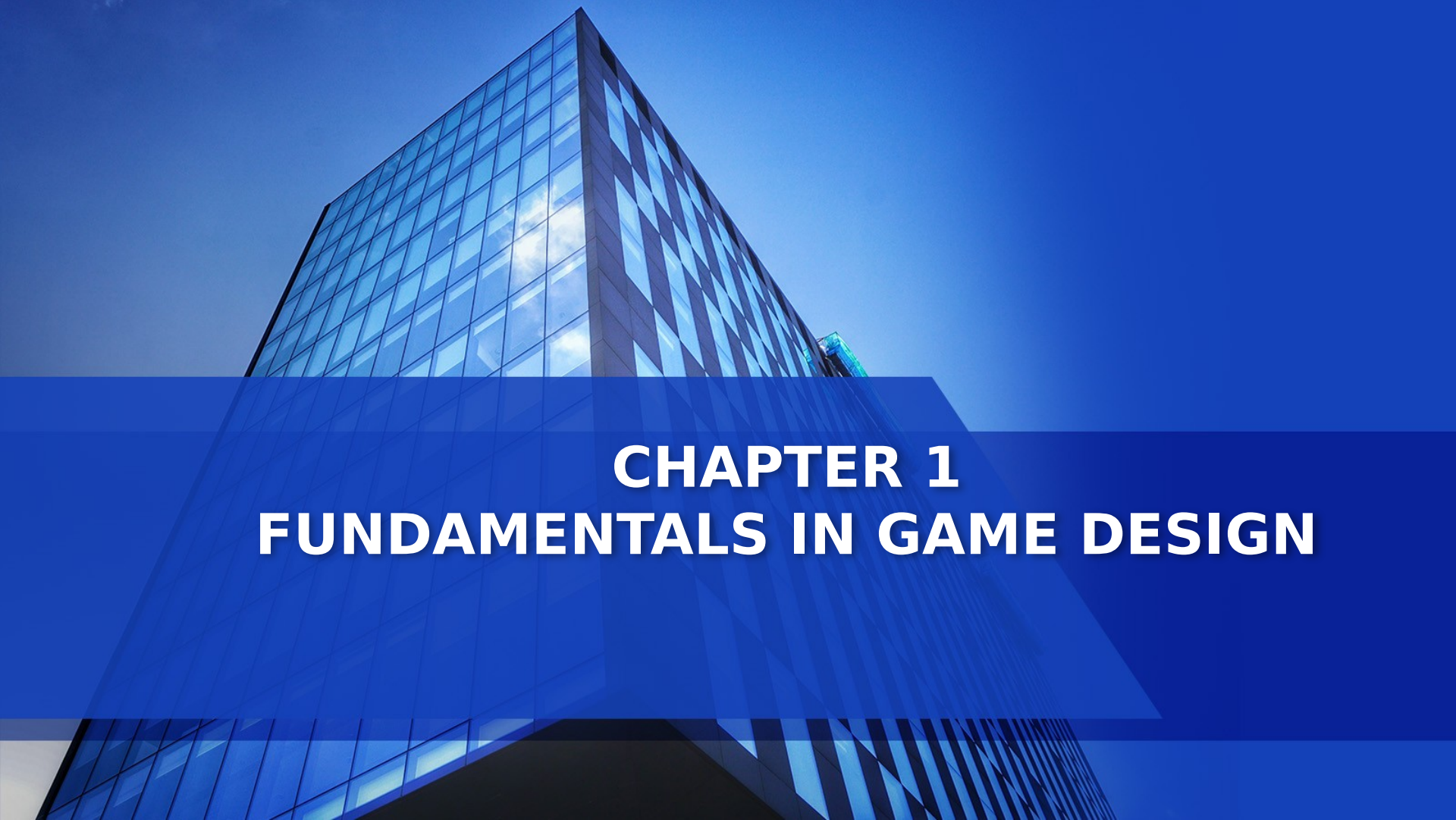


CHAPTER 1
FUNDAMENTALS IN GAME DESIGN



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Fundamentals in game design and elements

- **Game design** is the art of applying design and aesthetics to create a game for entertainment or for educational, exercise, or experimental purposes.
- Increasingly, elements and principles of game design are also applied to other interactions, in the form of gamification.
- Games can be characterized by "what the player does"and what the player experiences.
- This is often referred to as gameplay.
- Major key elements identified in this context are tools and rules that define the overall context of game.

Tools and rule development

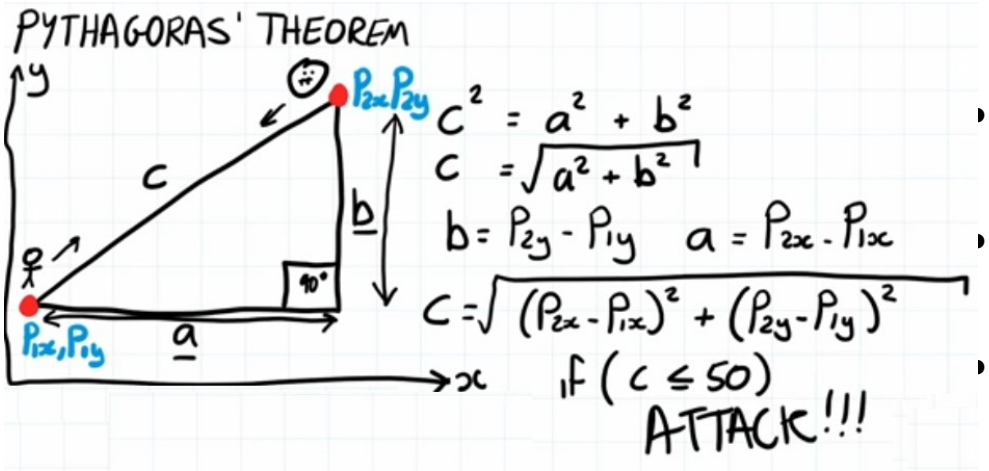
Tools of play

- Games are often classified by the components required to play them.

Rule development

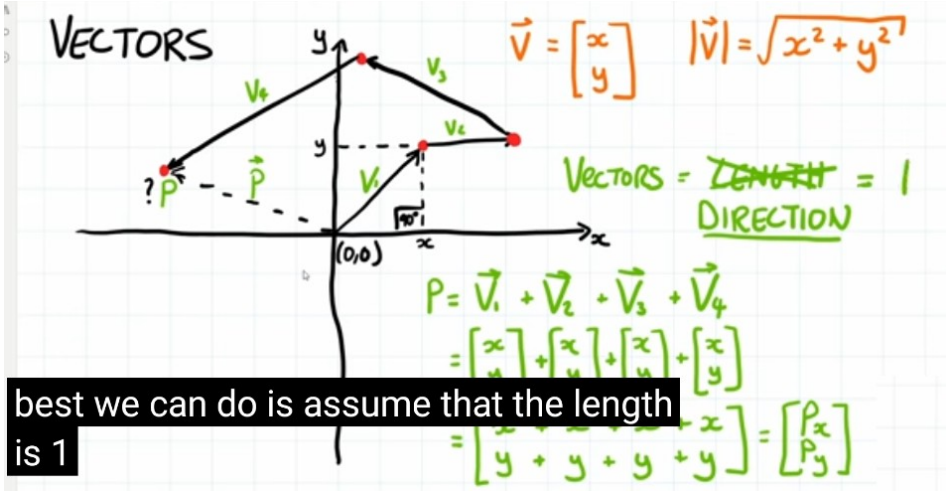
- **Gameplay** is the specific way in which players interact with a game , and in particular with video games.
- Gameplay is the pattern defined through the game rules, connection between player and the game, challenges and overcoming them, plot and player's connection with it.
- Video game gameplay is distinct from graphics and audio elements.
- Whereas games are often characterized by their tools, they are often defined by their rules.
- Certain rules like vectors, angles, dot product are illustrated in this lecture.

Essential math in Pythagoras theorem



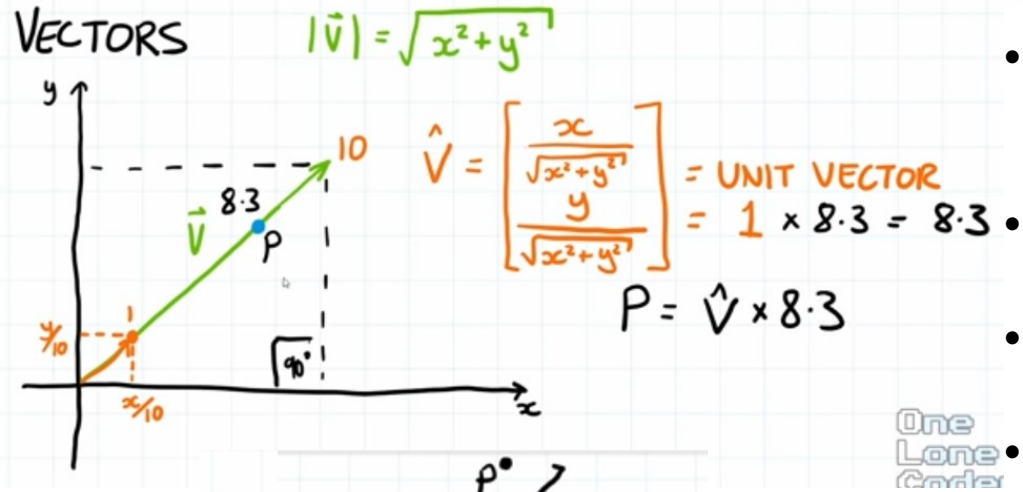
- Problem of player attacked by the enemy
- Theorem links the length to three sides a, b and c.
- Hypotenuse is calculating c by adding a and b.
- When player is close enough to the enemy, enemy response changes.
- b and a gives the difference between two points.
- Limit in game space exceeds attack occurs.

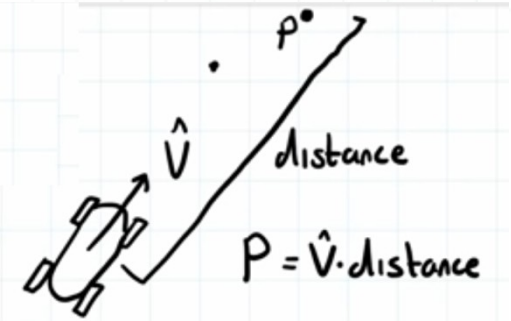
Calculate length of vector-magnitude



- Describing vector in terms of point x and y is shown.
- Vector at isolation start at (0,0).
- Sets of x and y are the component of each vector.
- Player character walk along the points. Hence sum of the vectors show how far the player walked.

