



Introduction to 3D Computer Game Programming

Introduction to Video Game Genres,
Platforms, Design, and Development



Game Genres

- Genre – a category describing similar gameplay characteristics
- Refer to https://en.wikipedia.org/wiki/List_of_video_game_genres



Genres

A listing of commonly used video game genres

- Action
- Adventure
- Action-Adventure
- Role-Playing (RPG)
- Strategy
- Simulation
- Others
 - Music/Rhythm
 - Survival
 - Sports
 - Puzzle
 - Traditional (board, card, word)

- Video game genres by purpose
 - Serious games (education and training)
 - Christian games
 - Exergames (exercise games)
 - etc

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Genres

- Action
 - Superset of all other action-oriented genres
 - Typified by fast-paced combat and movement - requires players to use quick reflexes and timing to overcome obstacles (hand-eye coordination and motor skill)
 - Sub-genres: fighting, shooting, platform, ..

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Genres

- Action > Fighting
 - Centers around close-ranged combat that typically emphasize one-on-one fights between two characters. Players typically fight other players or the computer using swordplay or martial arts
 - *Mortal Kombat*, and *Street Fighter* are examples
 - Street Fighter V – E3 2015 Trailer
<https://www.youtube.com/watch?v=2-9abLIPmp0>

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Genres



- Action > Shooter
 - Games focus primarily on combat involving projectile weapons, such as guns and missiles.
 - Divided into first-person and third-person shooters, depending on the camera perspective.

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Genres



- Action > Shooter > First-Person Shooter (FPS)
 - Action game where player is “behind the eyes” of the game character in a first-person perspective
 - id Software’s *Wolfenstein 3D* and *DOOM* are the earliest popular examples.
 - Another notable example is *Call of Duty* FPS franchise.

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Genres



- Action > Platformer
 - Typified by a character running, jumping, and climbing to navigate the world
 - Characterized by jumping to and from suspended platforms or over obstacles
 - Modern definition has expanded to include 3D
 - *Super Mario series*, *Sonic the Hedgehog*, *Pitfall!* are examples
 - Super Mario 64 <http://www.youtube.com/watch?v=bc6ov1-KUmQ&feature=related>

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Genres



■ Adventure

- Adventure describes a manner of gameplay **without** reflex challenges or action.
- They normally require the player to solve various puzzles by interacting with characters or the environment, most often in a non-confrontational way.
- Sub-genres include text-based adventure, graphical adventure, and visual novel (commonly characterized with dialog boxes and sprites determining the speaker).
- *Examples: Zork* by Infocom (text-based), *King's Quest* by Sierra and *the Longest Journey* by Funcom for Microsoft.

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Genres

■ Action-Adventure

- Adventure games with action elements – some obstacles require elements of action games to overcome using quick reflex or timing
- The Legend of Zelda was first break-out hit
- *Jak 3*, *Metroid Prime 2 Echoes*, and *Resident Evil 4* are examples of the genre.
 - [The Legend of Zelda Skyward Sword](#)

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Genres



The playable cast of
Final Fantasy XIII.

- Role-Playing Game (RPG)
 - The video game counterpart to pen and pencil games like Dungeons and Dragons
 - Most cast the player in the role of one or more "adventurers" who specialize in specific skill sets (such as combat or casting magic spells) while progressing through a linear or non-linear storyline.
 - *Final Fantasy*, *Baldur's Gate* and *Wasteland* are some popular examples of the genre
 - [FINAL FANTASY XIV: A Realm Reborn - Limit Break Trailer](#)

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Genres

- Role-Playing Game (RPG) > Massively Multiplayer Role-Playing Game (MMORPG)
 - An RPG set in a persistent virtual world populated by thousands of other players
 - *Ultima Online* in 1997 was the first popular one.
 - *World of Warcraft* is another popular one



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Genres



- Strategy
 - focus on gameplay requiring careful and skillful thinking and planning in order to achieve victory
 - Take one of four typical forms:
 - Turn-based or Real-time
 - Strategy (use of engagement) or Tactics (use of armed forces)

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Genres



- Strategy > Real-Time Strategy (RTS)
 - Typically, the goal is to collect resources, build an army and combat the other player or computer
 - Genre of computer wargames which do not progress incrementally in turns
 - Popularized by Westwood's *Dune 2* and *Command and Conquer* and Blizzard's *Starcraft* and *Warcraft*
 - Warcraft Lore: Sylvanas Windrunner Part 4
 - <http://www.youtube.com/watch?v=vi5VoGHWUYI>

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Genres



- Strategy > Turn-Based Tactics (TBT)
 - Turn-based. A player of a turn-based game is allowed a period of analysis before committing to a game action, and some games allow a certain number of moves or actions to take place in a turn.
 - Characterized by the expectation of players to complete their tasks using the combat forces provided to them.
 - Examples include Fire Emblem and Final Fantasy Tactics.

