Codeless Game Construction
Using Construct 2 & 3

Building Bump & Jump to Capture Browser Games

Creating "Artificial Intelligence" Game Mechanics

By Stephen Gose

Building Bump & Jump-to-Capture Browser Games

Codeless Game Construction Using Construct2 and Construct3

Stephen Gose

This book is available at https://leanpub.com/cgc-c23-bumpjump

This version was published on 2025-11-14

ISBN 9798320879604

For my students

@ Culpeper Public Schools, Culpeper, VA;

@ ITT Technical Institute, Tempe, AZ;

@ Early Career Academy, Tempe, AZ; and

@ University of Advancing Technology (UAT), Tempe, AZ

Contents

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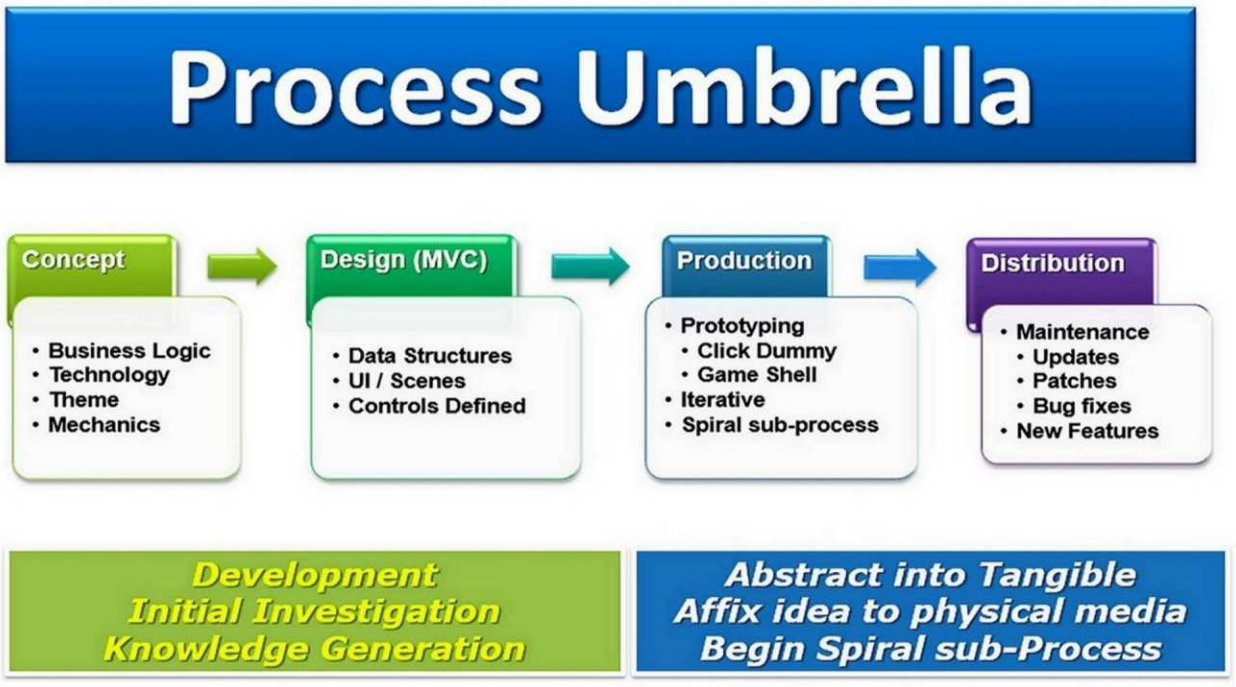
Part I — Concept & Design



Software Project Management for Games

Part I is an introduction to my ***Game Design System™*** and building ***Game Recipes™.*** By starting either "Part II" or "Part III", and ending with ***Part IV*** we'll have created everything our **game prototype** needs.

Affixing your idea to "physical media" **secures** your Copyrights © as an expression of your idea. **Never go public** during your "Concept" and "Design" phases. ***You cannot Copyright ideas!*** [1] Use your idea to publish "multiple tangible expressions".

Introduction

"Why should I study a "systems-based" design?", you say? **Answer:** Yes! Why indeed! The earliest decisions about what kind of game(s) a studio builds will impact all the development and production activities of that project's management. It affects how Construct "encodes" your game's features, how you will construct scenes, layouts, layers, and optimize Game Mechanics' Events, and how those "time-consuming animations" and "cut-scenes" are handled — just to mention a few. There's also a heavy cost associated with how much creative freedom is permitted. Historically, games with "open-ended" possibilities tend to be much more difficult to accurately schedule. The ***Game Design System™*** addresses those shortcomings in this project management approach.

