- Can be played through a standard Web browser

- Can be concurrently played by people with different abilities and preferences, including people with disabilities

  - E.g., low-vision, blind and hand-motor impaired
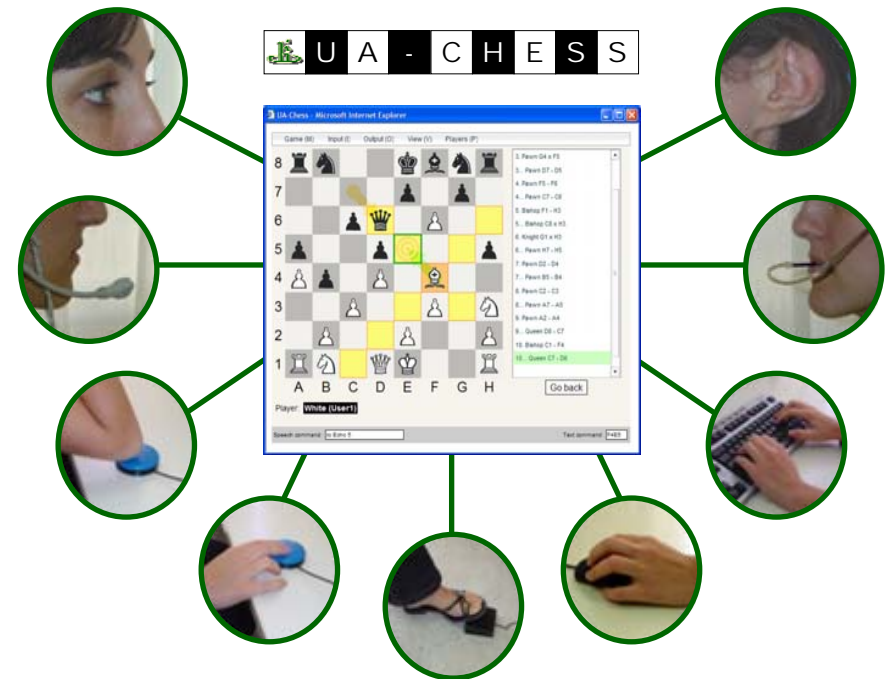
www.ics.forth.gr/hci/ua-games/ua-chess

Interacting with UA-Chess

- Alternative input / output modalities & interaction techniques
  - That can co-exist and co-operate in the game's user interface

- Customizable player profiles

- Fully accessible through:
  - The mouse
  - The keyboard
    - Or any type of switches emulating keystrokes
  - Speech recognition

- Self-voicing capabilities
  - Built-in screen reader that offers full auditory access to every part of the game

- Can be sized and zoomed in and out at different levels

Universally accessible action games

- Constitute a real challenge for Universal Access

- Have highly dynamic content comprising of many different moving objects with various characteristics that appear and disappear

  – E.g., the player's character / ship, enemies, bullets, balls, bonuses

- Require complex controls

- Are based on reflex-based reacting

- The way two players with different abilities disabilities can cooperatively play the same action game is currently an open research issue

Access Invaders

- An accessible remake of the classic Space Invaders game

- Developed by the HCI Lab of ICS-FORTH in close cooperation with the Centre for Universal Access & Assistive Technologies

  – In the context of the UA-Games Activity

- Can be concurrently played by people with different abilities & preferences, incl. people with disabilities