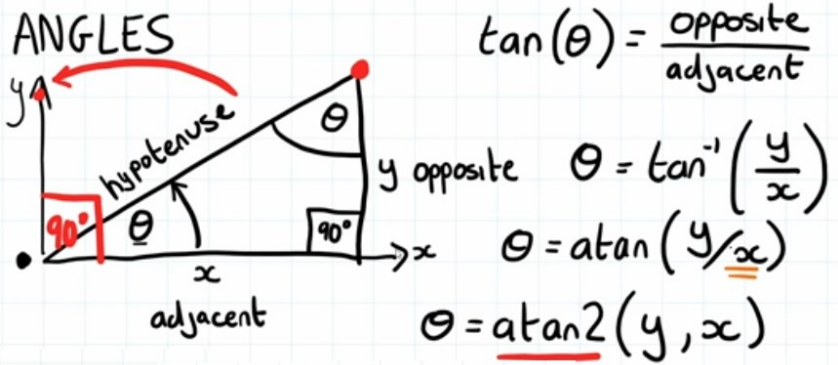
Normalization

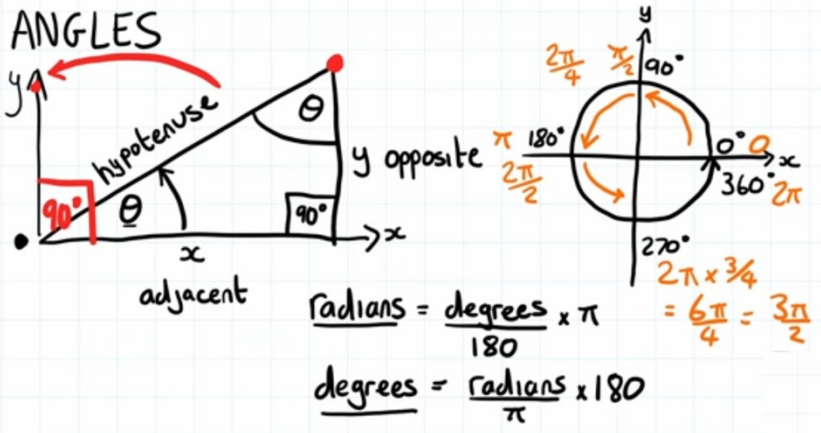




- Normal vector converted to unit vector by calculating magnitude length of unit vector
- Magnitude is calculated by Pythagoras theorem.
- Length is 10 and 1 for a unit vector, direction remains same.
- For scaling at point 8.3 for a case, unit vector can be multiplied by 8.3.
- Unit vectors work great in games for specifying the direction.
- The direction is included in the unit vector by scaling through the interested distance.

Angles





- How to measure angle when a right angle triangle is 90 degrees?
- Longest side hypotenuse, y opposite side and x adjacent side has the rule with tan.
- Hypotenuse is the vector and length of the vector with known direction calculates the angle where x is not equal to 0.
- Internal angle of y may be upto 180 degrees.
- If x=0, then it is not a triangle at all and only just a line along y goes up. In this case a crash may occur and values

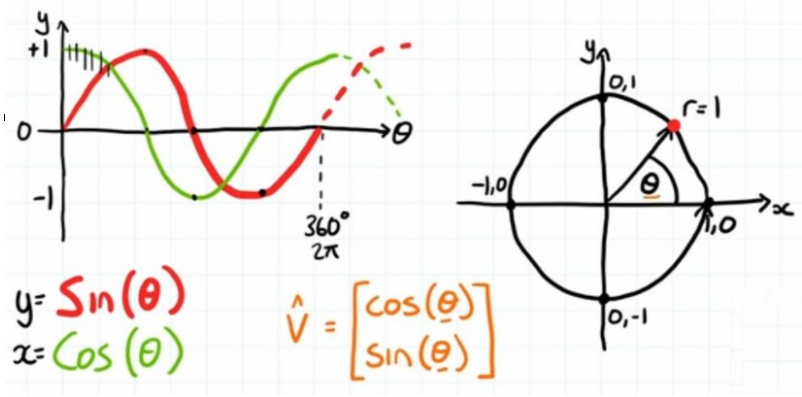
$$S\frac{O}{H}C\frac{A}{H}T\frac{O}{A}.$$

Degree of safety with a secondary tangent function

- Hence the calculation is performed with a degree of safety with a secondary tangent function atan2(y,x) which makes the necessary safety checks to make sure that we get an answer that we might expect.
- Any point away from origin moves towards y, passes the above secondary tangent function. Most programming work with radians and related to x axis 0 to 360 degrees.
- When opposite, O and adjacent, A is known, tan h can be worked out.
- When adjacent, A and hypotenuse, H is known, cos y can be worked out.
- When opposite, O and hypotenuse, H is known, sin x can be worked out.

Introducing cos and sin function

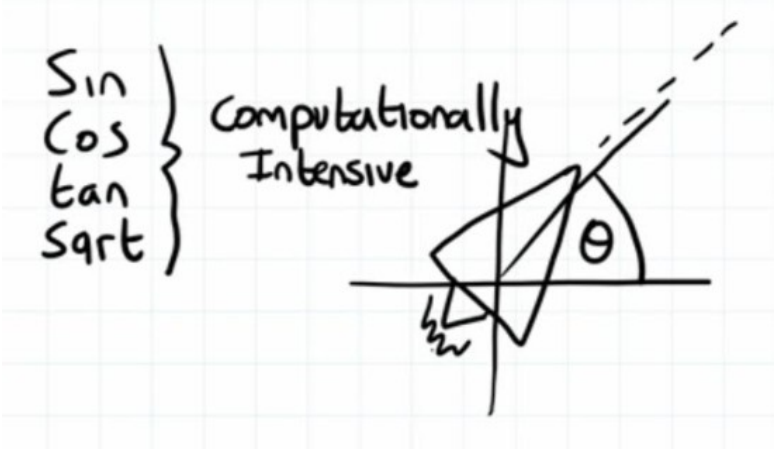
- Sin and cosine are periodic functions with useful properties.
- Assume Θ along X, plot y=sin(Θ) which is red along +1 and -1 in red.
- In green cos(Θ) goes on.
- Angle of sin and cos has a single full revolution of 360 degree ie. 2π.
- Plot the sin wave having their points on revolution (1,0), (0,1), (-1,0) and (0,-1).



- Every single point on the y wave becomes a circle and has a radius 1.
- It is now a vector with the direction length of 1 which is a unit direction.
- Also we can scale a unit vector and calculate the same.
- Any point in the 2D space can be described.

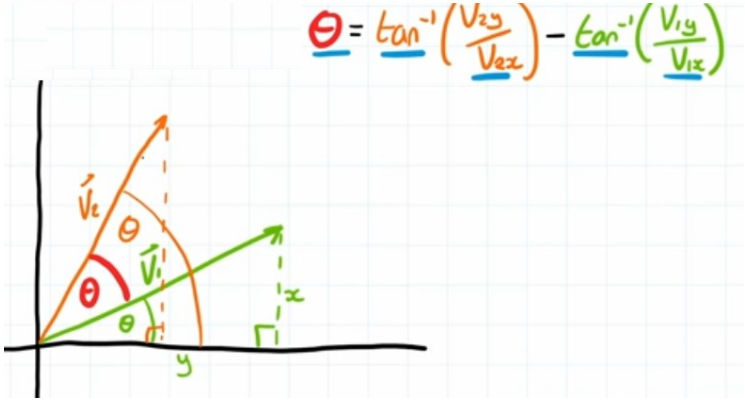
Angle rotation and drawbacks

- How it helps the game developers? Similar to car example, a space ship direction could be determined in the similar way as done for the car example.
- In order to make the space ship rotate the angle should be increased or decreased.
- Also it is computationally intensive which needs lot of CPU cycles for obtaining the result.
- Hence use of vectors are best instead using angles.



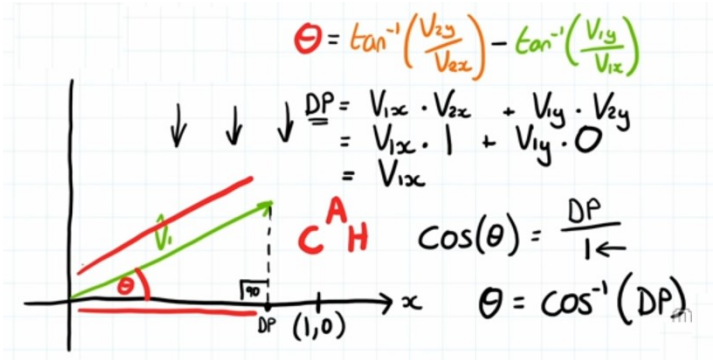
Dot product

- It is essential for the game developers.
- It allows to think about angles in terms of vectors.
- Consider the angle Θ between two vectors v1 and v2.
- Now break the vector down into a right angle tringle to give an x and y component.
- Inverse tangent is used to give angle relative to x axis.
- Red Θ = orange Θ - green Θ.
- Hence angle between two vectors v1 and v2 are determined as in figure.



Determining length using dot product

- Vector contain direction and length. Length is largely relevant and angle between them are not going to change.
- Let the vectors be represented as unit vectors. Dot product (DP) is defined as being sum of individual components of the vectors.
- It is a scaled result and does not give a vector a a result.
- Assume only v1 along x axis has a unit vector. How much a v1 project on x axis. If a light source casting on x axis. Shadow stops at arrow.
- The created right angle triangle has cos Θ calculations as shown in figure. Hypotenuse is a unit vector and the length is 1.
- If the length is not a unit vector, proper length

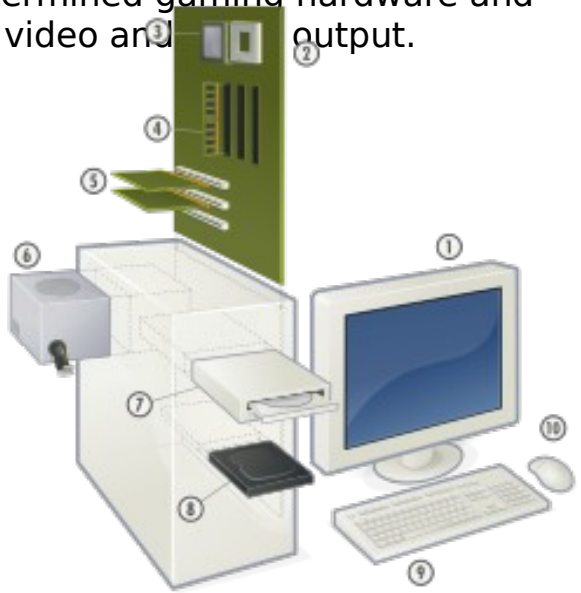


PC and gaming hardware/software

PC game

- A **PC game**, also known as a **computer game** or **personal computer game**, is a type of video game played on a personal computer rather than a video game console or arcade machine.
- Its defining characteristics include: more diverse and user-determined gaming hardware and software; and generally greater capacity in input, processing, video and output.