Creating your own bespoke game is an exciting adventure in creativity using the Construct Game Framework (or ***with any Gaming Framework*** for that matter); and, at the same time, **it's fun!** However, dealing with all those ***"full-stack" technical details*** — such as web pages, ***artwork production***, collisions, sprites, "game phases" (and there's a lot more!) — can be quite ***intimidating;*** especially, if this is your ***first experience with such game components.***

In general ***Construct, — and any other Code-less Gaming Framework —*** generates all the JavaScript resources and libraries for us that run inside our Internet device. Any of these "code-less frameworks" simplifies and abstracts those ***gaming programming patterns and algorithms*** into easy-to-use, high-level "worksheets" for those JavaScript functions. Using these "worksheets", we can quickly build various two-dimensional (aka "2D" or ***2.5D***) and even ***3D*** games are possible inside a simple ***HTML5 "<canvas>" tag***. ***Construct*** does ***95% of all that "work" for us;*** and beyond that, all you need is your imagination and some basic logic. If you'd like to create "complex game interactions" then JavaScript knowledge becomes handy; and with only a few hours spent, you can ***gain that knowledge for FREE from W3Schools.*** So, let's begin by creating a simple ***"Bump or Jump" to capture Game Mechanics.***

Hint: JavaScript ***is NOT*** the end-all for online gaming! To ***"future-proof"*** your time spent developing any game, you should begin reading about the ***"Internet-of-Things" (IoT)***, cloud-based ***"DevOps"*** and especially ***"web assembly"***.

In ***Part II (for Construct2) or Part III (for Construct3)*** our goal is to **"construct"** a fully functional **"Jump-To-Capture" and "Bump-to-Capture" Game Prototypes.** There are simple step-by-step "**Game Recipe**™ **instructions**" for each task. We'll catalog and create various ***Game Mechanism Components*** — those "visual elements" that are separate from the core Game Mechanics rules, logic, and data. From this simple foundation, we can combine them as easily as a child would use Lego™ blocks to construct a toy castle. Furthermore, you can review this construction process and

many other Game Mechanics in the ***Construct Game Starter Kit Collection*** workshop books — a growing collection of other classical and popular game mechanics and their sub-genres.

So then, "What's a game prototype", you asked?
Answer: It is an operational gaming foundation that can:

1. accepts inputs (***Game Framework Mechanism (GFM) component);***
2. moves game elements and components (***Game Framework Mechanism (GFM) component);***
3. transitions between game phases, and translates "game actions" (***Game Mechanics (GM) component*** which dictates changes to the "visual elements" in the displayed ***Game Framework Mechanisms (GFM).***)
4. reacts to internal game object collisions, visual animations, and "Heads-Up Display" (HUD) feedback — those interactions between both ***Game Mechanics (GM) and Game Framework Mechanisms (GFM) Components.***

What are the benefits of creating a game prototype first?

Answer: See the latest comments from various gaming experts ***here*** and ***here***; and other software engineers' opinions about ***prototyping in general — here.***

My **Game Design System**™ is clearly echoed in the **Construct Framework**, GDevelop, ***Apple's Game-Play Kit***, and ***Play Canvas*** as "***Entities and Components***". Apple's Game-Play Kit plainly states, "The Entity-Component design pattern is an architecture that ***favors composition over inheritance.*** To illustrate the difference between ***inheritance-based*** and ***composition-based*** architectures, consider how you might design, for example, a "tower defense" style game, with the following features … (Continue reading their comparisons in ***"Designing with Entities and Components"***.

It's a wonderful feeling to discover **after several decades** that other *prominent game developers* are thinking along the same patterns of "game prototype development".

Notes

1 Now might be a good time to review what the ***US Copyrights & Patent Office*** **says about game ideas.**

1. *"Code-less"* Game Design

Approaching Game Development

An Excerpt from "Macromedia Director Game Development" available from ***Amazon.com***

Whether you are an experienced game developer, a master of video games, or even new to computers, a great computer game will offer you entertainment and often some type of competition. Over the years, basic games have evolved to encompass numerous genres such as role-playing, first-person shooter, side-scrolling, ***strategy, education, and simulations.*** Role-play games involve a main character or characters thrust into a heroic plot. A first-person shooter, however, involves adrenaline-fed killing and destruction. Although simulations are generally designed to be as realistic as possible, most side-scrolling, strategy, and educational games tend to be a bit more simplistic. With the wide variety of games available today, the average person will have no trouble finding a game that suits their desires. As you develop your game design skills, ***avoid simply mimicking existing games.*** In most cases, however, any game you develop ***will fit clearly into a specific genre.***

Focusing Your Game

When you begin the process of designing a game, you must **first decide how to approach the task.** Determining the focus of your game is the best way to begin. You should decide on a ***topic, purpose, and theme*** for your game. Listing objectives that you want to accomplish through your game is often a smart way to begin. You might have objectives that direct the activities you will build into the game and a different set of objectives for the person who plays the game to accomplish. Through your thinking process, you will determine exactly what your game is about and how you should go about creating it. How focus your game **will affect all the decisions you make later in the design process.**

> **Generic programming** centers around the idea of abstracting from concrete, efficient algorithms to obtain **generic algorithms** that can be **combined with different data representations** to produce a **wide variety** of useful software.
>
> — Musser, David R.; Stepanov, Alexander A., ***Generic Programming***

