# Serious Game Construction Worksheet

Created by Brian M. Winn (winnb@msu.edu), Assistant Professor, Games for Entertainment and Learning (GEL) Lab (http://gel.msu.edu), Michigan State University

Use this worksheet and the accompanying material to help guide the brainstorm on the design of your serious game. The structure of the brainstorm is based on the "Design/Play/Experience" framework described in the workshop and summarized below:
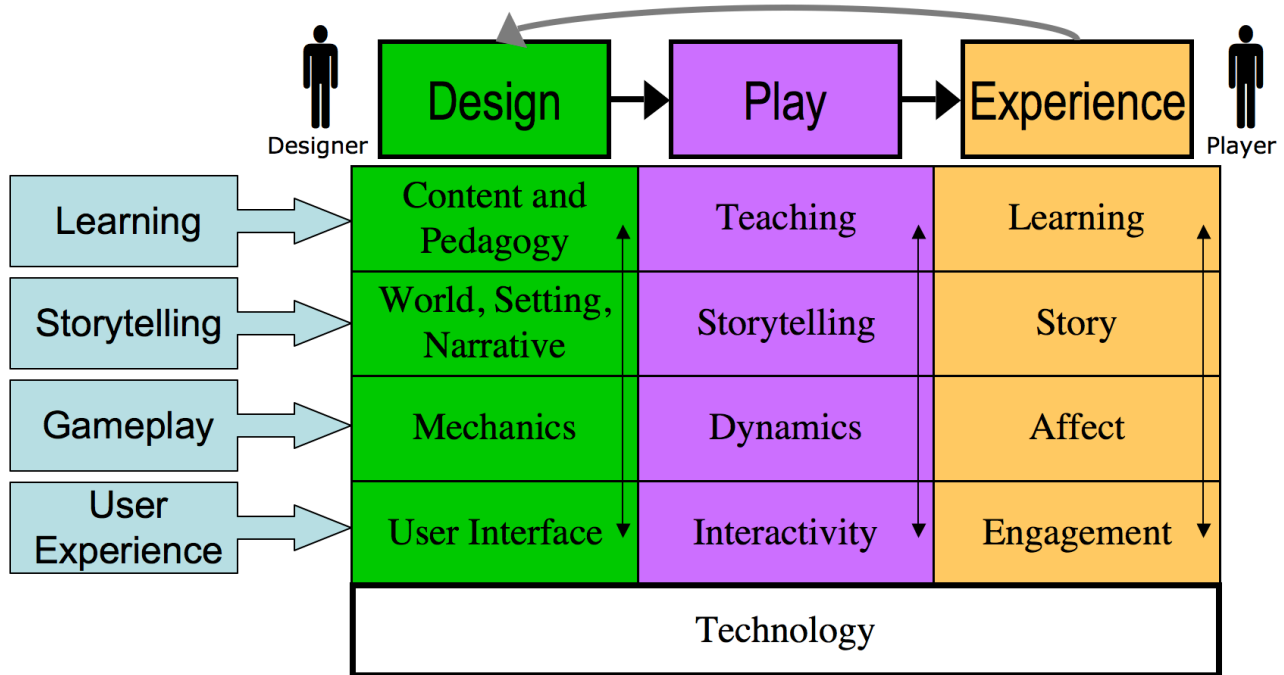
The framework presents a language to discuss design, a methodology to analyze a design, and a process to design a serious game. The framework depicts the *designer* and the *player*. The designer *designs* the game; the player *plays* the game; which results in the player's *experience*. The designer only has direct control over the design itself. To design a game effectively, the designer should first come up with *goals* for the resulting experience. These goals can be used both to guide the design and to gage the effectiveness of the design once implemented. The grey arrow from Experience back to Design represents both the influence of the goals on the original design and the iteration on the design once a prototype of the game is tested against the experience goals. This reflects the inherently *iterative process* of game design, including designing, prototyping (not explicitly depicted in the framework), playtesting, and iterating back to design based on the experience of the playtesting.

