What are Digital Games?

Commonly referred to as video games

People who play video games are called gamers

Rapidly growing industry
  • Generated close to USD 100 billion in revenue in 2015

What do you need to play a digital game?

1. An input device

2. An output, typically video, device
Input Devices

Commonly used input devices:
- Keyboard and mouse
- Gamepad
- Touchscreen
- Motion controllers

Other input devices include steering wheels, joysticks, light guns, and rhythm game controllers
Output Devices

Screens

Speakers

Controllers
  • Haptic feedback
Damir Azhar, 24/08/2016

Platforms

Personal computers

Consoles
  • Home and handheld

Mobile devices

Arcade machines
Media

Cartridges

Optical discs
  • CD, DVD, Blu-Ray, Proprietary

User-writable media
  • Floppy discs, cassettes, memory cards

Digital downloads
  • Steam, GOG, XBL, PSN

Genres – Platform Games

Primarily involve navigation through environments
• 2D or 3D
• Traversal from one platform to the next
Genres - Shooters

Combat oriented using ranged weapons

- First-person
- Third-person
- Light gun
- Shoot ‘em ups
Genres – Fighting Games

Focus on close combat
• 2D or 3D

Usually involves 2 combatants
• Player vs. Player
• Player vs. AI
• AI vs. AI
Genres – Role Playing Games

Play the role of one or more characters immersed in a well-defined world

• Detailed lore
• Focus on narrative, exploration, and quest completion
Genres – Sports Games

Emulate real-world sports
  • Degree of realism varies widely
  • Realistic titles are referred to as sims
  • Usually competitive – against AI or other gamers
Genres - Strategy

Outcome of combat determined by skilful thinking and planning

- Real-time vs. turn-based
- Strategy vs. tactics
Other Notable Genres

Massively multi-player online games
Casual games
Party games
Rhythm/music games
Puzzle games
Exergames
Educational games
Adventure games

Many games incorporate elements of more than one genre
The Game Industry

Developer
- Company specializing in video game development
- Multi-disciplinary – programming, art, testing etc.
- E.g. Crystal Dynamics, Rockstar Games, Rare, Naughty Dog

Publisher
- Company responsible for funding, marketing, and distribution
- May also develop video games – internal team of developers referred to as a studio
- E.g. Electronic Arts, Activision Blizzard, Ubisoft, Take-Two Interactive
Business Models

“Packaged” games
  • Purchase game for full access to its features
  • Further monetary outlay unnecessary

Subscription games
  • Playing the game requires paying a subscription fee
  • May require initial purchase as well
  • “Pay-to-play”

Free-to-play games
  • Core game is free
  • Certain game content locked behind in-game currency that is difficult to obtain
  • In-game currency can be purchased directly with real world money
Business Models

Microtransactions
- Ability to purchase in-game goods using real world money
- Often used in conjunction with free to play games – “Pay-to-win”

Downloadable content
- Additional content released for a game post-release
- Can include new modes, levels or aesthetic content
Gamer Demographics

Based on a study by the Entertainment Software Association (ESA) in the US in 2016:

• 59% of gamers are men. 41% are women

• The average age of a male gamer is 35. The average age of a female gamer is 44.

• The average gamer has been playing video games for 13 years.

• 63% of households have at least one gamer.

eSports

Organized video game competition
  • Competitors typically professional
  • Competitions are broadcast
  • Prize money for winners

Genres associated with eSports:
  • Real-time strategy games
  • Fighting games
  • First-person shooters
  • Multiplayer online battle arena games

First established in South Korea
  • Since 2000
  • Now a global phenomenon with an audience of 226 million people in 2015
Controversies

Negative behavioural effects:
  • Heightened aggression, lowered empathy
  • Various studies performed – no consensus

Censorship and regulation

Portrayal of women and minorities

Online harassment
  • Gamergate
Future

Virtual Reality
• Immerses user in a virtual environment
• User can look around, move and interact with environment
• Headsets for VR gaming recently released – Oculus Rift, HTC Vive

Augment Reality
• Real-world environment augmented with computer generated input – imagery, sound etc.
  • Hololens
3D content creation from where to now

- Most games up to the early 1990s were 2D
    - First attempts at 3D feel (stage 3: robots destruction)
    - Political resonance: https://en.wikipedia.org/wiki/Raid_over_Moscow
  - First attempts at 3D (First role player game)
    - Doom (1993)
The Real-Time Problem (cont.)

Early 3D games were able to render reasonably complex scenes in real time, even on very limited hardware (16MHz Intel 286!).

If traditional Ray Casting is slow on today's computers, how did they do it then?

The solution: 2D Ray Casting!
Do you want to know more?
COMPSCI 105-210-369-373-773-715
2D Ray Casting

2D Ray Casting is a rendering technique that was popularized in the early 1990s.
2D Ray Casting (cont.)

Rather than represent the environment in 3D, we represent it as a 2D grid, where each filled grid square is a solid wall, and a color for the type of wall (grey: stone, brown: wood, etc).

Since everything in the world lies on the same plane, we need only cast one ray along this plane for each pixel column of our viewplane.

Walls are drawn as a series of vertical strips, one per ray and with a height dependent on the length of the ray.
2D Ray Casting (cont.)

Some perspective projections of different views in the previous map...
Ray casting example
How to generate 3D contents today?

- From Reality: Need sensing devices able to gather 3D information from the environment (indoor/outdoor) both depth and colour.
  - Need a combination of imaging, image processing and computer graphics
  - Nowadays self-content creation becomes popular
Online Interactive Web-based Stereo Vision

- **Build a portable / comprehensive website and mobile app:**
  - Accept off-the-lab real-life photos of different types:
    - Left + right
    - Anaglyph
    - Auto-stereogram
  - Automatically align images to epipolar stereo form
  - Reconstruct 3D information and display online
  - Returns different 3D results

- **URL:** [ww.ivs.auckland.ac.nz/quick_stereo](http://ww.ivs.auckland.ac.nz/quick_stereo)
  - Thousands of visitors from **47 countries** around the World
  - **First rank** on Google Search on key words:
    - online stereo matching
    - online stereo vision
The IVS mobapp/The IVS online stereo website
Real time 3D reconstruction from video

Clockwise from top left: A single frame from a video; the depth map associated with the video frame; the reconstructed 3D point cloud; A quad copter which can be used to capture video footage.
3D terrain mapping

- Goal: map terrain using flight-over or walk-by
- Output: 3D points-cloud
- Equipment: A set of cameras
  - Monocular or stereo
- Video recorded
- SLAM (Simultaneous localization and mapping)
LIDAR + Drone
An expanding area

- Games from the 1990s are refitted for mobile platforms
- Increasing capabilities of GPUs: no limit to what can be simulated?
- Skills required: Maths, programming, arts, story telling