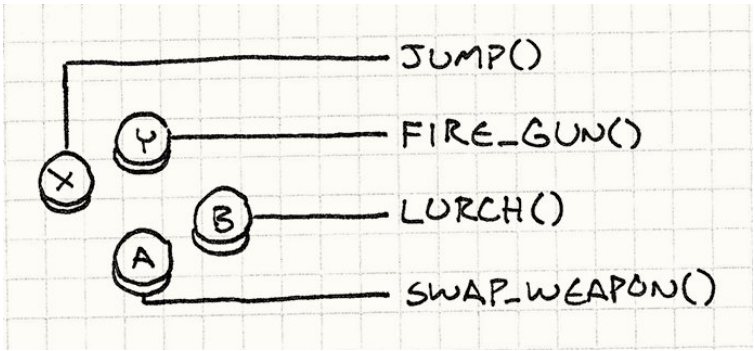
***Game Design System*™ creating new Games by "re-skinning" Artwork Themes!**

Game classification is diverse. So, I'd like to agree on some standard definitions as we "cook up" our game using the Game Design system™ and its Game Recipes™ tools.

- ***game prototypes —*** are a blend of three components: the Game Mechanics (GM — composed of data, logic, and rules); the Artwork Theme(s); and the Game Framework Display Mechanisms (GFDM). It is the ***"Minimum Viable Product" (MVP)***. Quoted from "***Construct Game Starter Kit Collection***" (page 69), "By combining all of our game mechanisms, with a set of game mechanics and its rule systems — as ***non-invasive aspects*** in our gaming product — along with an ***artwork theme***, **we're able to create multiple game products quickly.** It simply becomes a matter of exchanging any of those ***"3 cross-cut" components*** into a new innovative mixture for a new game product. ***This is the secret to concocting a new game every month or even every week!*** For example, swapping a "Guitar Hero" artwork theme with a "Plants & Zombies". The new game uses

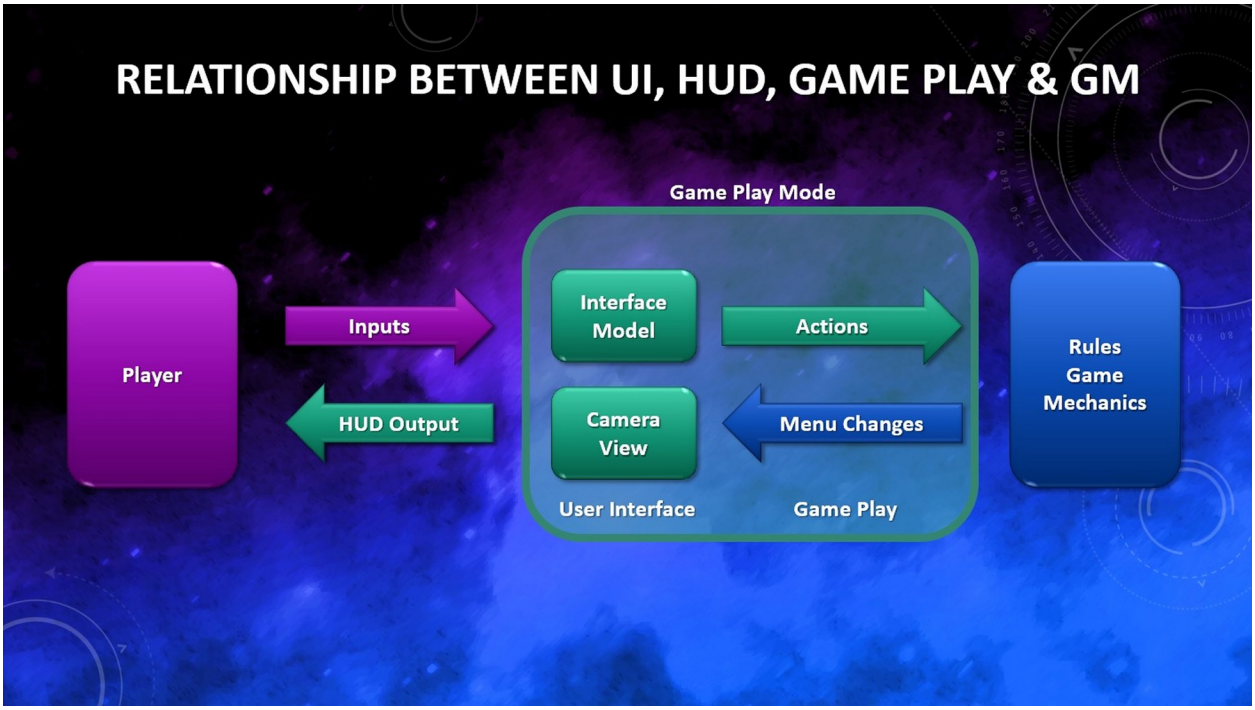
the same "Game Mechanics" and "Game Display Mechanisms" but with a "fresh organic garden" look and feel! From Page 117, "... let me write that code once and reuse it for similar items in other games as a "component prototype" — this is the secret sauce in our Game Recipes™! Keep your "featured ingredients" D.R.Y (Don't Repeat Yourself) and use it everywhere in your game Studio!" Construct has already given us many "Plug-ins" components to help us. (See the Appendix for ***300+ more*** Plugins, Behaviors, and Effects!)