The four layers below the Design/Play/Experience layer represent the subcomponents of the serious game design, including Learning, Storytelling, Gameplay, and User Experience. Each layer has a design, play, and experience component. For example, in the Learning layer the designer designs the content and pedagogy, which results (hopefully) in teaching when the player plays the game, which leads to a set of learning outcomes (either realized or not) derived from the overall experience. Just as described above, the designer should first come up with *goals*, or in this case, learning outcomes for the resulting experience and then design the content and pedagogy to meet these goals.

The vertical arrows reflect the fact that each layer has influence over other layers. For example, the learning will influence and be influenced by the other levels.

Technology is represented in the bottom layer. While the designer does not necessarily design the technology, the design itself is realized (or not) on the technology. Further, the capabilities and limitations of the technology or the resources require to implement the technology may greatly influence the design and should be considered throughout the design process.

Introduction

This workshop represents a microcosm on serious game design. As such, your group's first task will be to decide on the topic and target audience of the serious game you will be designing in this workshop. In the "real-world", this step may be defined for you.

1. Introduce yourselves by answering the following questions:
   - Who are you?
   - Where are you from?
   - Why do YOU care about games?
   - Any experience designing games?

2. Quickly decide upon a general "topic" for your serious game. Perhaps it could be something from:
   - everyday life, such as maintaining a healthy life style, traffic safety, or balancing your budget
   - academia, such as geography, chemistry, physical, mathematics, history, or any other discipline.
   - the corporate world, such as real-estate, management, or on-the-job safety.

   You do not need to get too specific at this point. That will soon follow.

   As we do not have time to do thorough research in the framework of the workshop, make sure at least one person in your group can serve as a "content expert". That is, someone is knowledgeable about the topic of your serious game.

3. Define your target audience (i.e., the player).

4. Given the topic area and the target audience, what "problem" are you trying to solve?

Learning

As you work through the following questions, begin to envision how learning will take place as the player plays the game.

1. Define the scope of the game:
   - Is the game stand-alone, supplementary or an integral part of a course?
   - What is the duration most players will ideally play the game? Is this is part of a course? If so, is it played outside of class, during just one class or does it span multiple classes?
   - Where is the game played, in class, in a computer lab, or at home?

2. Define the desired learning outcomes (knowledge, skills, and attitudes). Refer the Bloom's Taxonomy overview in Appendix A for inspiration on crafting learning outcomes.

3. What content should be included and pedagogical approach should you take to best achieve the above learning outcomes?

Storytelling

There are two perspectives on storytelling in games, the "designer's story" and the "player's story". The designer's story is the storytelling that you design into the game. Story can be used to set the stage, provide purpose and engagement, and convey content, among other things. The player's story is the story of the interactions and choices the player makes as they play the game. Some games have stronger designer's stories, such as typically adventure and role-playing games, while others have little to no designer's story, such as classic arcade games like Pacman and puzzle games like Tetris. However, all games have a player's story. Consider the following questions as you consider the design of storytelling in your game:

1. What are the goals of "story" in your game?

2. What is the "designer's story"?
   - Where and when does the game take place? How will the game world and setting convey this information?
   - What are the primary "characters" in the game and what role do they serve? Does the player assume one of these roles?
   - Is there a defined narrative (plot)? If so, what is it and how will it be communicated to the player (e.g., dialog with NPCs, cutscenes, interactions with objects in the world)?

3. What is the "player's story"? That is, what stories can they tell by playing the game?

4. How is the resulting storytelling complementary or conflicting with your learning outcomes? How can you enhance the storytelling to be in line with your learning outcomes?

Gameplay

The gameplay defines what the player does in the game. That is, what choices the player can make in the game world and what ramifications those choices will have on the rest of the game. Gameplay can be broken down into mechanics (the rules that define the operation of the game world, what the player can do, the challenges the player will face, and the goals) and dynamics (the resulting behavior when the rules are instantiated over time during play). The following questions should aid you in the design of your gameplay:

1. What are the "affective" (emotional) goals for the player? Which forms of fun will your game employ (see Appendix B for inspiration.)