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Genres

- Simulation
 - Based on the simulation of a system
 - Attempt to provide the player with a realistic interpretation of a device or world
- Simulation > Construction Simulation
 - Type of simulation game which task players to build and manage fictional communities. (e.g. *SimCity*)
- Simulation > Life Simulation
 - Involve living or controlling one or more artificial lives
 - *The Sims* are example of "God" simulations where you control the lives of a town or a family
 - *Wing Commander* and *X-Wing* are popular space combat simulation games

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Genres

- Simulation > Vehicle Simulation
 - Provide the player with a realistic interpretation of a vehicle



[FlightGear](#) is a vehicle simulation game.

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Genres

- Simulation > Vehicle Simulation > Racing
 - Games that typically place the player in the driver's seat of a high-performance vehicle and require the player to race against other drivers or sometimes just time
 - Typically try to re-create a real-world activity
 - *Pole Position* was first popular racing game
 - *Gran Turismo* series (Track Racing)
 - Gran Turismo Sports
 - <https://www.youtube.com/watch?v=ppq1cRwBJCI>

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Genres



- Others > Music/Rhythm
 - Gauge player's success based on the ability to trigger the controls in time to the beat of music
 - Sometimes require specialized controllers such as dance pads or bongo drums
 - Konami's *Dance Dance Revolution* is the pre-eminent title of the genre.
 - *Guitar Hero* and *Rock Band* have achieved huge popularity among casual gamers.

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Genres

- Others > Sports
 - Games that simulate the sporting experience
 - Breakouts include *John Madden Football* and *Tiger Woods' Golf*

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Genres

- Others > Puzzle
 - Games that combine pattern matching, logic, strategy and luck with a timed element
 - *Tetris* is the breakout hit of this genre

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Genres

- Others > Traditional
 - Computerized versions of board, word, and card games
 - *Battle Chess* and the *Hoyle* series are standouts of this genre

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Platforms

- "platform" refers to the specific combination of electronic or computer hardware which, in conjunction with low-level software, allows a video game to operate

https://en.wikipedia.org/wiki/Video_game#Platforms

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Platforms



- Arcade games - played on a specialized type of electronic device that is typically designed to play only one game and is encased in a special cabinet
- PC games
- Console games – an electronic device that connects to a video monitor (e.g. TV)
- Handheld and mobile games

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Platforms

■ PCs

- Includes Windows, Linux, and Macs
- Can have very powerful hardware
- Easier to patch
- Need to support a wide range of hardware and drivers
- Games need to play nice with other programs and the operating system
- Examples: World of Warcraft, Sid Meier's Civilization V, Starcraft II, etc.



Starcraft II: Wings of Liberty

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Platforms

■ Game consoles

- Games are played on a special device that connects to TV or video monitor
- A dedicated video game platform manufactured by a specific company
- Usually use custom APIs and comes with a specific controller
- Examples consoles: PlayStation, Xbox, Nintendo
- Example games: God of War Series, Wii Sports, Halo: Reach, Final Fantasy Series, etc.



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Platforms



- Handhelds and mobiles

- Small, self-contained device that is portable and can be held in one's hands.
- Usually less powerful than PCs
- Programming sometimes done in lower-level languages
- Relatively smaller projects, teams, and budgets
- Handheld game consoles – Sony PS Vita, Nintendo 3DS XL
- Mobile devices - mobile phone, smartphone, PDA, or handheld computer.

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Platforms

- Hybrid

- Nintendo Switch: support both a home console and a handheld play.

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Platforms



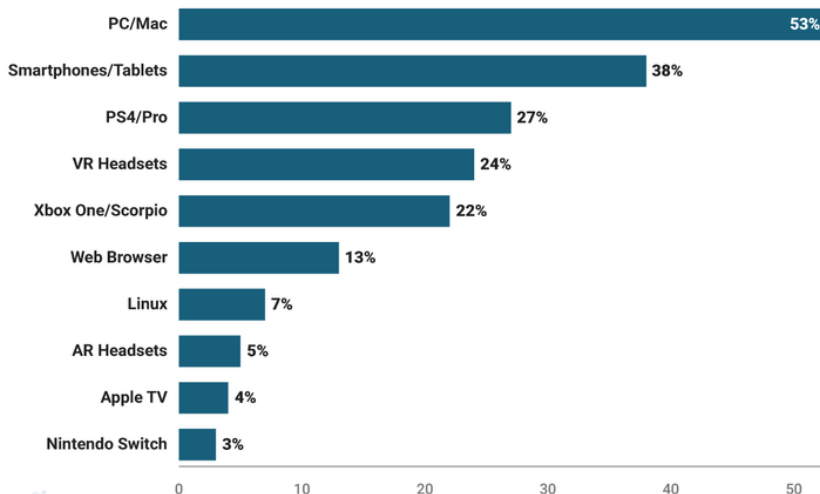
- Browser games
 - Video games that are played over the Internet using a web browser.
 - often free-to-play and do not require any client software to be installed apart from a web browser
 - Small games – mostly 2D
 - Need to be downloaded quickly