- ***mechanics —*** are written into Construct's "Event sheets". You merely describe ***how*** your game "works" using a "logical block system". Quoted from "***Construct Game Starter Kit Collection***" (page 68), "From a game programming perspective, basic Game-Play can be deconstructed — revealing tactical components inside a game's overall mechanics, logic, and rules. For example, a fighting game deconstructs into various tactics such as attacks (or punches, throws, and kicks), defensive moves, and dodges. These tactics are assigned to code functions and mechanisms — the input keys, mouse clicks, and screen interactions.



From "Game Programming Patterns" by Robert Nystrom

- ***mechanisms —*** are those visible objects placed in Construct's "Scenes, Layouts, and Layers". Quoted from "***Construct Game Starter Kit Collection***" (page 85), "The gameboard grid defines the ***Game Mechanics (GM)*** movement rules; ***how that grid is drawn*** is a ***Game Framework Mechanism (GFM).*** Players will send their decisions from their device's inputs using their browser — keyboard, mouse, game-pad, etc. — and the visual widgets and mechanisms we designate as drop-down menus, buttons, and "sliders". Mechanisms are those "visual-display elements" of ***Construct's Game Framework Mechanism (GFM)."***



***Game Design System*™ User Interface (UI) to Game Mechanics — there and back again!**

1.1 Game Genres Defined

> **"Genres are not usually defined by the actual content of the game nor its medium of play but by its common challenge."** quoted from ***"Fundamentals of Game Design"***.

Game Genres can be confusing. The inconsistency comes from trying to describe a game's mechanics, a game's delivery mode, with details associated with a game's theme. Game genres are specific game categories related by ***their similar gameplay characteristics.*** Remember that gameplay **IS** the "rules of a game" (i.e.: the ***Game Mechanics (GM)***). Single-player and multi-player are therefore not game genres. They are "delivery" mechanisms dictating the "mode" of gameplay.

A genre's challenges are those rules that govern its gameplay. Game genres are separate from their interfaces, and operating systems. If we turn to ludology (aka **"gaming theory"**), it classifies games according to several criteria —

- whether a game is **symmetric** or asymmetric,

- what a game's "sum" is (**zero-sum**, constant sum, and so forth),
- whether a game is a **sequential game** or **a simultaneous one**,
- whether a game includes **perfect information** or **imperfect information**, and
- whether a game is **determinate**.

GG Interactive — *Game Design Course*

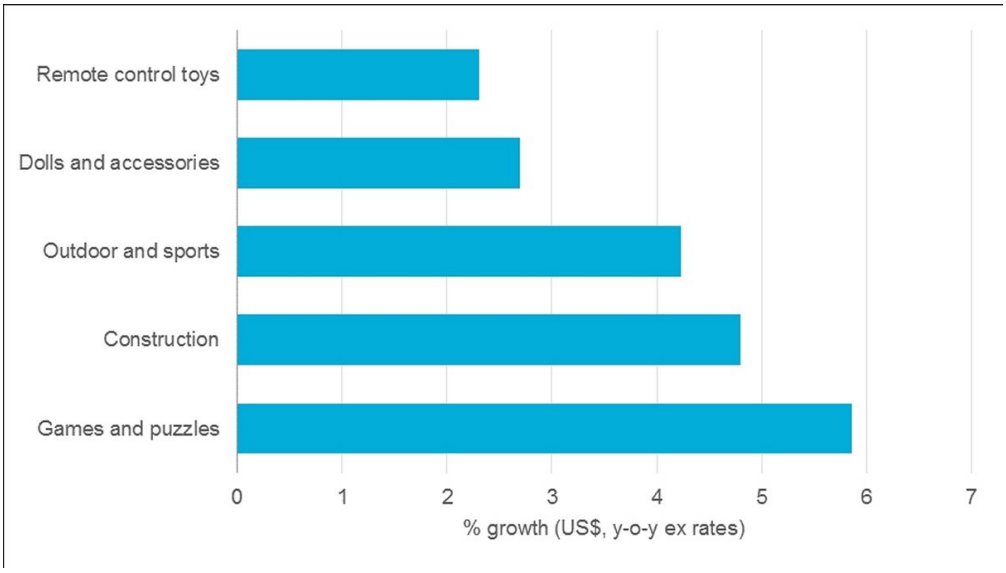
Genres don't help market a game — instead, the selection of a genre has an effect on what (the size of) the audience is likely to be interested and willing to purchase a game. Genres do help an audience understand the basics of a game by promising them a certain amount of familiar elements they desire (or demand) in a particular genre. For example, fans of medieval fantasy will expect some common themes in a ***Fantasy Real-Time Strategy*** (FRTS) game: knights, castles, troop combat, and magic, to name a few. As a game designer, it is important to understand what kind of audience expectations exist across different genres. Stray too far from these expectations without designing a brilliant alternative and the game will lose its audience. Stick too close to what has come before and the game will be overlooked as offering nothing new. Even the bold designer who intends to rewrite all that we know about how a genre game is played needs to understand what, to this point, has made the genre popular before deconstructing it and making it better.