2. What mechanics and dynamics will help you achieve the affective goals?
   - What does the player "do" in the game (what are the action verbs)?
   - What are the players overall goals? sub-goals?
   - What challenges/obstacles does the player face as they strive to reach their goals? (see Appendix C for inspiration.)

- What game genre or genres would you classify your game as? (see Appendix D and E for assistance.)

3. How is the resulting gameplay complementary or conflicting with your learning outcomes? How can you enhance the gameplay to be in line with your learning outcomes?

User Experience

The user experience is where the rubber meets the road. That is, your game design manifests itself in the user experience, which encompasses everything the user sees, hears, and interacts with and how that interaction happens (i.e., the control system.) Consider the following questions as you define your games user experience:

1. Interface
   - What are the components of the in-game interface?
     - What information needs to be communicated to the player and how will it be communicated (such as, game world, score, lives indicator, level indicator, mini-map)?
     - What actions does the player need to take while playing and what interface elements (if any) are needed to input/perform these actions (such as a popup menu for dialog response)?
   - What out-of-game screens are necessary (such as a main menu, configuration screen, avatar builder screen, load/save screen, and network-play configuration screens)?

2. Output
   - Is this a 2D or 3D game?
   - Is it photorealistic, cartoon, abstract?
   - How will audio be used in the game (SFX, music, narration, …)?
   - Are other forms of output necessary/desired (force-feedback, …)?

3. Input
   - What controls are available (keyboard, mouse, joystick, controller, …)?
   - Are there standard control system conventions used by other similar games? If so, what are they?
   - How will the controls map to the actions available to the player?

Technology

Your game design is ultimately grounded by technology. Technology can be both an enabler and a limiter. The following questions should help you begin to flush out your technology needs:

1. Given the design of the game, what are the technology needs?
   - 2D or 3D graphics engine
   - Real-time vs. turn-based interaction
   - If real-time, do you need a physics engine
   - Single-player or multiplayer or massively multiplayer
   - Local vs. Online vs. Mobile

2. What are your technology limitations?
   - Computing environment limitations (CPU, memory, video card, sound, …)
   - Time, talent, and resources (tools, $$$)

After flushing out your technology needs, you should be better able to make technology decisions (see Appendix F for a list of possible technologies you can use to build your game.)

Generating the High Concept Document and/or Presentation

To refine and solidify your ideas from the above brainstorm activities and make them presentable to others, create a "high concept" document and/or presentation. Your high concept should include the following components:

- The name of your game
- The topic area, audience, and problem you are solving
- An overview of the game based on the Design/Play/Experience elements
- If you have time, create storyboards or mockup screenshots

Appendix A: Generating Student Learning Outcomes with Bloom's Taxonomy

I have found Bloom's Taxonomy on Teaching and Learning useful in thinking about and generating the student learning outcomes in serious game design.

The following is an excellent overview of Bloom's Taxonomy generated by Donald Clark (Copyright 1999 Donald Clark) and used by permission. It, along with many other resources, is available online at http://www.nwlink.com/~donclark/.

The Three Types of Learning

There is more than one type of learning. A committee of colleges, led by Benjamin Bloom, identified three domains of educational activities:
- Cognitive: mental skills (*Knowledge*)
- Affective: growth in feelings or emotional areas (*Attitude*)
- Psychomotor: manual or physical skills (*Skills*)

Since the work was produced by higher education, the words tend to be a little bigger than we normally use. Domains can be thought of as categories. Trainers often refer to these three domains as KSA (Knowledge, Skills, and Attitude). This taxonomy of learning behaviors can be thought of as "the goals of the training process." That is, after the training session, the learner should have acquires new skills, knowledge, and/or attitudes.

The committee also produced an elaborate compilation for the cognitive and affective domains, but none for the psychomotor domain. Their explanation for this oversight was that they have little experience in teaching manual skills within the college level (I guess they never thought to check with their sports or drama department).