  – E.g., low-vision, blind & hand-motor impaired

www.ics.forth.gr/hci/ua-games/access-invaders

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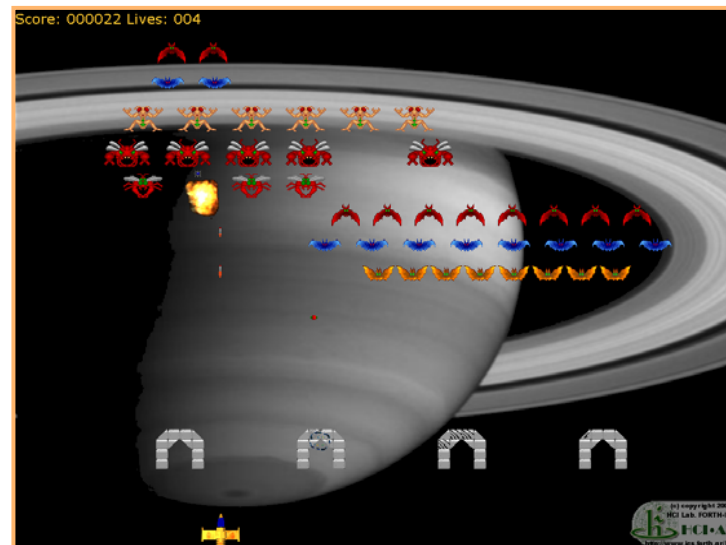
Access Invaders characteristics

- Every aspect of the game's functionality is fully accessible through many input devices

- Non-visual (audio-based) gameplay is also supported
  - Acoustic rendering of game information is provided through the use of spatial audio and of a built-in screen reader

- Highly customizable
  - Supports the creation and use of unlimited user profiles
  - Each game parameter can be adapted both 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

Alternative input techniques (1/2)

- Musical input

  – Whistling
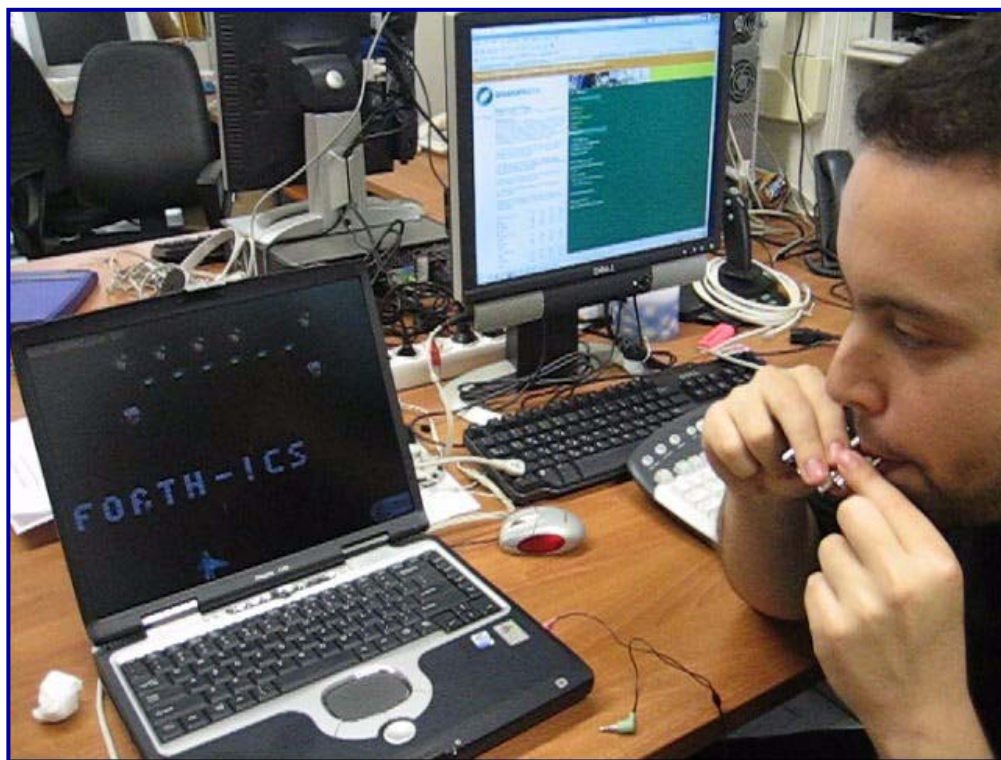
Alternative input techniques (2/2)

- Vision-based gesture recognition

  – Computational Vision and Robotics Laboratory of ICS-FORTH

- Related links

  – http://www.ics.forth.gr/~argyros/research/colortracking.htm

  – http://www.ics.forth.gr/~argyros/research/fingerdetection.htm

  – http://www.ics.forth.gr/~argyros/research/virtualmouse.htm

Parallel Game Universes (PGUs) (1/2)