Exercise: Launch your personal ***FREE Game Design course***.
Exercise: Download your Free Bonus Content: "***Game Category Classifications Compared***"

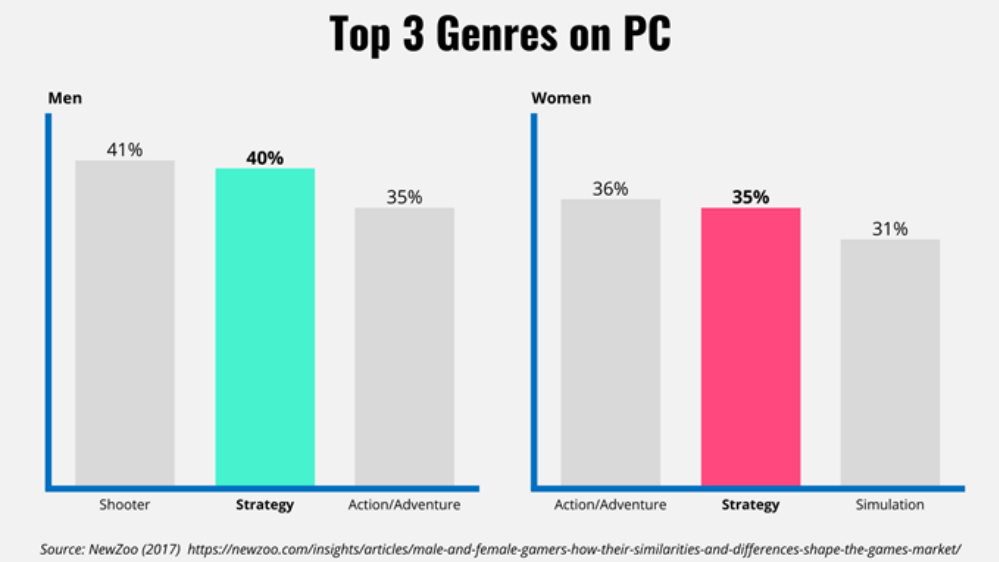
1.2 Demand for *Abstract* Games

> ***Euromonitor International*** states, "The 2014 release of the LEGO Movie made construction toys the fastest growing category in 2015 and the main growth driver in the global traditional toys and games market. By 2016, however, the power of the hit movie had faded, with construction toys growing by 5% in value globally. At the same time, games and puzzles continued to gain popularity among adults, especially in North America, where category value sales grew by 14% in 2016. Globally, adults aged 20 years and over are the fastest-growing demographic among traditional toys and games consumers. This surge in popularity made games and puzzles the fastest growing category in value terms overall in 2016."

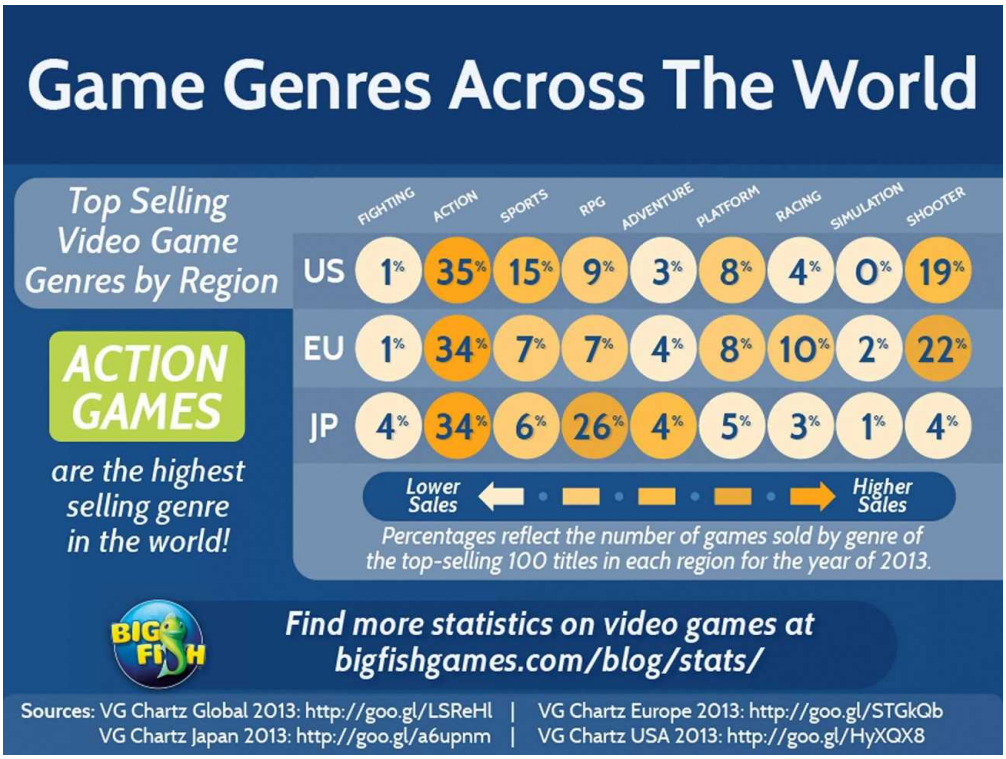
These charts show what games you should ***develop profitably,*** in which languages, and where to deploy them (i.e.: marketing channels). ***"Bump & Jump-to-Capture (J2C)"*** games are a subset of both the "Puzzle" and "Strategy" genres.