This compilation divides the three domains into subdivisions, starting from the simplest behavior to the most complex. The divisions outlined are not absolutes and there are other systems or hierarchies that have been devised in the educational and training world. However, Bloom's taxonomy is easily understood and is probably the most widely applied one in use today.

Knowledge (Cognitive) [(1)](#)

The cognitive domain involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major categories, which are listed in order below, starting from the simplest behavior to the most complex. The categories can be thought of as degrees of difficulties. That is, the first one must be mastered before the next one can take place.

Category	Description	Examples	Keywords
Knowledge	Recall data or information.	Recite a policy. Quote prices from memory to a customer. Knows the safety rules.	defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states
Comprehension	Understand the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.	Rewrites the principles of test writing. Explain in one's own words the steps for performing a complex task. Translates an equation into a computer spreadsheet.	comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives Examples, infers, interprets, paraphrases, predicts, rewrites, summarizes, translates
Application	Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the work place.	Use a manual to calculate an employee's vacation time. Apply laws of statistics to evaluate the reliability of a written test.	applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses
Analysis	Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences.	Troubleshoot a piece of equipment by using logical deduction. Recognize logical fallacies in reasoning. Gathers information from a department and selects the required tasks for training.	analyzes, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates
Synthesis	Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure.	Write a company operations or process manual. Design a machine to perform a specific task. Integrates training from several sources to solve a problem. Revises and process to improve the outcome.	categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes
Evaluation	Make judgments about the value of ideas or materials.	Select the most effective solution. Hire the most qualified candidate. Explain and justify a new budget.	appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports

Attitude (Affective) [(2)](#)

This domain includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes. The five major categories listed the simplest behavior to the most complex:

Category	Description	Examples	Keywords
Receiving Phenomena	Awareness, willingness to hear, selected attention.	Listen to others with respect. Listen for and remember the name of newly introduced people.	asks, chooses, describes, follows, gives, holds, identifies, locates, names, points to, selects, sits, erects, replies, uses.
Responding to Phenomena	Active participation on the part of the learners. Attends and reacts to a particular phenomenon. Learning outcomes may emphasize compliance in responding, willingness to respond, or satisfaction in responding (motivation).	Participates in class discussions. Gives a presentation. Questions new ideals, concepts, models, etc. in order to fully understand them. Know the safety rules and practices them.	answers, assists, aids, complies, conforms, discusses, greets, helps, labels, performs, practices, presents, reads, recites, reports, selects, tells, writes
Valuing	The worth or value a person attaches to a particular object, phenomenon, or behavior. This ranges from simple acceptance to the more complex state of commitment. Valuing is based on the internalization of a set of specified values, while clues to these values are expressed in the learner's overt behavior and are often identifiable.	Demonstrates belief in the democratic process. Is sensitive towards individual and cultural differences (value diversity). Shows the ability to solve problems. Proposes a plan to social improvement and follows through with commitment. Informs management on matters that one feels strongly about.	completes, demonstrates, differentiates, explains, follows, forms, initiates, invites, joins, justifies, proposes, reads, reports, selects, shares, studies, works.
Organization	Organizes values into priorities by contrasting different values, resolving conflicts between them, and creating an unique value system. The emphasis is on comparing, relating, and synthesizing values.	Recognizes the need for balance between freedom and responsible behavior. Accepts responsibility for one's behavior. Explains the role of systematic planning in solving problems. Accepts professional ethical standards. Creates a life plan in harmony with abilities, interests, and beliefs. Prioritizes time effectively to meet the needs of the organization, family, and self.	adheres, alters, arranges, combines, compares, completes, defends, explains, formulates, generalizes, identifies, integrates, modifies, orders, organizes, prepares, relates, synthesizes.
Internalizing values (characterization)	Has a value system that controls their behavior. The behavior is pervasive, consistent, predictable, and most importantly, characteristic of the learner. Instructional objectives are concerned with the student's general patterns of adjustment (personal, social, emotional).	Shows self-reliance when working independently. Cooperates in group activities (displays teamwork). Uses an objective approach in problem solving. Displays a professional commitment to ethical practice on a daily basis. Revises judgments and changes behavior in light of new evidence. Values people for what they are, not how they look.	acts, discriminates, displays, influences, listens, modifies, performs, practices, proposes, qualifies, questions, revises, serves, solves, verifies.