- Multiplayer action games constitute an open research challenge
  - Since it is not only the interface that changes, but also the game's content and rules

- Two (or more) people should be able to play the same game, being aware of each other, while at the same time each one follows different rules and perceives distinct content

- A possible solution to this problem is to allow each player to play in a different "game universe" and then somehow project each universe to the other(s)

Parallel Game Universes (PGUs) (2/2)

- The term "Game Universe" is used to denote an instance of the game after it has been adapted to suit the requirements and needs of a particular player

  - For example, the alternative profiles of Access Invaders could be considered as different game universes
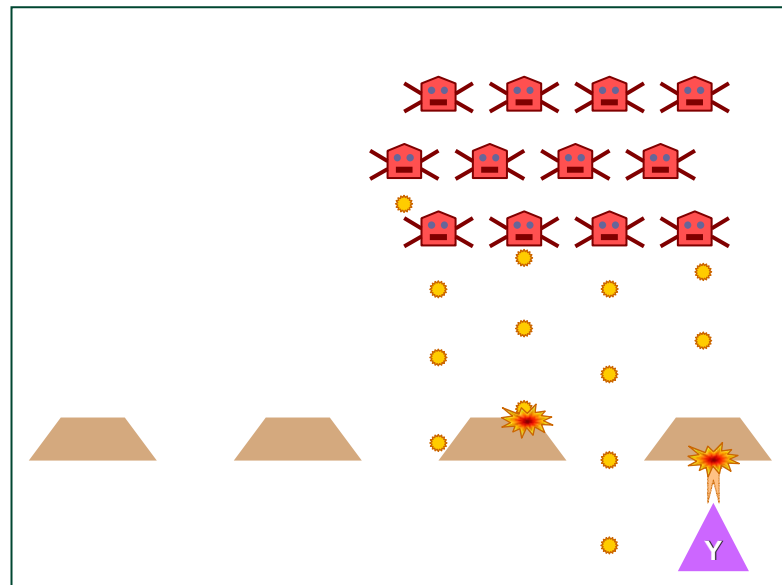
PGUs – Example (1/4)

- Two friends want to play the game together
  - Player X
    - due to severe motor-impairments, can use only a single switch
    - a manageable difficulty level includes a small group of aliens that move slowly and fire very scarcely, while the player's bullets do not collide with shields
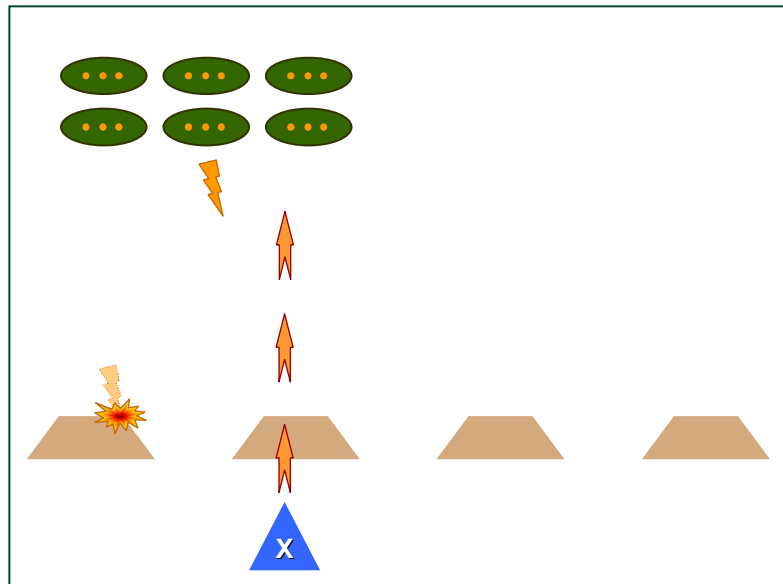
PGUs – Example (2/4)