Demand for Puzzles and Games per Euro-monitor



Top 3 Genres on PCs



Game Genre's Popularity compared Worldwide

If you combine the ***"Action-adventure"*** with the ***RPG*** genre, you will have a "healthy market share" to target for your final product. This also guides you into "what style" of Abstract Puzzle Strategy game to create — ***"Bump or Jump" To Capture is a sub-genre of both "Abstract Strategy" and "Puzzle" games.***

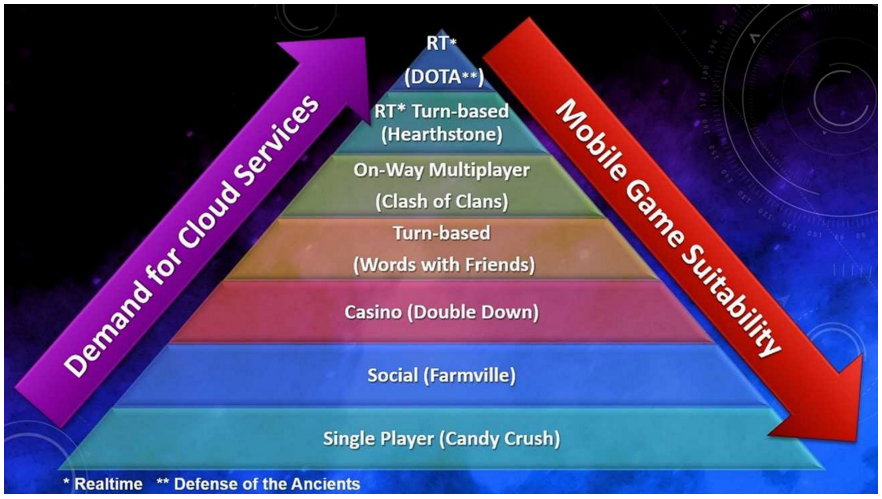
1.3 Game Delivery Modes

This is another often-misused term and is often confused with a game's ***perspective*** or participants. Let's agree that ***"game mode"*** refers to a game's participation and the number of players within a game session. Armed with this definition let's further define how gamers participate.

Single Player — A single-player game accepts input from only one participant and refers to those games that can be played by only one active person. "Single-player mode" converts game-play into a single-player input. Furthermore, the "Single-player mode" **might have representation** as an avatar found in PacMan which shows the position and interaction of a player within the gaming world. Single-player is not restricted in representation as in arcade-style games of Tetris. Many ***military strategy games*** allow **multiple avatars per single gamer** while battling the computer's artificial intelligence. Much of the online games, today were designed for single-player mode. Here's an interesting and controversial article on ***the future of computer-monitored single-player games. Are single-player games doomed?***