Skills (Psychomotor) [(3)]

The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. The seven major categories listed the simplest behavior to the most complex:

Category	Description	Examples	Keywords
Perception	The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation.	Detects non-verbal communication cues. Estimate where a ball will land after it is thrown and then moving to the correct location to catch the ball. Adjusts heat of stove to correct temperature by smell and taste of food. Adjusts the height of the forks on a forklift by comparing where the forks are in relation to the pallet.	chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects.
Set	Readiness to act. It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets).	Knows and acts upon a sequence of steps in a manufacturing process. Recognize one's abilities and limitations. Shows desire to learn a new process (motivation). NOTE: This subdivision of Psychomotor is closely related with the "Responding to phenomena" subdivision of the Affective domain.	begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers
Guided Response	The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing.	Performs a mathematical equation as demonstrated. Follows instructions to build a model. Responds to hand-signals of instructor while learning to operate a forklift.	copies, traces, follows, react, reproduce, responds
Mechanism	This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence and proficiency.	Use a personal computer. Repair a leaking faucet. Drive a car.	assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.
Complex Overt Response	The skillful performance of motor acts that involve complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation, and automatic performance. For example, players are often utter sounds of satisfaction or expletives as soon as they hit a tennis ball or throw a football, because they can tell by the feel of the act what the result will produce.	Maneuvers a car into a tight parallel parking spot. Operates a computer quickly and accurately. Displays competence while playing the piano.	assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches. NOTE: The Keywords are the same as Mechanism, but will have adverbs or adjectives that indicate that the performance is quicker, better, more accurate, etc.

Adaptation	Skills are well developed and the individual can modify movement patterns to fit special requirements.	Responds effectively to unexpected experiences. Modifies instruction to meet the needs of the learners. Perform a task with a machine that it was not originally intended to do (machine is not damaged and there is no danger in performing the new task).	adapts, alters, changes, rearranges, reorganizes, revises, varies.
Origination	Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills.	Constructs a new theory. Develops a new and comprehensive training programming. Creates a new gymnastic routine.	arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.

Other Psychomotor Domains

As mentioned earlier, the committee did not produce a compilation for the psychomotor domain model, but others have. The one discussed above is by Simpson (1972). There are two other popular versions:

Dave's[4]:
- Imitation: Observing and patterning behavior after someone else. Performance may be of low quality. Example: Copying a work of art.
- Manipulation: Being able to perform certain actions by following instructions and practicing. Example: Creating work on one's own, after taking lessons, or reading about it.
- Precision: Refining, becoming more exact. Few errors are apparent. Example: Working and reworking something, so it will be "just right."
- Articulation: Coordinating a series of actions, achieving harmony and internal consistency. Example: Producing a video that involves music, drama, color, sound, etc.
- Naturalization: Having high-level performance become natural, without needing to think much about it. Examples: Michael Jordan playing basketball, Nancy Lopez hitting a golf ball, etc.

Harrow's[5]:
- Involuntary movement - reaction
- Fundamental movements - basic movements
- Perception - response to stimuli
- Physical abilities - stamina that must be developed for further development
- Skilled movements - advanced learned movements
- No discursive communication - effective body language

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1.   Bloom B. S. (1956). *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain.* New York: David McKay Co Inc.
2.   Krathwohl, D. R., Bloom, B. S., & Bertram, B. M. (1973). *Taxonomy of Educational Objectives, the Classification of Educational Goals. Handbook II: Affective Domain.* New York: David McKay Co., Inc.
3.   Simpson E. J. (1972). *The Classification of Educational Objectives in the Psychomotor Domain.* Washington, DC: Gryphon House.
4.   Dave, R. H. (1975). *Developing and Writing Behavioural Objectives.* (R J Armstrong, ed.) Educational Innovators Press.
5.   Harrow, A. (1972) *A taxonomy of psychomotor domain -- a guide for developing behavioral objectives.* New York: David McKay.