An exploded view of a modern personal computer:



- Display
- Motherboard
- CPU (Microprocessor)
- Primary storage (RAM)
- Expansion cards (graphics cards, etc.)
- Power supply
- Optical disc drive
- Secondary storage (Hard disk)
- Keyboard
- Mouse

Game Hardware

Hardware

- Modern computer games place great demand on the computer's hardware, often requiring a fast central processing unit (CPU) to function properly.
- CPU manufacturers historically relied mainly on increasing clock rates to improve the performance of their processors, but had begun to move steadily towards multi-core CPUs by 2005.
- These processors allow the computer to simultaneously process multiple tasks, called threads, allowing the use of more complex graphics, artificial intelligence and in-game physics.

GPU Integration and its uses

- Similarly, 3D games often rely on a powerful graphics processing unit (GPU), which accelerates the process of drawing complex scenes in realtime.
- GPUs may be an integrated part of the computer's motherboard, the most common solution in laptops, or come packaged with a discrete graphics card with a supply of dedicated Video RAM, connected to the motherboard through either an AGP or PCI-Express port.
- It is also possible to use multiple GPUs in a single computer, using technologies such as NVidia's Scalable Link Interface and ATI's CrossFire.

Sound card in 3D standards

- Sound cards are also available to provide improved audio in computer games.
- These cards provide improved 3D audio and provide audio enhancement that is generally not available with integrated alternatives, at the cost of marginally lower overall performance.
- The Creative Labs SoundBlaster line was for many years the *de facto* standard for sound cards, although its popularity dwindled as PC audio became a commodity on modern motherboards.

PPU, functions and gaming peripherals

- Physics processing units (PPUs), such as the Nvidia PhysX (formerly AGEIA PhysX) card, are also available to accelerate physics simulations in modern computer games.
- PPUs allow the computer to process more complex interactions among objects than is achievable using only the CPU, potentially allowing players a much greater degree of control over the world in games designed to use the card.
- Virtually all personal computers use a keyboard and mouse for user input.
- Other common gaming peripherals are a headset for faster communication in online games, joysticks for flight simulators, steering wheels for driving games and gamepads for console-style games.

Gaming Software and API

- Computer games also rely on third-party software such as an operating system (OS), device drivers, libraries and more to run.
- Today, the vast majority of computer games are designed to run on the Microsoft Windows family of operating systems.
- Whereas earlier games written for DOS would include code to communicate directly with hardware, today application programming interfaces (APIs) provide an interface between the game and the OS, simplifying game design.

API

- Microsoft's DirectX is an API that is widely used by today's computer games to communicate with sound and graphics hardware.
- OpenGL is a cross-platform API for graphics rendering that is also used.
- The version of the graphics card's driver installed can often affect game performance and gameplay.
- In late 2013, AMD announced Mantle, a low-level API for certain models of AMD graphics cards, allowing for greater performance compared to software-level APIs such as DirectX, as well as simplifying porting to and from the PlayStation 4 and Xbox One consoles, which are both built upon AMD hardware.
- It is not unusual for a game company to use a third-party game engine, or third-party libraries for a game's AI or physics.

Single Vs multiplayer games

- Most games require multiple players. Single-player games are unique in respect to the type of challenges a player faces.
- Unlike a game with multiple players competing with or against each other to reach the game's goal, a single-player game is against an element of the environment, against one's own skills, against time, or against chance.
- This is also true of cooperative games, in which multiple players share a common goal and win or

Game theory-Cooperative games and Harsanyi dividend

- In game theory, a **cooperative game** (or **coalitional game**) is a game with competition between groups of players ("coalitions") due to the possibility of external enforcement of cooperative behavior (e.g. through contract law).

Harsanyi dividend

- The *Harsanyi dividend* (named after John Harsanyi, who used it to generalize the Shapley value in 1963) identifies the surplus that is created by a coalition of players in a cooperative game.
- To specify this surplus, the worth of this coalition is corrected by the surplus that is already created by subcoalitions.

Nash equilibrium and Non-cooperative game

- Harsanyi dividends are useful for analyzing both games and solution concepts.
- In game theory, the **Nash equilibrium**, named after the mathematician John Forbes Nash Jr., is a proposed solution of a non-cooperative game involving two or more players in which each player is assumed to know the equilibrium strategies of the other players, and no player has anything to gain by changing only their own strategy.

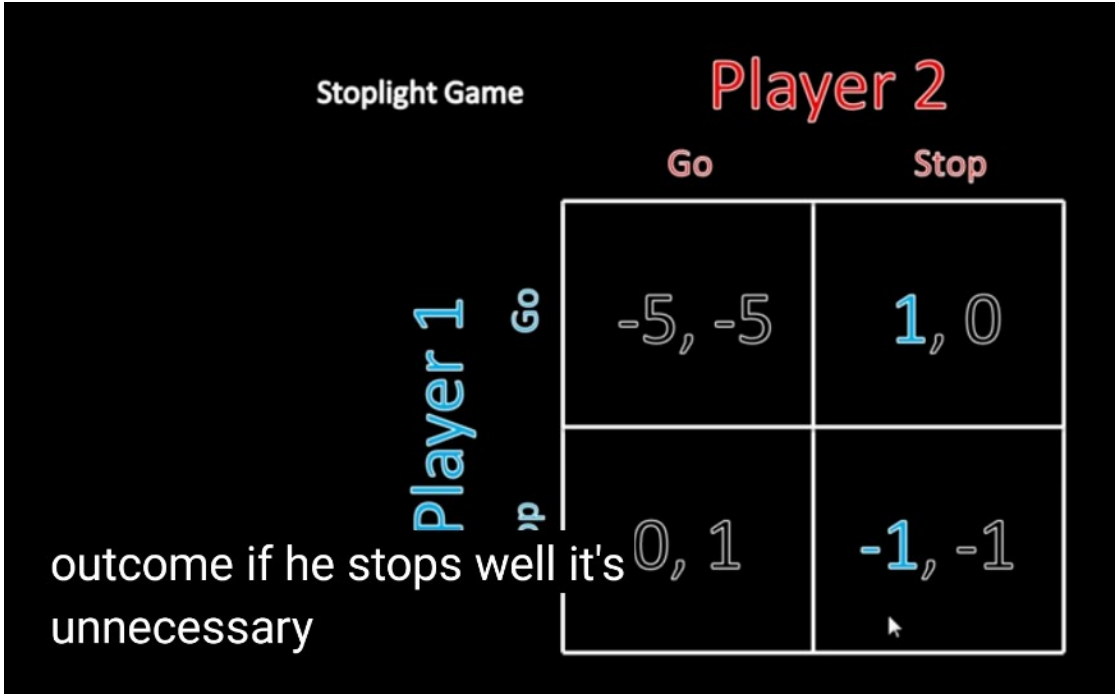
Coordination game

- The *coordination game* is a classic (symmetric) two player, two strategy game, with an example payoff matrix shown to the right.
- The players should thus coordinate, both adopting strategy A, to receive the highest payoff; i.e., 4. If both players chose strategy B though, there is still a Nash equilibrium.
- Although each player is awarded less than optimal payoff, neither player has incentive to change strategy due to a reduction in the immediate payoff (from 2 to 1).

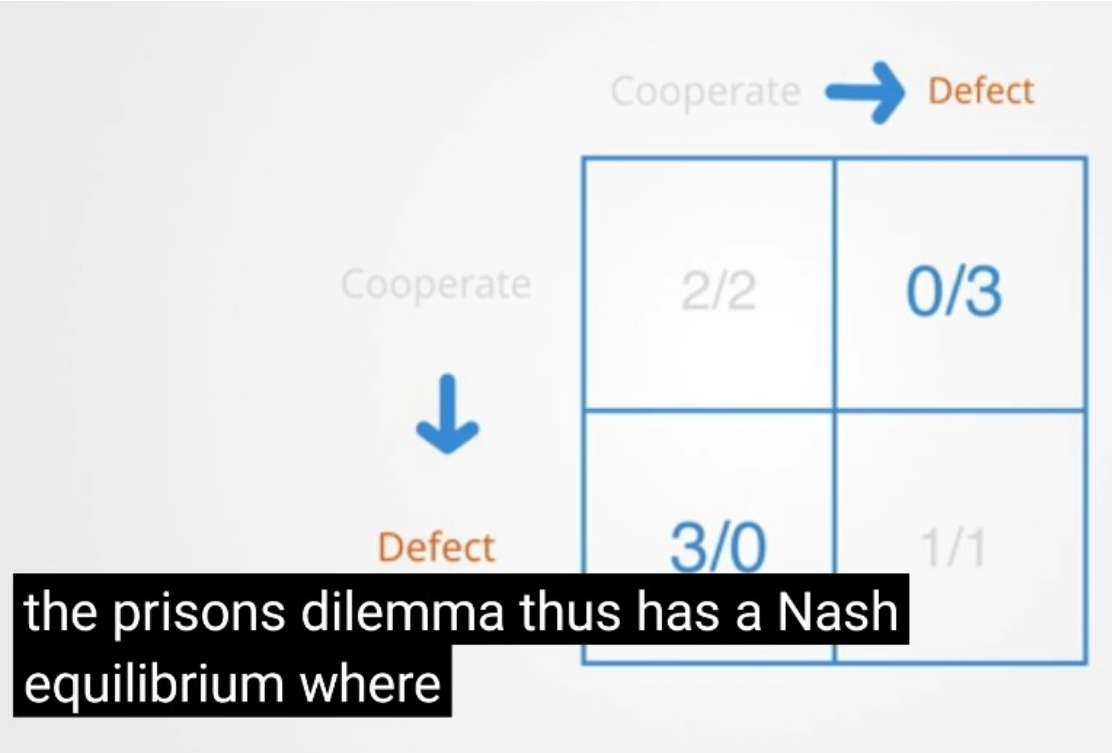
Player 1 \ Player 2	Player 2 adopts strategy A	Player 2 adopts strategy B
Player 1 adopts strategy A	4 / 4	3 / 1
Player 1 adopts strategy B	1 / 3	2 / 2

A sample coordination game showing relative payoff for player 1 (row) / player 2 (column) with each combination

Car Crash/Don’t crash Pay off strategy



Prisoner,s dilemma



Game Storyline/Plot and Game of luck and strategy

Storyline and plot

- Stories told in games may focus on narrative elements that can be communicated through the use of mechanics and player choice.

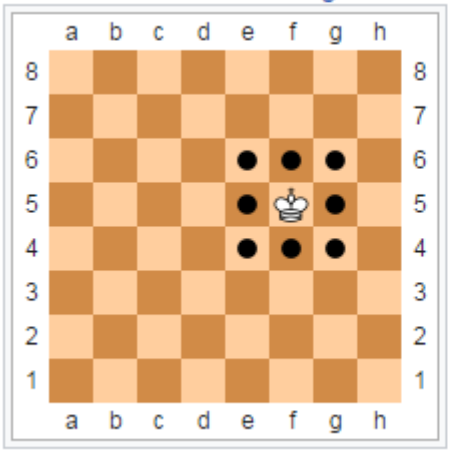
Luck and strategy

- A game's tools and rules will result in its requiring skill, strategy, luck, or a combination thereof, and are classified accordingly.
- Games of skill include games of physical skill, such as chess,etc.
- Games of strategy include tic-tac-toe,etc.
- Games of chance include gambling games roulette, etc.