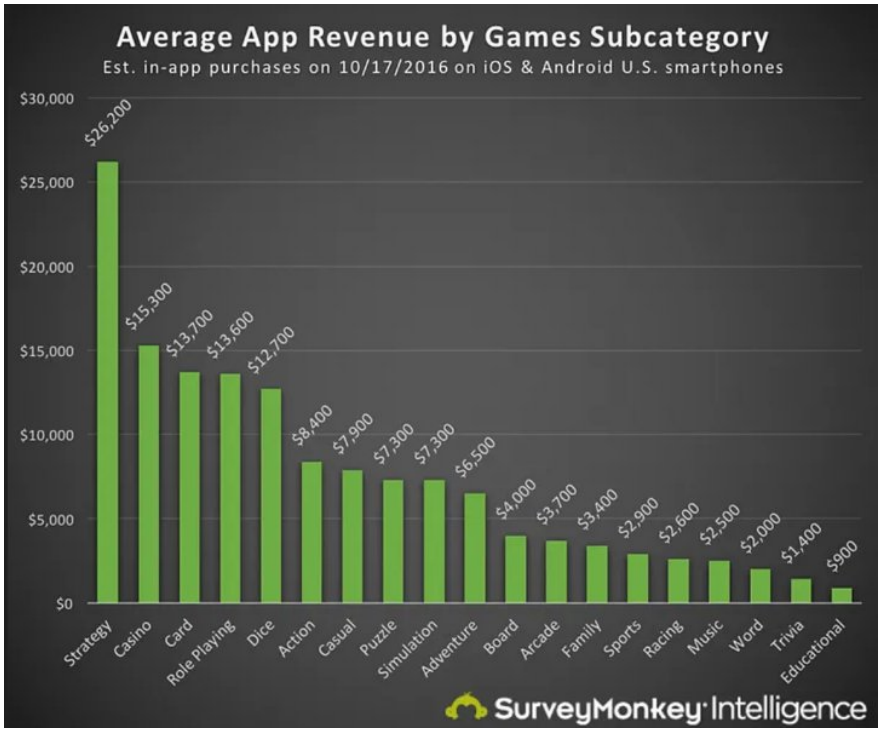
Multi-Player — This mode, as its name suggests, allows more than one game participant. Many game publishers mistakenly set Massive Multi-Player Online Games (MMoG) as a separate gaming genre. Yet, in my opinion, it is not. Massive Multi-Player Online Games (MMoG) is a **mode of play couched within many different game genres** just as single-player games have varying genres. Gamers can play ***cooperatively in teams*** or ***antagonistically as opponents*** in this mode. Like single-player games, Multi-Players normally have avatar representation as "one player to one avatar" or "one participant with multiple avatar teams". The gaming party might have local or remote access to a single game session. Two gamers could play in **"hot-seat" mode**; in which, they would pass the input devices to the next player for their game-turn. This was popular in the early days of console gaming when local area networks were significantly diminished as compared to current modern-day network capabilities. Modern networks have provided the foundation for Massive Multi-Player Online Games. I have dedicated an entire section to various considerations in the multi-player game development.

With these definitions, we can now determine which "game mode" to use, how, and where to deploy our game as either a "***Cloud Service***" or a "Mobile app".



Using Cloud Delivery Services vs Mobile Targeted Audience

> Mobile "In Apps Purchases" (IAP) ROI



Strategy Games Return On Investment (ROI) has the greatest revenues!

Revenues from Game in-app purchases on 20161017 for iOS & Android US smartphones

Top	**$21,188,000 (clash of clans)**
Average	**$8,400**
80th Percentile	**$3,100**
50th Percentile (Median!)	**$150**
20th Percentile	**$0**

Exercise: Read this report from ***Instabug on Mobile Game Development***.
Exercise: Read "***How To Collaborate On Construct Projects using GIT***"
Exercise: Read "***Team Collaboration On Construct Projects using GitHub***"

1.4 Game Tools & Generators

You will discover many supporting tools from ***"MakingBrowserGames" GitHub*** and in the Appendix of this book. Here are some tools that will help in generating gaming ideas, game design documents, and dynamically generated project source code.

- ***YourKit*** — supports open source projects with innovative and intelligent tools for monitoring and profiling Java and .NET applications.
- ***Random Game Mechanics Generator*** — This idea generation machine randomly selects 3 — by default — common game theory mechanics. The game mechanics and descriptions should help your imagination blend and produce the next blockbuster game.
- ***Game Framework Mechanisms (FREE Limited Access)*** — This library of game controls and mechanisms spans several JavaScript gaming frameworks — more are on the way! This tool helps you choose those game controls and then opens the generic code snapshots (aka "snippets"). Spend a minute to re-factor those snapshots to your bespoke design and you'll have a functional game prototype within minutes.
- ***GIT*** — Git is a free and open-source distributed version control system designed to handle everything from small to very large projects with speed and efficiency. Git allows and encourages you to have multiple local branches that can be entirely independent of each other. The creation, merging, and deletion of those lines of development takes seconds.
- ***Construct Tools & Resources***
- ***"12 Handy Free Productivity Tools For Game Designers"***

> The Digital Ludeme Project

This project is a computational study of the world's traditional strategy games ***throughout recorded human history.*** Their aim is to improve our understanding of traditional games using modern AI techniques, chart historical game development, and explore their role in the development of human culture while incorporating ludic ideas. They define games as structured sets of "`ludemes`" (units of game-related information), which will allow the full range of traditional games to be modeled into a ***single software system for the first time.*** (See the "***Ludii General Game System***" below — a general game system designed to play, evaluate, and design a wide range of games, including board games, card games, dice games, and mathematical games.) Their system will not only model and play games but will also evaluate reconstructions for quality and historical authenticity. This will lay the foundations for a new field of study called ***"Digital Archaeoludology" (DA).***

> Ludii General Game System

> "Ludii" produced 1,389 new games over a four-week run, of which it deemed 19 to be playable and of varying degrees of interest. It ranked ***"Yavalath"*** — designed by the Ludii program — as the fourth best-evolved game, while a group of human player testers found ***Yavalath*** to be the ***second most interesting*** of the evolved games. However, it was obvious, at that time, that Yavalath had a special quality about it, and it has since emerged as the clear favorite and now stands as a game in its own right. The game caught the attention of Néstor Romeral Andrés and was commercially published by Nestorgames in 2009.