Appendix B: Generating Design Goals by Decomposing the Forms of Fun

In 2001, Pierre-Alexandre Garneau wrote an article that appeared in Gamasutra, titled "Fourteen Forms of Fun". Garneau's goal in proposing 14 forms of fun was "to be as complete as possible in the enumeration of categories of activities that are fundamentally entertaining." I worked with Heeter et al (2003) to apply these categories to a content analysis of forms of fun in space learning games. I have found the forms of fun useful in helping derive storytelling, gameplay, and user interface goals. Heeter's interpretation of Garneua's definitions of each form of fun appears below:

Form of Fun	Description
Beauty	Beauty is "that which pleases the senses", may include graphics, music, sound effects or touch.
Immersion	Immersion involves "going into an environment different from one's usual environment by physical means or by use of one's imagination." This includes the pleasure of being in a different environment than usual, the pleasure of living a different life, the pleasure of escaping from one's problems. Novels, story telling and movies are passive forms of immersion. Artificial intelligence, sound and physics are also important aspects of immersion.
Intellectual Problem Solving	Intellectual Problem Solving refers to "finding solutions to problematic situations that require thought." This can involve perceiving pattern of problems: rules (the constraints of the computer and of the programming language for programming, for example), a setting (the current situation in a board game, the program in which the module must be integrated for programming) and a goal (what it is that must be achieved).
Competition	Competition includes "an activity where the goal is to show one's superiority" either over other players or against oneself, improving previous scores.
Social Interaction	Social Interaction involves "doing things with other human beings" such as chatting, cooperating, or competing. (We defined social interaction as NOT involving NPCs but only involving other real humans.)
Comedy	Comedy includes "things that make one want to laugh."
Thrill of Danger	Thrill of Danger is fun where the stakes are high. Failure could lead to the player being killed or aliens destroying the earth or the space program being cancelled. According to Garneau, "some players found it to be more frustrating than fun"
Physical Activity	Physical Activity refers to fun involving "activities requiring intense physical movements." (We interpreted this to mean more than mouse or keyboard movement. Therefore none of our games included physical activity forms of fun.)
Love	Love as a form of fun can include strong affection toward, love, lust, or caring for somebody (real or virtual, human or alien or pet). Love can include "Strong affection toward somebody.
Creation	Creation fun is "to make exist that which didn't." For this form we coded games with creation as a main gameplay feature – games which focus more on creation than destruction.
Power	Power as a form of fun involves the "capacity of having a strong effect, of acting with strength."
Discovery	Discovery fun is about "finding something that wasn't known before." This can include new levels, new planets or aliens, new environments, new weapons, new enemies, etc., seeing new things, or doing new things.
Advancement and Completion	Advancement and Completion fun means "going forward in, and eventually finishing, an activity."
Application of an Ability	Application of an ability, according to Garneau is "using one's physical abilities in a difficult setting." We stuck with Garneau's focus on physical abilities such as hand-to-eye coordination and quick reflex actions in a challenging situation.
Altruism*	Altruism involves helping other players or helping NPCs (human, alien, or animal) or helping humanity.

Learning*	Learning refers to increasing your understanding of or knowledge about the real world – this includes how high you can jump on Pluto, the impact of budgets on space exploration, why there are seasons, etc. The fun of learning facts and concepts which relate to the real world.