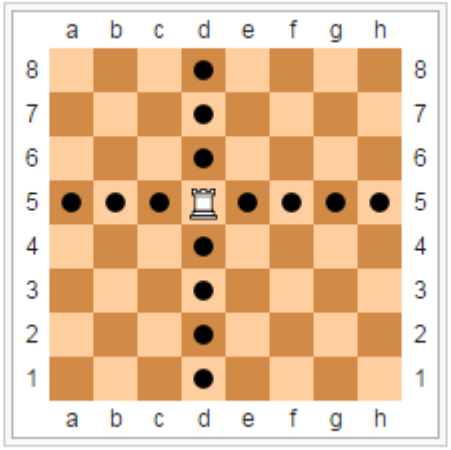
Game of skill-chess game functions

- **Chess** is a two-player strategy board game played on a checkered board with 64 squares arranged in an 8×8 grid.
- The game is played by millions of people worldwide.
- Chess is believed to be derived from the Indian game *chaturanga* sometime before the 7th century.

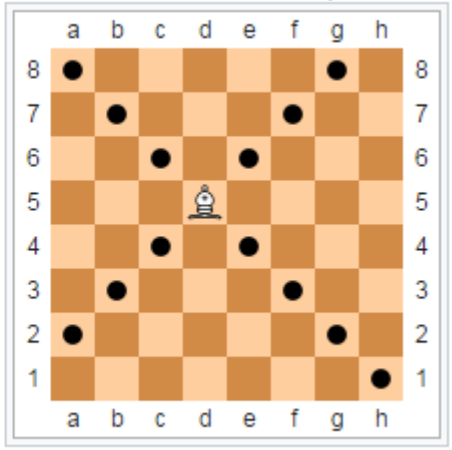
Moves of the king



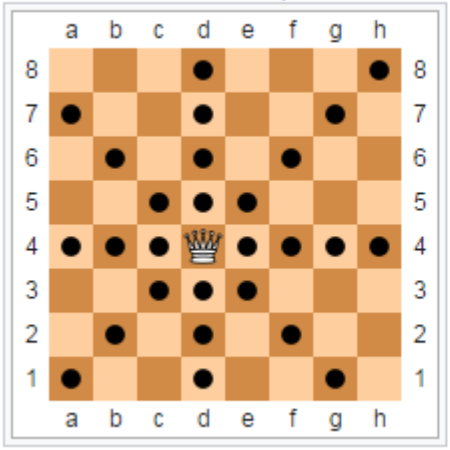
Moves of a rook



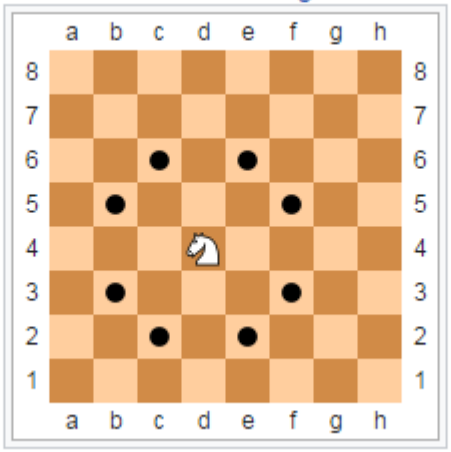
Moves of a bishop



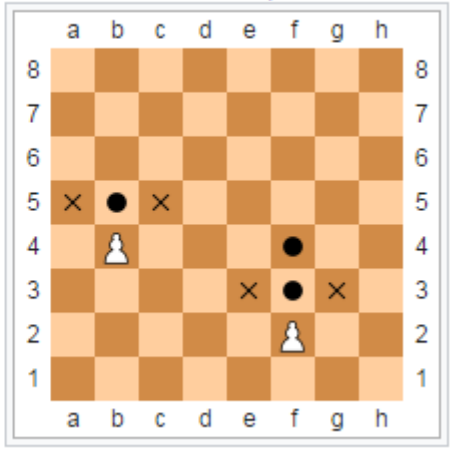
Moves of the queen



Moves of a knight



Moves of a pawn



- The king moves one square in any direction. The king also has a special move called *castling* that involves also moving a rook.
- A rook can move any number of squares along a rank or file, but cannot leap over other pieces. Along with the king, a rook is involved during the king's castling move.
- A bishop can move any number of squares diagonally, but cannot leap over other pieces.
- The queen combines the power of a rook and bishop and can move any number of squares along a rank, file, or diagonal, but cannot leap over other pieces.
- A knight moves to any of the closest squares that are not on the same rank, file, or diagonal. (Thus the move forms an "L"-shape: two squares vertically and one square horizontally, or two squares horizontally and one square vertically.) The knight is the only piece that can leap over other pieces.

- A pawn can move forward to the unoccupied square immediately in front of it on the same file, or on its first move it can advance two squares along the same file, provided both squares are unoccupied (black dots in the diagram); or the pawn can capture an opponent's piece on a square diagonally in front of it on an adjacent file, by moving to that square (black "x"s). A pawn has two special moves: the *en passant* capture and promotion.

Games of strategy - tic-tac-toe functions

- **Tic-tac-toe** (American English), **noughts and crosses** (British English), or **Xs and Os** is a paper-and-pencil game for two players, *X* and *O*, who take turns marking the spaces in a 3×3 grid.
- The player who succeeds in placing three of their marks in a horizontal, vertical, or diagonal row is the winner.
- The fol  the first player,

Games of chance - Roulette functions

- **Roulette** is a casino game named after the French word meaning *little wheel*.
- In the game, players may choose to place bets on either a single number, various groupings of numbers, the colors red or black, whether the number is odd or even, or if the numbers are high (19–36) or low (1–18).



Bet Strategy

Example

Call the teams A and B

Friend A believes team A has 3/4 chance to win

Friend B believes team B has 3/5 chance to win

is a fan of Team A and he just thinks
they're going to crush a

Friend A will take the bet...

Friend A (team A has 3/4 chance to win)
You pay $4 if team A wins, he pays $5 if team A loses

Expected value = (team A wins)Pr(win) + (team A loses)Pr(loss)
Expected value = ($4)(3/4) + (-$5)(1/4)
Expected value = +$1.75

Positive expected value = bet is favorable for friend A

think about the bet in terms of the expected value this

Friend B will take the bet...

Friend B (team B has 3/5 chance to win)
You pay $4 if team B wins, he pays $5 if team B loses

Expected value = (team B wins)Pr(win) + (team B loses)Pr(loss)
Expected value = ($4)(3/5) + (-$5)(2/5)
Expected value = +$0.40

Positive expected value = bet is favorable for friend B

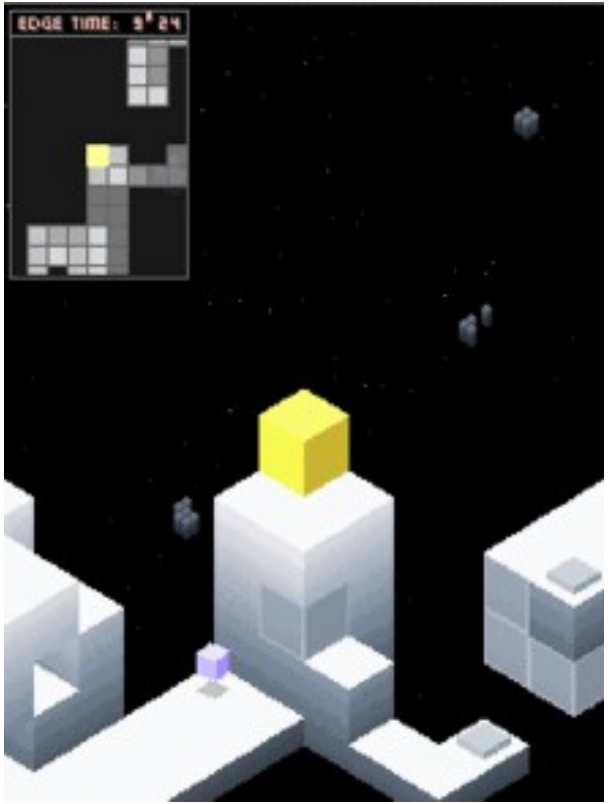
belief they
that their team B has a 3/5 chance to

You always win!

	Friend A	Friend B	You	
Team A wins	-$4	$5	$1	**IF team A wins, you earn $1**
Team B wins	$5	-$4	$1	**IF team B wins, you earn $1**

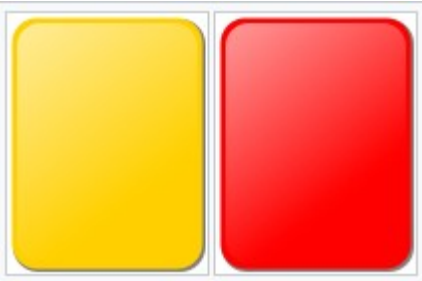
Puzzle game

- The gameplay of an early version of the puzzle game *Edge*.
- ***Edge*** is a puzzle platformer game developed by Mobigame for iOS devices. The objective is to guide a rolling cube through maze-like levels and reach the goal.