Ludii, a computer program, creates games by taking the rules of existing games and scrambling them into new combinations using ***genetic programming (GP)*** techniques of crossover and mutation. New games are tested through self-play trials and assigned a quality score based on their estimated potential to interest human players. ***The complete process of design, testing, and evaluation is entirely automated.*** Ludii creates a unique name for each evolved game using a Markovian stochastic process seeded with Tolkien-style words.

Exercise: Review the available "***Ludii generation tools***" for game developers.

2. Project Management Overview

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2.1 Demo Game License

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2.2 *Game Recipe™* just add Artwork, stir, & season to taste!

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2.3 Development:

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2.4 Design:

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> Deeper Dive: Putting Background Stories in the Wrong Place

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2.5 Construct's *"Code-less"* Encoding

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> Deeper Dive: Creating Display Mechanisms — a 4-Step method

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3. Starting a *"Bump or Jump" To Capture* Game

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3.1 Design Considerations

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> Following the herd? — *Use expected "Conventions"*

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3.2 Game Mechanics (GM) — Logic & Rules

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3.3 Game Mechanics (GM) — Data Structure

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3.4 Game Framework Mechanisms (GFM)

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> Deeper Dive: Using D.R.Y. "Event Sheets" as "Includes"!

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3.5 Turn-based Gameplay

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> Deeper Dive: Multi-Player versions

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> Deeper Dive: Construct's Multi-Player Plugin

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4. *"Bump-To-Capture" (B2C)* Concept & Design

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4.1 Creating a *"B2C"* Chess Variant

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> Deeper Dive: *Vassal or "Zillions-of-Games"* vs. *Construct & Jocly*?

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4.2 Reviewing our *"B2C"* Competition

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5. Part I: Conclusion

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6. Lesson 1: *C2 "Jump-To-Capture"* Project

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6.1 *About* Your Project

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6.2 Project Settings:

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6.3 Configuration Settings

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> Creating a C2 CMS or PWA Game Version?

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Part III: *Starting C3 Production*

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7. Lesson 1: *C3 "Jump-To-Capture"* Project

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7.2 Project Settings: Color Theme, Start-up & Display

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7.3 Configuration Settings: Advanced & Editor

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Part IV: *"Ubiquitous"* Production

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8.1 *"Best laid schemes o' mice an' men" ...*

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8.5 Main Menu Navigation

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8.6 Encoding the Main Menu

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9. Lesson 3: *J2C* Gameboard, Holes, & Pegs

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9.1 Gameboard Construction

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9.2 Holes & Pegs

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10. Lesson 4: *J2C* AIBot & FSM

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11.5 Checkers AI Resources

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12. Lesson 5: *B2C* Gameboards & Tiles

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> Using Squares?

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> Using Hexagons!

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12.2 Building a *"Grid-less"* game …

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12.3 Building a *"Squish"* Movement System …

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> The Tessellation Gameboard Recipe.

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> Easier Tessellations Using Construct Sprite frames

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12.4 Gameboard Customization Tool

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13. Lesson 6: *B2C* AIBot, Captures, & FSM

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13.1 *"Making your own AIBot"*

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13.2 Capturing Tokens

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13.3 11 Combat Systems & counting ...

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> *"Match3"* Combat System

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> *"Guitar Hero"* Defensive Combat System

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> "Sequence Reveal" Combat System

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> *"Rock, Paper, Scissors"* Combat System

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> Magic Combat System

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> *"Click & Timing"* Combat System

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> *"Doom & Wolfenstein"* (1st Person) Combat System

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> *"Las Vegas-Style"* Combat Systems

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> Historic Example

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14. Let's Start *SIMPLE EinStein* ...

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14.1 Gameboard & Tokens

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14.2 Dice Tokens

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14.3 Deeper Dive: AIBot Analysis

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14.4 *B2C* Captures, Collisions, FSM, & Game Turns

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> Single Player (Blue) vs. AIBot (Red)

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14.5 *"EWN"* expanded variants

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15. Deriving a “Chess Variant Game”

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15.1 My *B2C* Elevator Speech

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15.2 *War Lord Tourney™* Prototype

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Starting *Your Game Studio!*

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16. One “GM” to Rule them all!

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17. Capstone "*Practicum*"

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17.1 The "*Jump-To-Capture*" (*J2C*) Game Zoo

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> LeapFrog

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> Fox & Geese

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> Fox, Hares, Hounds, Wolf, & Sheep

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> *"Blue & Gray"* — a *J2C* US Civil War game

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17.2 *"Bump-To-Capture" (B2C)* Game Variations

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> *B2C* Strategy Wargames

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18.4 Book Review Protocol

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