* Perhaps because we are interested in learning, we noticed the original list of 14 left out at least two particularly relevant forms of fun. Learning about the world (the real world) can be enjoyable and is extremely germane to consideration of educational games. In addition, none of Garneau's forms of fun seemed to address the pleasure of helping or taking care of others. Altruism might include helping another person, caring for a pet, or even saving humanity. Learning and altruism are forms of fun that will also likely appeal to girls according to an AAUW (2000) report.

References

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Heeter, C., Chu, K., Maniar, A., Mishra, P., Egidio, R., and Winn, B. Comparing 14 Forms of Fun (and Learning and Gender Issues) In Commercial Versus Educational Space Exploration Digital Games, International Conference on Digital Games Research conference, Netherlands, November, 2003.

Appendix C: Gameplay Challenges

Andrew Rollings and Ernest Adams, in their highly recommended book "Andrew Rollings and Ernest Adams on Game Design" (New Riders, 2003), define gameplay as "one or more casually linked series of challenges in a simulated environment" and break the challenges into "pure challenges" and "applied challenges". You may find this useful in thinking about the design of your serious game's mechanics and dynamics.

Pure Challenges

Pure challenges are common types of challenges found in gameplay, including:

Challenge	Description	Examples
Logic and Inference	Test the ability of the player to assimilate information and use that information to decide upon the best course of action.	Chess
Memory Challenges	tax the player's memory of recent game events	Simon says style games
Knowledge-Based	test knowledge of the player	Trivia Pursuit
Pattern-Recognition	test the player's ability to identify and recognize patterns	Tetris, Space Invaders, Brickout
Spatial-Awareness	test player's ability to understand a virtual space	All First Person (Quake) and Third Person 3D (Lara Croft) Games
Coordination	test the ability of the player to perform many simultaneous actions	Super Mario (control character to run, jump, and duck at proper times as enemy approach)
Reflex/Reaction Time	test the timing ability of the player	Almost any real-time game
Physical	test the players ability to do something physically	Dance Dance Revolution

Applied Challenges

Applied challenges are combination of one or more of the pure challenge forms applied to a given gameplay situation or style, including:

Challenge	Description	Examples
Races	attempt to accomplish something before someone else	Chess, Warcraft resources, racing game
Puzzles	mental challenge, often represents a lock in the game	Lara Croft, Myst, Prince of Persia
Exploration	Desire by player to see new worlds. Often limited by design of gameplay (locked doors, traps, mazes, ...)	Mario 64, Mario Sunshine
Conflict	Beat the other player, survival, defending something, stealth, Strategy (planning), Tactics (putting a plan into execution), Logistics (weapons production, managing inventory)	Warcraft
Economies	system which resources move around, either physically from place to place, or conceptually from owner to owner.	Warcraft, Age of Empire, Civilization
Conceptual	Require player to understand something new	Relationships of transportation to economy in SimCity

Appendix D: Types of Learning and Possible Game Styles

The following table is from *Digital Game-Based Learning* by Marc Prensky (McGraw-Hill, 2001), another strongly recommended book. The table maps different types of content to potential learning activities and game styles/genres.

"Content"	Examples	Learning Activities	Possible Game Styles
Facts	Laws, policies, product specifications	Questions Memorization Association Drill	Game show competitions Flashcard type games Mnemonics Action, sports games
Skills	Interviewing, teaching, selling, running a machines, project management	Imitation Feedback Coaching Continuous practice Increasing challenge	Persistent state games Role-playing games Adventure games Detective games
Judgment	Management decisions, timing, ethics, hiring	Reviewing cases Asking questions Making choices (practice) Feedback Coaching	Role-playing games Detective games Multiplayer interaction Adventure games Strategy games
Behaviors	Supervision, self-control, setting examples	Imitation Feedback Coaching Practice	Role-playing games
Theories	Marketing rationales, how people learn	Logic Experimentation Questioning	Open-ended simulation Building games Construction games Reality testing games
Reasoning	Strategic and tactical thinking, quality analysis	Problems Examples	Puzzles
Process	Auditing, strategy creation	System analysis and deconstruction Practice	Strategy games Adventure games
Procedures	Assembly, bank teller, legal	Imitation Practice	Timed games Reflect games
Creativity	Invention, product design	Play	Puzzles Reflex games
Language	Acronyms, foreign languages, business or professional jargon	Imitation Continuous practice Immersion	Role-playing games Reflect games Flashcard games
Systems	Health care, markets, refineries	Understanding principles Graduated tasks Playing in microworlds	Simulation games
Observation	Moods, morale, inefficiencies, problems	Observing Feedback	Concentration games Adventure games
Communication	Appropriate language, timing, involvement	Imitation Practice	Role-playing games Reflect games