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TECH CHART OF THE DAY

THE MOST IMPORTANT GAMING PLATFORMS IN 2017

Percentage of game developers who are currently developing games for the following platforms



SOURCE: Survey of 4,500 game developers ahead of Game Developers Conference 2017

statista | BUSINESS INSIDER

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Game Design

- Game design is the process of designing the content and rules of a game.
- There is no one "right" way to design
- There are many successful approaches

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Game Design - Issues

- Issues to consider
 - Interface (communication between player and game)
 - GUI Design
 - Perspective (First-person, Over-the-shoulder (OTS), Overhead (top-down), Side, Isometric)
 - Audio (music, sound effect, dialog, ...)
 - Controls (physical input device, user manipulations with key maps,..)
 - Platform (PC, mobile, console, web, ..)
 - Target audience (age, hardcore gamer vs casual gamer, ...)

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Game Design - Documentation

- Written, descriptive model of the game
 - Depth varies according to the needs of the game
- Treatment
 - A brief, general description of the game and the fundamental concepts
 - May include:
 - Concept statement
 - Goals and objectives
 - Core mechanics and systems
 - Target platform and audience
 - Scope
 - Key features
 - Competitive analysis
 - Licensing and IP information
 - ...

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Game Design - Documentation

- Document types may include:
 - Preliminary design document
 - Initial Design Document
 - Revised Design Document
 - General Design Document
 - Expanded Design Document
 - Technical Design Document
 - Final Design Document

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Game Development

- Teams
 - Visual arts
 - **Programming**
 - Production Process
 - Audio
 - Narrative
 - ...

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Programming Teams

- In the 1980s programmers developed the whole game (and did the art and sounds too!)
- Now programmers write code to support designers and artists (who are the real content creators)

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Programming Areas

- Game code
 - Anything related directly to the game
- Game engine
 - Any code that can be reused between different games
- Tools
 - In house tools
 - Plug-ins for off-the-shelf tools

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Programming Team Organization

- Programmers often have a background in Computer Science or sciences
- They usually specialize in some area (AI, graphics, networking) but know about all other areas
- Teams usually have a lead programmer
- They sometimes have a lead for each of the major areas

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Programming Methodologies

- A methodology describes the procedures followed during development to create a game
- Every company has a methodology (way of doing things), even if they don't explicitly think about it
- Examples:
 - Code & Fix (unfortunately very common)
 - Waterfall (follow well defined sequential process)
 - Iterative (multiple development cycle during a single project)
 - Agile (very short iterations dealing with unexpected)
 - ...

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Programming - Common Practices

- Version control
 - Database with all the files (source code as well as game assets) and history.
 - Only way to work properly with a team.
 - Branching and merging can be very useful.

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Programming - Common Practices

- Coding standards
 - Set of coding rules for the whole team to follow
 - Improves readability and maintainability of the code
 - Easier to work with other people's code
 - They vary a lot from place to place
 - Get used to different styles

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Programming - Common Practices

- Automated builds
 - Dedicated build server builds the game from scratch
 - Takes the source code and creates an executable
 - Also takes assets and builds them into game-specific format
 - Build must never break

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Programming - Quality

- Code reviews
 - Another programmer reads over some code and tries to find problems
- Asserts and crashes
 - Use asserts anytime the game could crash or something could go very wrong
 - An assert is a controlled crash
 - Much easier to debug and fix

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Programming - Quality

- Unit tests
 - With very large codebases, it's difficult to make changes without breaking features
 - Unit tests make sure nothing changes
 - Test very small bits of functionality in isolation
- Bug database
 - Keep a list of all bugs, a description, their status, and priority
 - Team uses it to know what to fix next
 - Gives an idea of how far the game is from shipping
 - Doesn't prevent bugs, just helps fix them more efficiently

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Programming - Leveraging Existing Code

- A lot of code that games use is the same
- It's a total waste of time to write it over and over
- Instead, spend your time in what's going to make your game unique

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Programming - Leveraging Existing Code (free)

- Reuse code from previous project
 - Easier in a large company if you have an engine and tools group
- Use freeware code and tools
 - No support
 - Make sure license allows it

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Programming - Leveraging Existing Code (Buy it)

- Middleware
 - Companies provide with specific components used in game development
 - physics, animation, graphics, etc
- Commercial game engines
 - You can license the whole engine and tools and a single package
 - Good if you're doing exactly that type of game

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