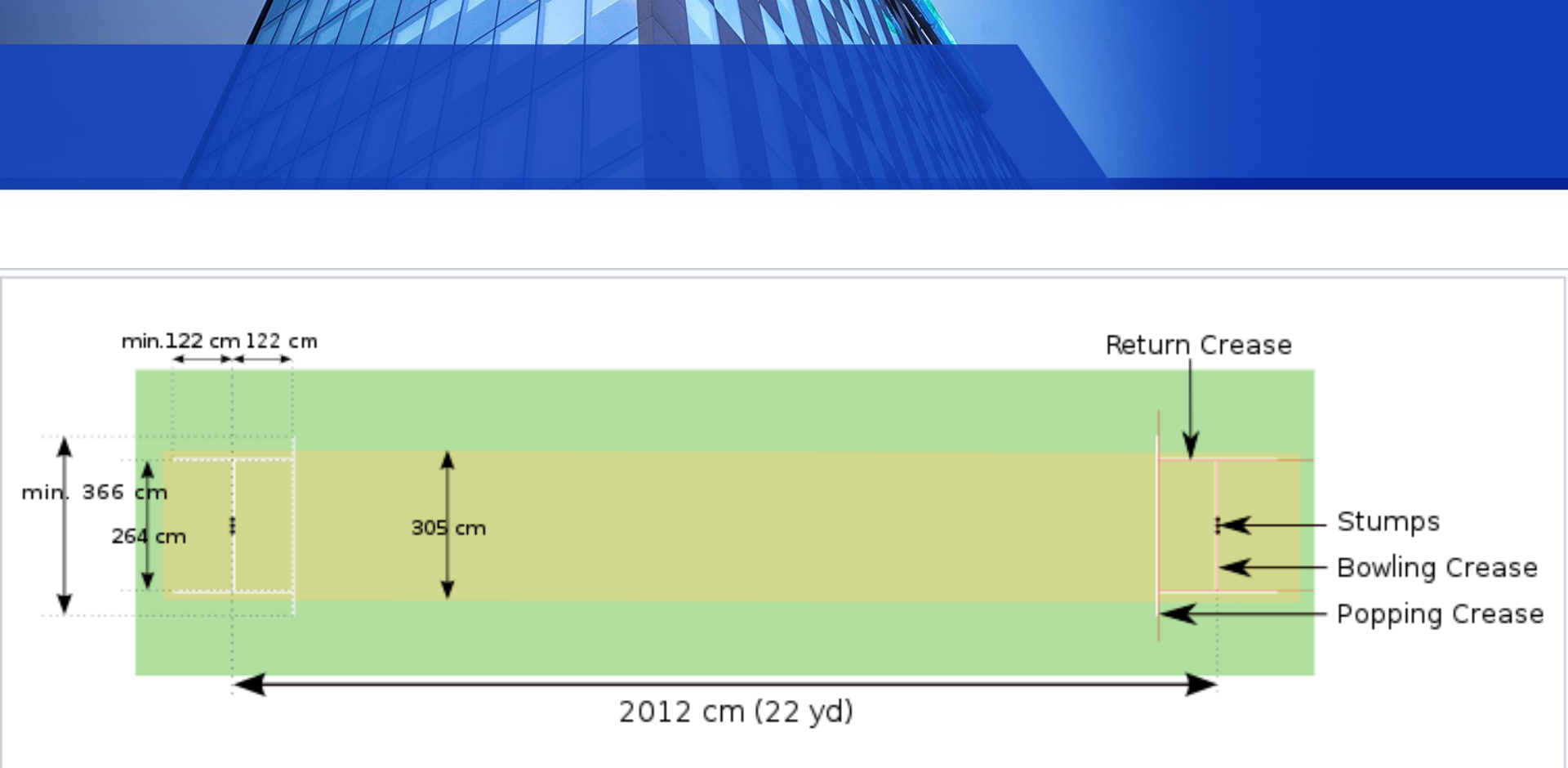
Football and cricket game functions

- **Association football**, more commonly known as **football** or **soccer**
- Players are cautioned with a yellow card, and dismissed from the game with a red card. These colours were first introduced at the 1970 FIFA World Cup and used consistently since.
- **Cricket** is a bat-and-ball game played between two teams of eleven players on a field at the centre of which is a 20-metre (22-yard) pitch with a wicket at each end, each comprising two bails balanced on three stumps.



- Cricket is a bat-and-ball game played on a cricket field (see image, right) between two teams of eleven players each.
- The field is usually circular or oval in shape and the edge of the playing area is marked by a boundary, which may be a fence, part of the stands, a rope, a painted line or a combination of these; the boundary must if possible be marked along its entire length.

- In the approximate centre of the field is a rectangular pitch (see image, below) on which a wooden target called a wicket is sited at each end; the wickets are placed 22 yards (20 m) apart.
- The pitch is a flat surface 3 metres (9.8 ft) wide, with very short grass that tends to be worn away as the game progresses (cricket can also be played on artificial surfaces, notably matting).
- Each wicket is made of three wooden stumps


min.122 cm
122 cm
Return Crease
min. 366 cm
264 cm
305 cm
Stumps
Bowling Crease
Popping Crease
2012 cm (22 yd)

- As illustrated above, the pitch is marked at each end with four white painted lines: a bowling crease, a popping crease and two return creases.
- The three stumps are aligned centrally on the bowling crease, which is eight feet eight inches long.
- The popping crease is drawn four feet in front of the bowling crease and parallel to it; although it is drawn as a twelve-foot line (six feet either side of the wicket), it is, in fact, unlimited in length.

- The return creases are drawn at right angles to the popping crease so that they intersect the ends of the bowling crease; each return crease is drawn as an eight-foot line, so that it extends four feet behind the bowling crease, but is also, in fact, unlimited in length.

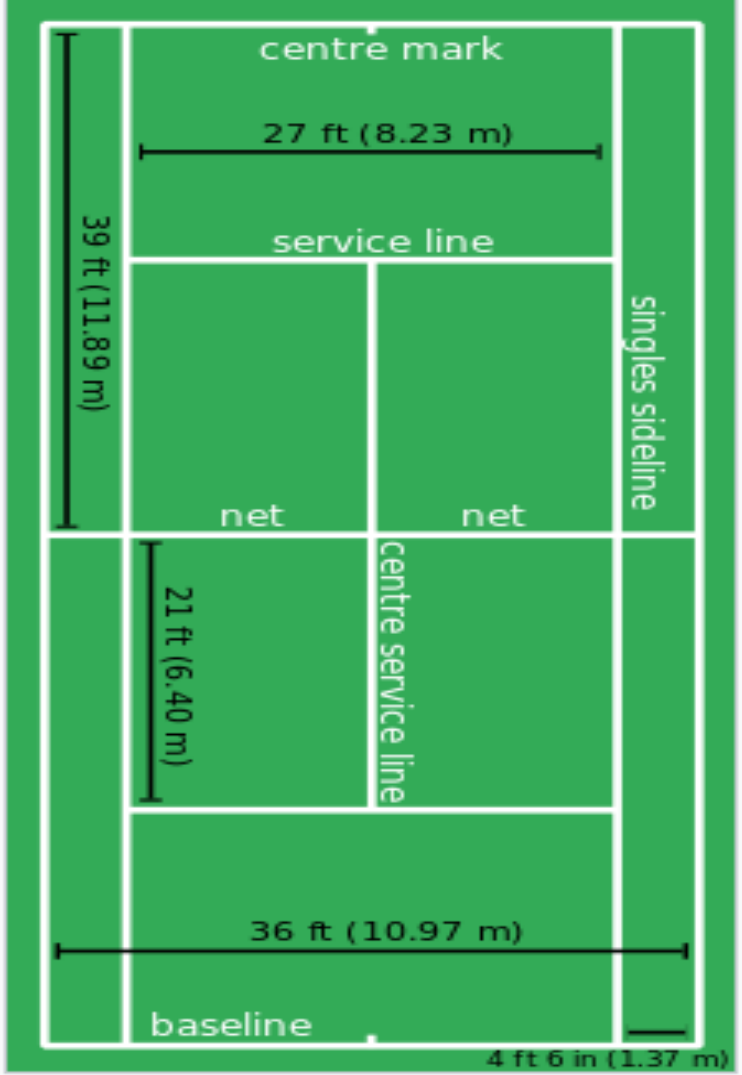
Tennis game functions

- **Tennis** is a racket sport that can be played individually against a single opponent (singles) or between two teams of two players each (doubles).
- Each player uses a tennis racket that is strung with cord to strike a hollow rubber ball covered with felt over or around a net and into the opponent's court.
- The object of the game is to maneuver the ball in such a way that the opponent is not able to play a

- Tennis is played on a rectangular, flat surface.
- The court is 78 feet (23.77 m) long, and 27 feet (8.2 m) wide for singles matches and 36 ft (11 m) for doubles matches.
- Additional clear space around the court is required in order for players to reach overrun balls.
- A net is stretched across the full width of the court, parallel with the baselines, dividing it into two equal ends.
- It is held up by either a cord or metal cable of diameter no greater than 0.8 cm (⅓ in).
- The net is 3 feet 6 inches (1.07 m) high at the posts and 3 feet (0.91 m) high in the center.
- The net posts are 3 feet (0.91 m) outside the doubles court on each side or, for a singles net, 3 feet (0.91 m) outside the singles court on each side.

- The dimensions of a tennis court.
- The scoreboard of a match between Andy Roddick and Cyril Saulnier.





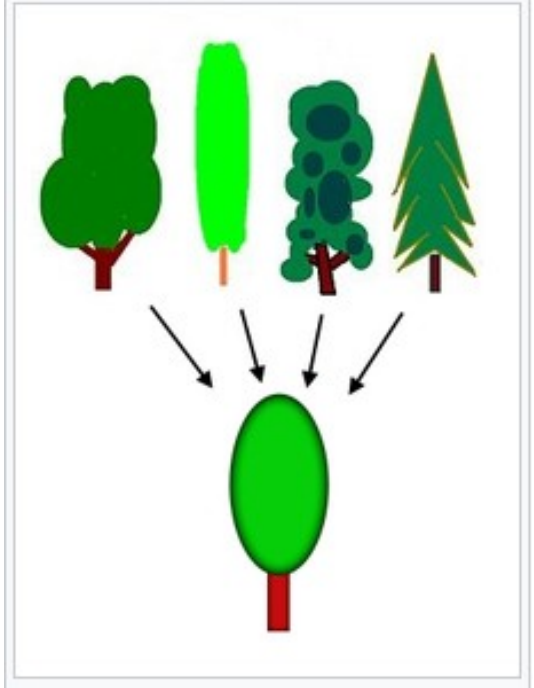
Game use as educational tool and cognition

Use as educational tool

- By learning through play children can develop social and cognitive skills, mature emotionally, and gain the self-confidence required to engage in new experiences and environments.

Cognition

- When the mind makes a generalization such as the concept of *tree*, it extracts similarities from numerous examples; the simplification enables higher-level thinking (abstract thinking).



Video game

- A **video game** is an electronic game that involves interaction with a user interface to generate visual feedback on a two- or three-dimensional video display device such as a touchscreen, virtual reality headset or monitor/TV set.
- **Game theory** is the study of mathematical models of strategic interaction among rational decision-makers.



The Nintendo Game Boy was the first successful handheld console, selling over 100 million systems.

Video game terms

- Most games will launch into a title screen and give the player a chance to review options such as the number of players before starting a game.
- Most games are divided into levels which the player must work their avatar
- Through, scoring points, collecting power-ups to boost the avatar's innate attributes, all while either using special attacks to defeat enemies or moves to avoid them.



- Taking damage will deplete their avatar's health, and if that falls to zero or if the avatar otherwise falls into an impossible-to-escape location, the player will lose one of their lives.
- Should they lose all their lives without gaining an extra life or "1-UP", then the player will reach the "game over" screen.
- In some games, intermediate points between levels will offer save points where the player can create a saved game on storage media to restart the game should they lose all their lives or need to stop the game and restart at a later time.