– Player Y

- does not have a specific impairment

- in order for the game to be challenging enough, he wants to confront numerous fast, fire blazing aliens
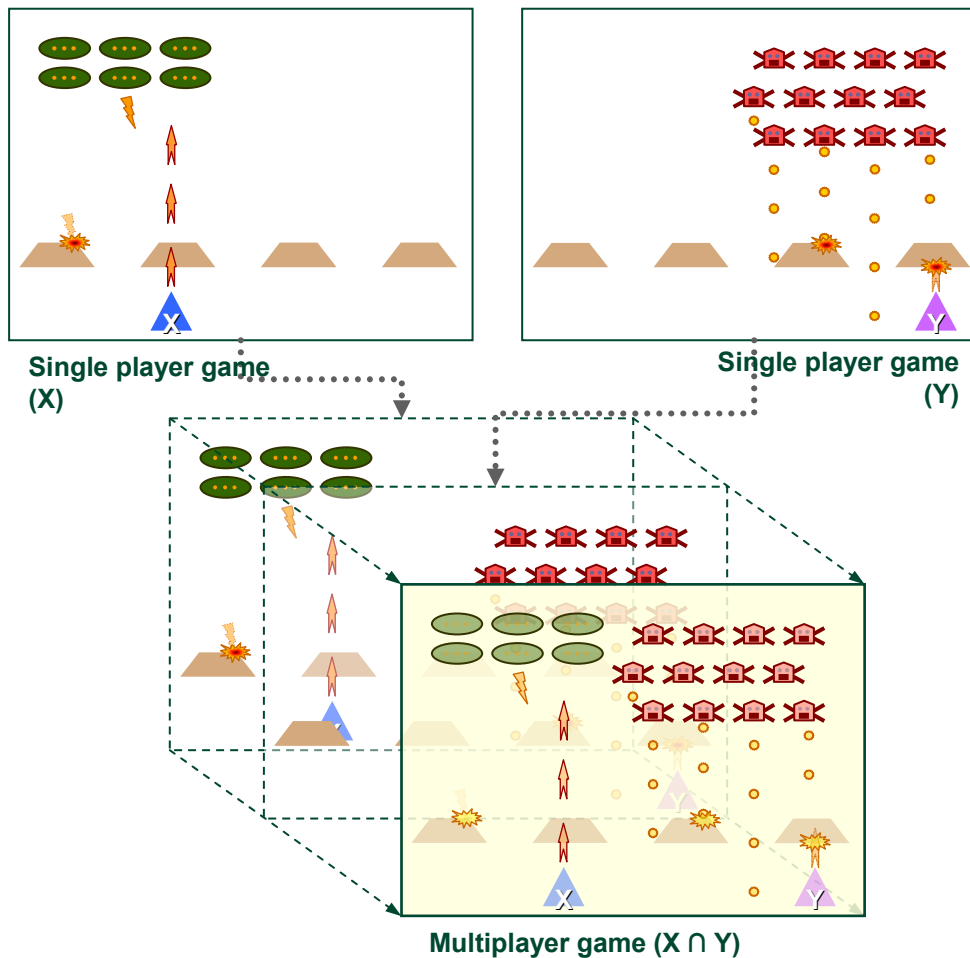
PGUs – Example (3/4)

- If the players attempt to share the very same game

    – If it is adapted to X, then it will be rather boring for Y

    – If it is adapted to Y it will be extremely difficult - if not impossible - for X

- A solution, following the concept of PGUs, is to merge the 2 distinct game versions into 1, where

    – 2 groups of aliens exist:

        - A big, fast & powerful which can destroy and be destroyed by Y

        - A small, slow and quite harmless that plays against X

    – The bullets of each player will not affect the aliens fighting against the other

    – Y's bullets will collide with the shields, and X's will not

PGUs – Example (4/4)

Single player game (X)

Single player game (Y)

Multiplayer game (X ∩ Y)

Thank you

- References:

  - http://www.ics.forth.gr/hci/ua-games

- Questions ?

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