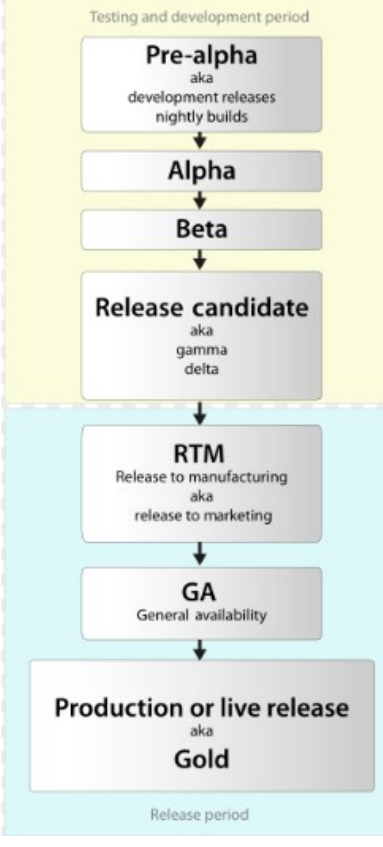
Development team

- A game designer (or inventor) is the person who invents a game's concept, its central mechanisms, and its rules.
- A game developer is the person who fleshes out the details of a game's design, oversees its testing, and revises the game in response to player feedback.
- A game artist is an artist who creates art for one or more types of games.
- Video game development: Placeholder graphics are characteristic of early game prototypes.

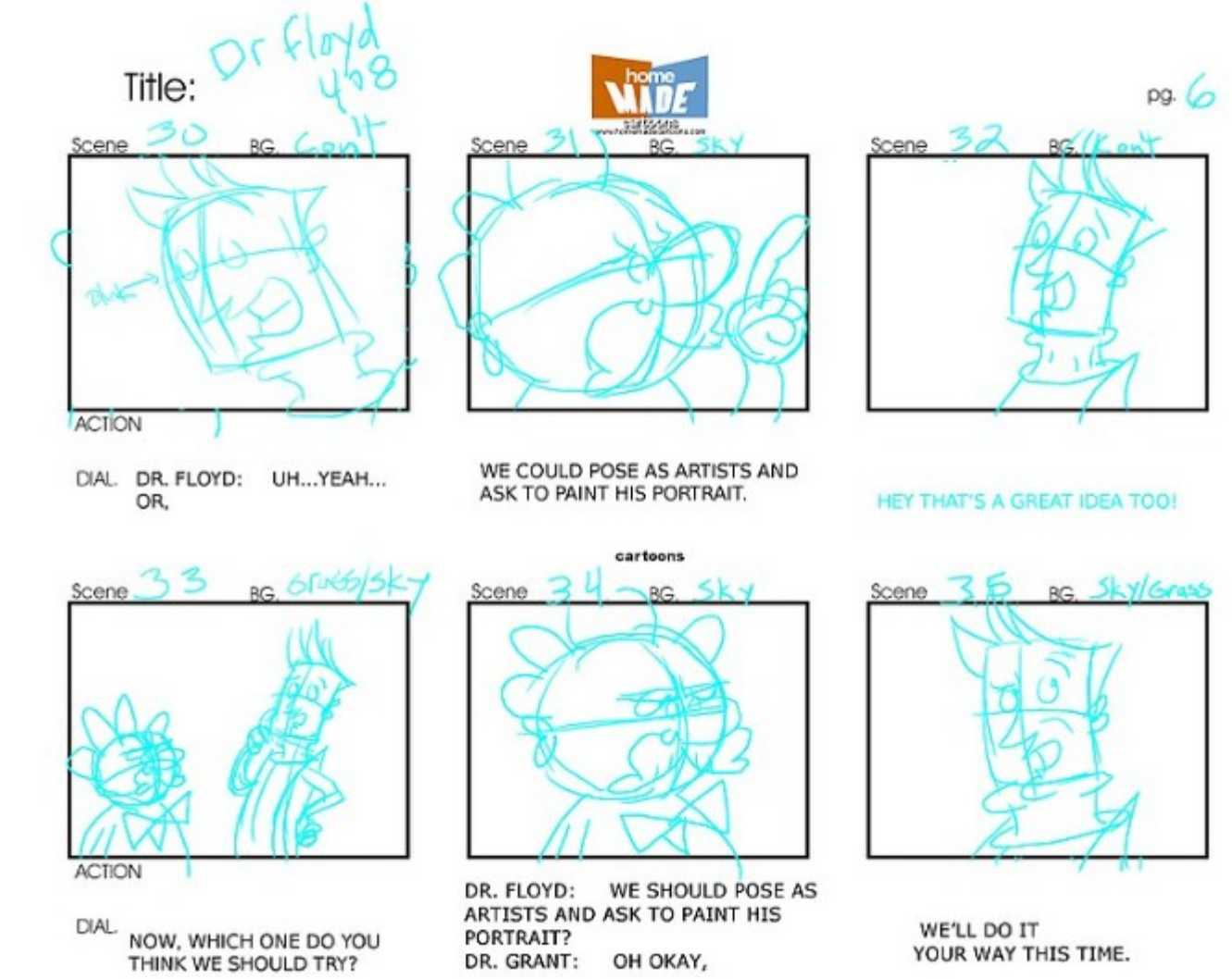


Development process, concept and storyboard

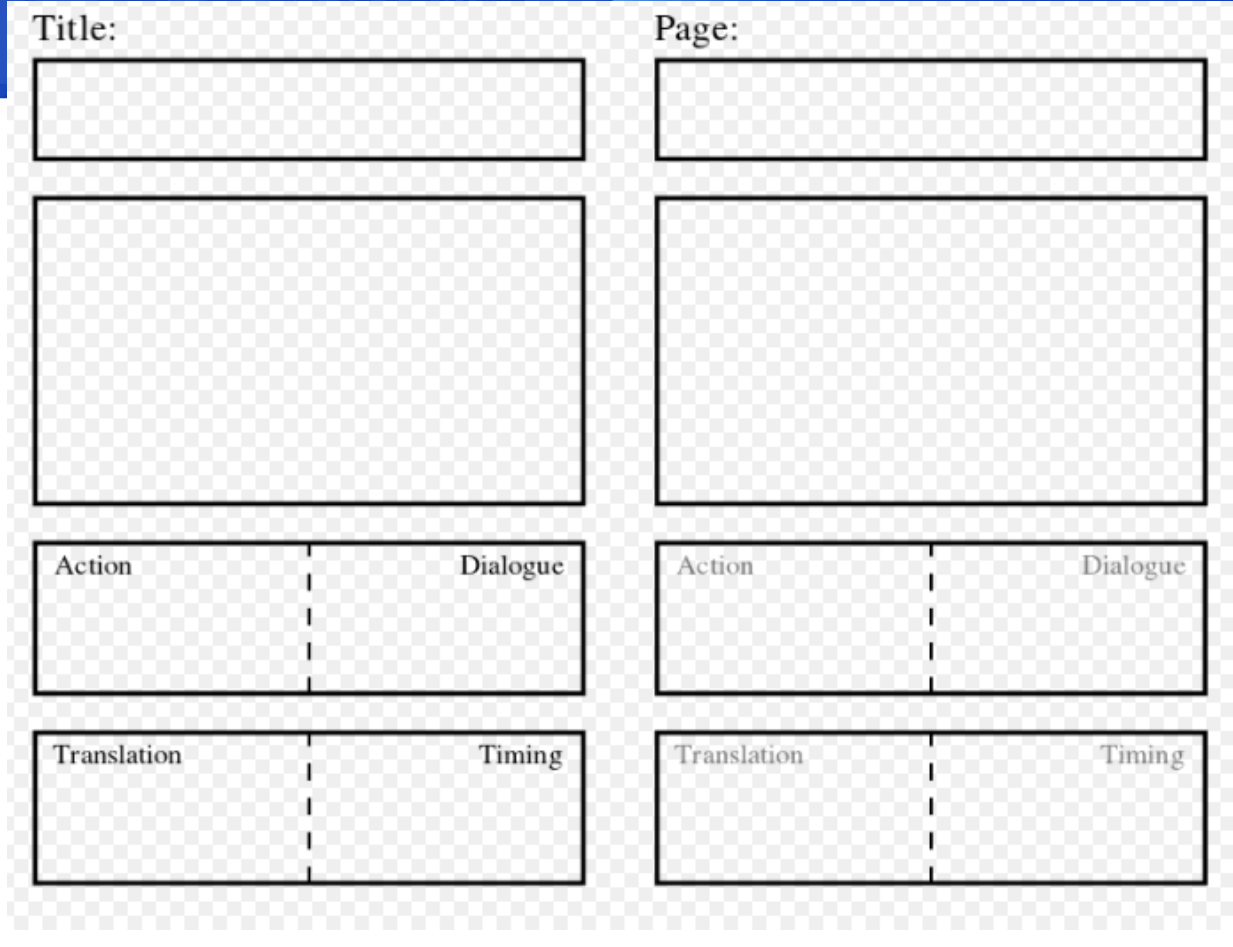
- Video game development milestones follow a similar process as with other software development.
- A game concept is an idea for a game, briefly describing its core play mechanisms, who the players represent, and how they win or lose.
- During design, a game concept is fleshed out.
- In video games, storyboards and screen mockups may be created
- A **storyboard** is a graphic organizer that consists of illustrations or images displayed in sequence for the purpose of pre-visualizing a motion picture, animation, motion graphic or interactive media sequence.



- A storyboard for *The Radio Adventures of Dr. Floyd* episode #408



- A storyboard template.
- A game prototype is a draft version of a game used for testing.

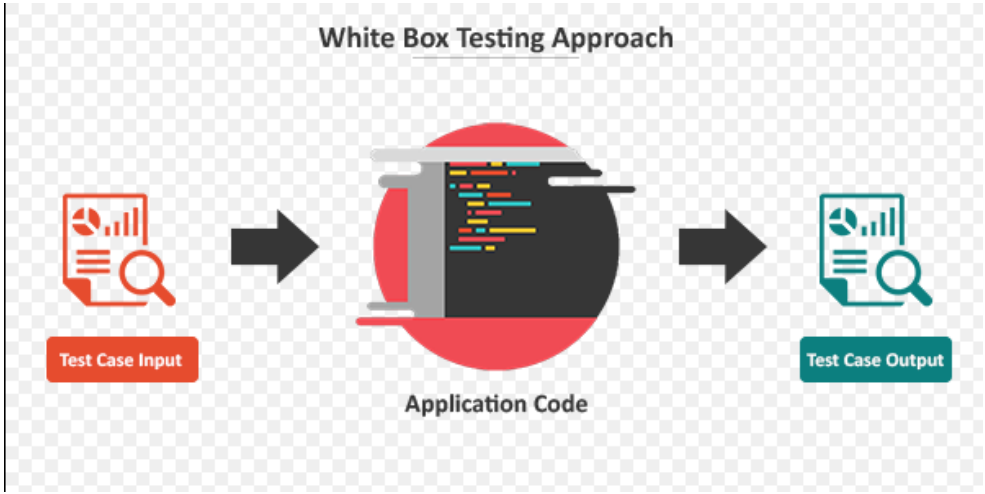


Game testing

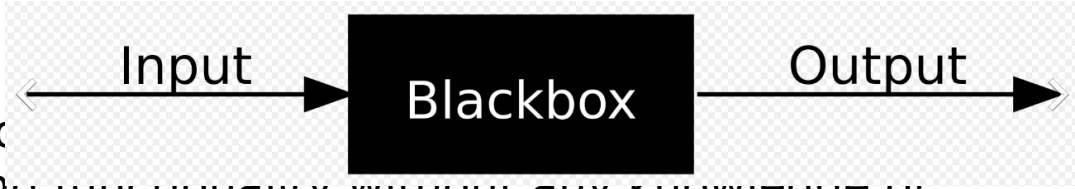
- Game testing is a major part of game development.
- During testing, players play the game and provide feedback on its gameplay, the usability of its components or screen elements, the clarity of its goals and rules, ease of learning, and enjoyment to the game developer.
- Video game testing is a software testing process for quality control of video games.
- The primary function of game testing is the discovery and documentation of software defects (aka bugs).
- Interactive entertainment software testing is a highly technical field requiring computing expertise, analytic competence, critical evaluation skills, and endurance.

Software testing

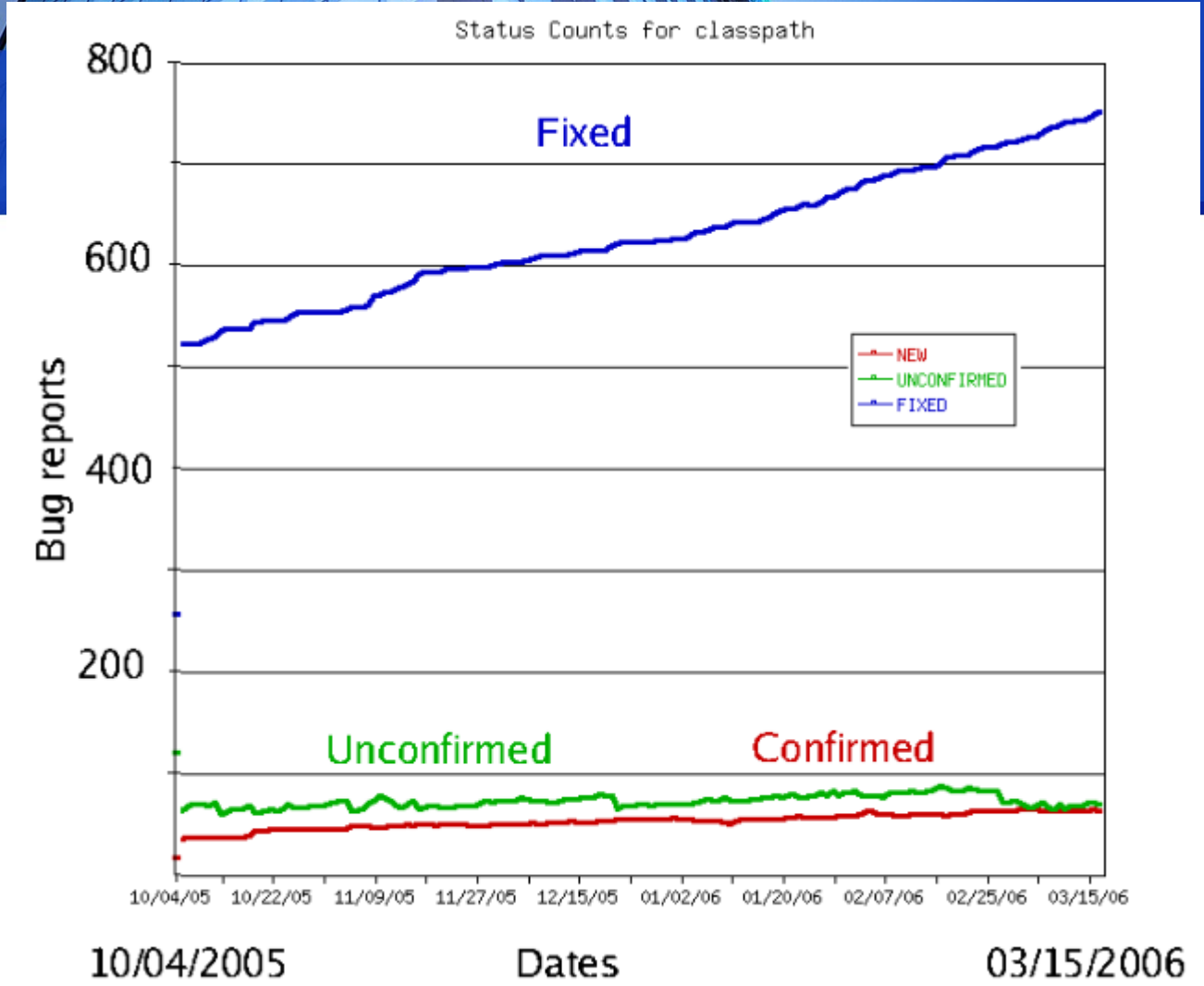
- White Box Testing Diagram
- White-box testing (also known as clear box testing, glass box testing, transparent box testing, and structural testing) verifies the internal structures or workings of a program, as opposed to the functionality exposed to the end-user.



- Black box diagram



- Black-box testing (also kno
  as a "black box," examining functionality without any knowledge of internal implementation, without seeing the source code.
- Software defects
- The typical bug history (GNU Classpath project data).
- A new bug submitted by the user is *unconfirmed.* Once it has been reproduced by a developer, it is a *confirmed* bug.
- The confirmed bugs are later *fixed*. Bugs belonging to other categories (unreproducible, will not be fixed, etc.) are usually in the minority.

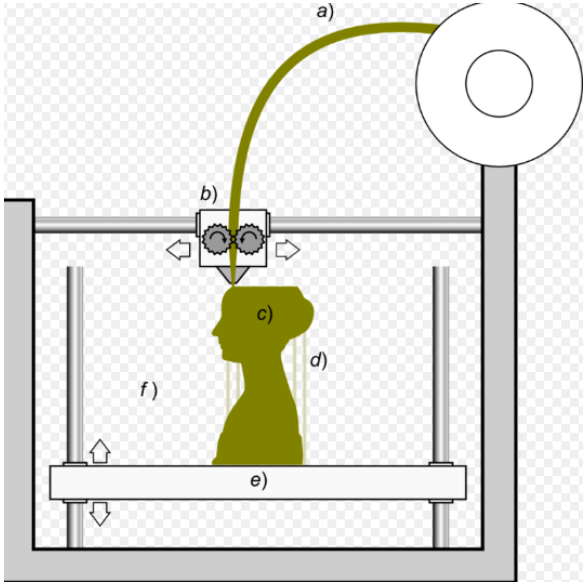

Status Counts for classpath
800
600
400
200
Bug reports
Fixed
NEW
UNCONFIRMED
FIXED
Unconfirmed
Confirmed
10/04/05
10/22/05
11/09/05
11/27/05
12/15/05
01/02/06
01/20/06
02/07/06
02/25/06
03/15/06
10/04/2005
Dates
03/15/2006

3D printers and game production prtotypes

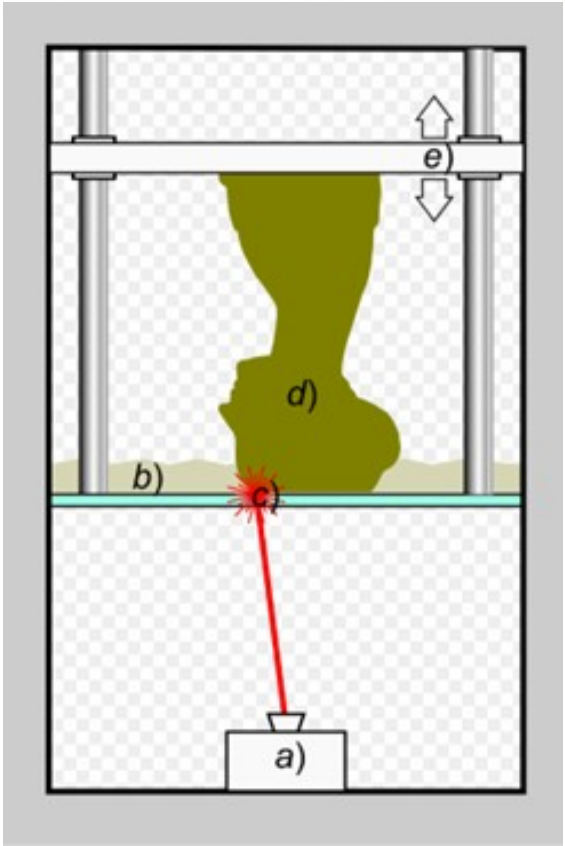
- Modern technological advances have had a democratizing effect on board game production, with services like Kickstarter providing designers with essential startup capital and tools like 3D printers facilitating the production of game pieces and board game prototypes
- The **3D printing** process builds a three-dimensional object from a computer-aided design (CAD) model, usually by successively adding material layer by layer, which is why it is also called **additive manufacturing.**
- A multi-material 3D printed toy.



- Schematic representation of the 3D printing technique known as Fused Filament Fabrication; a filament **a)** of plastic material is fed through a heated moving head **b)** that melts and extrudes it depositing it, layer after layer, in the desired shape **c)**. A moving platform **e)** lowers after each layer is deposited. For this kind of technology additional vertical

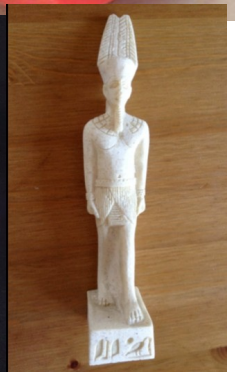


- A timelapse video of a robot model being printed using FDM
- Schematic representation of Stereolithography; a light-emitting device *a)* (laser or DLP) selectively illuminate the transparent bottom *c)* of a tank *b)* filled with a liquid photo-polymerizing resin; the solidified resin *d)* is progressively dragged up by a lifting platform *e)*



- A 3D selfie in 1:20 scale printed using gypsum-based printing
- A 3D printed jet engine model
- 3D printed enamelled pottery
- 3D printed sculpture of an Egyptian

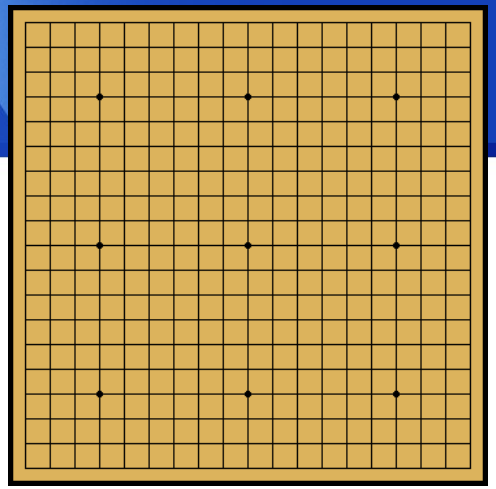


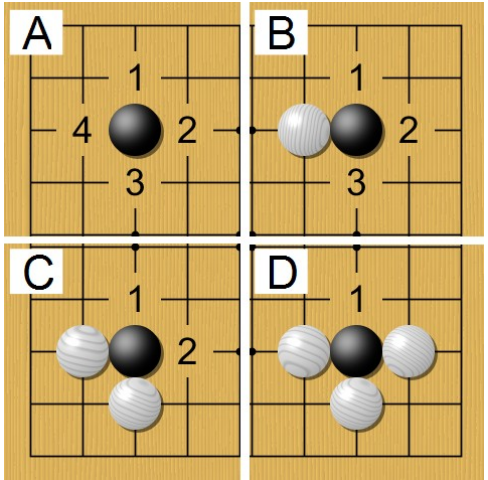



- The most ancient board games known today are over 5000 years old.
- They are frequently abstract in character and their design is primarily focused on a core set of simple rules.
- Of those that are still played today, games like go (c.400BC), mancala (c.700AD), and chess (c.600AD) have gone through many presentational and/or rule variations.
- In the case of chess, for example, new variants are developed constantly, to focus on certain aspects of the game, or just for variation's sake.

Go game functions

- The first 60 moves of a Go game animated. This particular game quickly developed into a complicated fight in the lower left and bottom.
- The four liberties (adjacent empty points) of a single black stone (A), as White reduces those liberties by one (B, C, and D).
- When Black has only one liberty left (D), that stone is "in atari". White may capture that stone (remove from board) with a play on its last liberty (at D-1).





Mancala and three player chess game functions

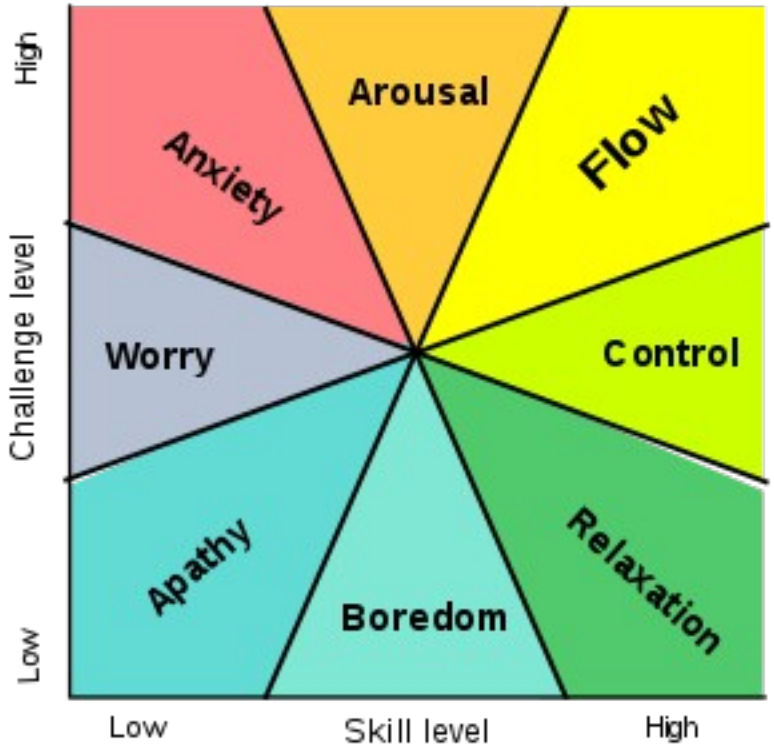
- A toguz korgool board with balls, Kyrgyzstan
- Chess
- A three-player chess variant which uses a hexagonal board
- The concept of elegant game design has been identified by *The Boston Globe*'s Leon Neyfakh as related to Mihaly Csikszentmihalyi's concept of "flow" from his 1990 book, "Flow: The Psychology of Optimal Experience"





Skill level in games

- Mental state in terms of challenge level and skill level, according to **Csikszentmihalyi**'s flow model
- How players play their cards, revealing information and interacting with previous plays as they do so, is central to card game design.
- In partnership card games, such as Bridge, rules limiting communication between players on the same team become an important part of the game design.
- This idea of limited communication has been extended to cooperative card games, such as Hanabi.



- Dice games differ from card games in that each throw of the dice is an independent event, whereas the odds of a given card being drawn is affected by all the previous cards drawn or revealed from a deck.
- Dice game design often centers around forming scoring combinations and managing re-rolls, either by limiting their number
- The two most fundamental rules of casino game design is that the games must be non-fraudable (including being as nearly as possible immune from advantage gambling), and that they must mathematically favor the house winning.

- The design of role-playing games requires the establishment of setting, characters, and basic gameplay rules or mechanics.
- After a role-playing game is produced, additional design elements are often devised by the players themselves. In many instances, for example, character creation is left to the players.
- Likewise, the progression of a role-playing game is determined in large part by the gamemaster whose individual campaign design may be directed by one of several role-playing game theories

- Sports games are made with the same rules as the sport the game portrays
- establish the rules and narrative, an internally consistent game world is created, requiring visual, audio, and programming development for world, character, and level design.An important aspect of video game design is human-computer interaction and game feel.

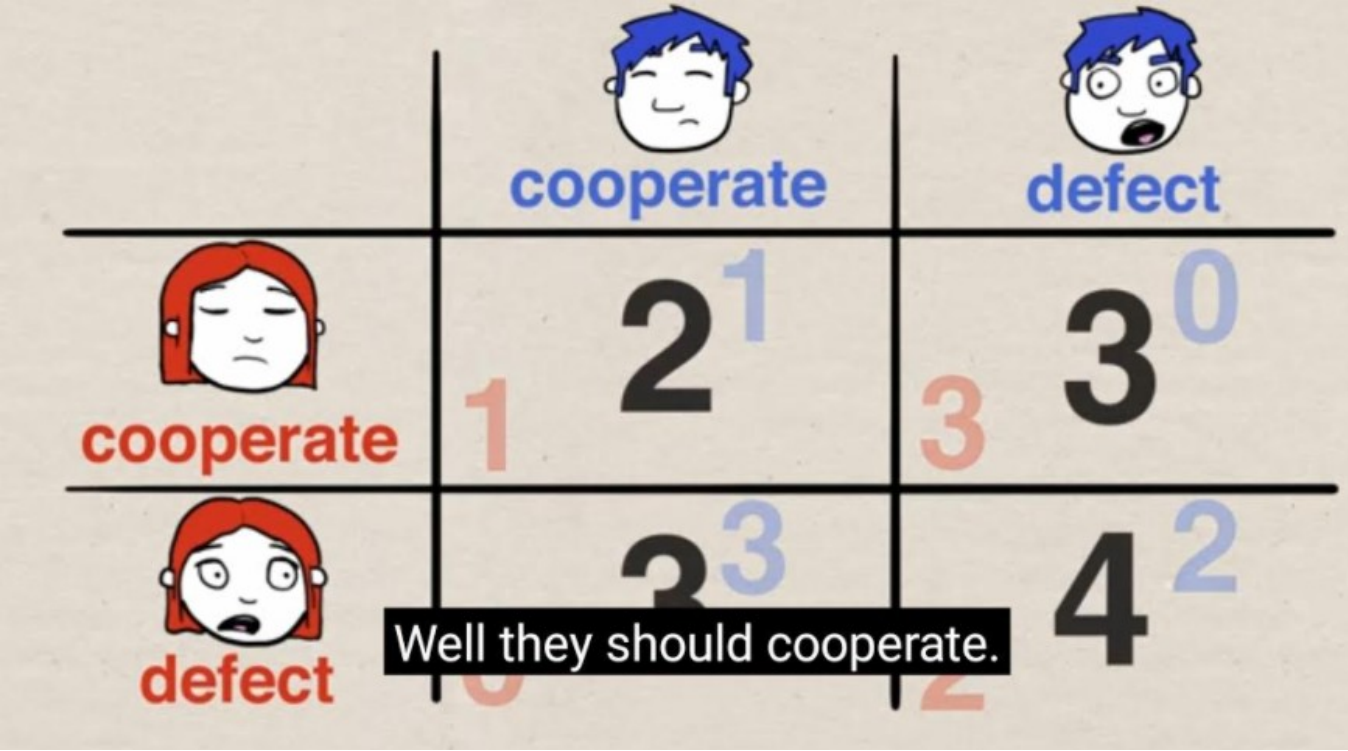
Game types

Symmetric / asymmetric

- A symmetric game is a game where the payoffs for playing a particular strategy depend only on the other strategies employed, not on who is playing them.
- That is, if the identities of the players can be changed without changing the payoff to the strategies, then a game is symmetric.

- Many of the commonly studied 2×2 games are symmetric. The standard representations of chicken, the prisoner's dilemma, and the stag hunt are all symmetric games.
- Some scholars would consider certain asymmetric games as examples of these games as well. However, the most common payoffs for each of these games are symmetric.
- Most commonly studied asymmetric games are games where there are not identical strategy sets for both players.
- For instance, the ultimatum game and similarly the dictator game have different strategies for each player.
- It is possible, however, for a game to have identical strategies for both players, yet be asymmetric.

Prisoner's dilemma



- For example, the game pictured to the right is asymmetric despite having identical strategy sets for both p[illegible]

	E	F
E	1, 2	0, 0
F	0, 0	1, 2

An asymmetric game

Zero-sum / non-zero-sum

- Zero-sum games are a special case of constant-sum games in which choices by players can neither increase nor decrease the available resources.
- In zero-sum games, the total benefit to all players in the game, for every combination of strategies, always adds to zero (more informally, a player benefits only at the equal expense of others).
- Poker exemplifies a zero-sum game (ignoring the possibility of the house's cut), because one wins exactly the amount one's opponents lose.
- Other zero-sum games include matching pennies and most classical board games including Go and chess.

	A	B
A	−1, 1	3, −3
B	0, 0	−2, 2

A zero-sum game



- Many games studied by game theorists (including the famed prisoner's dilemma) are non-zero-sum games, because the outcome has net results greater or less than zero.
- Informally, in non-zero-sum games, a gain by one player does not necessarily correspond with a loss by another.
- Constant-sum games correspond to activities like theft and gambling, but not to the fundamental economic situation in which there are potential gains from trade.
- It is possible to transform any game into a (possibly asymmetric) zero-sum game by adding a dummy player (often called "the board") whose losses compensate the players' net winnings.