Note: This is intended to be suggestive, not exhaustive. Send comments to Marc Prensky at marc@games2train.com.

Appendix E: Entertainment Game Genres and Subgenres

Several game genres (and subgenres) have emerged from the interactive entertainment industry. These genres are each characterized by typical game elements across the Design/Play/Experience framework. The genre of your game gives your players some idea of what to expect. Further, players often make choices on what they play based on their genre preferences. As a designer, genres give you standard design elements to adhere to (or deviate from.) The genres below are the common game genres. Today, many games are beginning to combine elements of multiple genres, create new hybrid or blended genres.

Genre	Typical Elements	Examples

Action Games	• Real-time
	• Quick reactions required by user
	• Fast frame rate
	• Less cerebral (snap judgments and quick reflexes)
		• First-person Shooters
		  o Quake, Unreal, Tomb Raider
		• 2D Space
		  o Space Invaders, Asteroids, Galaga
		• Platform Games
		  o Donkey Kong
		• Side-Scrollers
		  o Defender
		  o Prince of Persia, Super Mario Brothers, Sonic
		• Classics
		  o Pacman, Centipede, Breakout
		• Fighter
		  o Mortal Combat, VirtuaFighter

Role-Playing Games (RPGs)	• Gamer directs hero (or group of heros) on series of quests
	• Gameplay resolves building characters
	• Huge world
	• Gradually unfolding story
	• Combat is important element
	• Lots of parallels with traditional role-playing games (D&D)
		• Single Player
		  o Ultima series
		  o Might and Magic series
		  o Final Fantasy series
		  o Fable
		• Multiplayer
		  o Diablo
		  o Dungeon Siege
		  o Neverwinter Nights
		• Massively Multiple Player
		  o MUDs
		  o World of Warcraft
		  o Everquest

Strategy Games	• Players manage a limited set of resources to achieve a predetermined goal
	• Management typical involves decisions on which units to create, where to put them, and what they should do
		• Turn-based
		  o Civilization
		• Real Time Strategy (RTS)
		  o Command & Conquer
		  o StarCraft

God Games (Construction, Simulation, A-Life, World Building)	• Simulation of a complex system, such as a city, household, theme park, ant colony, etc. • No real goal other than to create and destroy • Open-ended with no "correct" way to play • Often no winning condition (just keep playing forever)	• Populous • SimCity • The Sims • Railroad Tycoon • RollerCoaster Tycoon

Adventure Games	• Story-based games (detailed storylines)
	• Usually rely on puzzle solving to move game along
	• Large, complex worlds
	• Traditional turn-based (recently some have classified real-time adventure games as a subgenre of action, as in the "action adventure" genre)
		• Text-based
		   o Zork, Planetfall
		• Graphical
		   o Myst
		   o Bard's Tale, Wizardry
		   o King's Quest, Seventh Guest, Monkey Island

Sports Games	• Usually based on real-life sports game • Accurately reproduces the rules and strategies of the sport • May cover individual match, series, or entire season • Some focus on playing the game others focus on management side (coach or general manager)	• EA Sports Golf • EA Sports Football • EA Sports Hockey • EA Sports Basketball • EA Sports Baseball

Flying/Driving Simulations	• Seek to emulate the real-world
	• Often involve simulation of vehicles
	• Some are very accurate to real-life, requiring long learning time and manual
	• Others are less accurate to real-life, simplified controls, and more forgiving of mistakes, dubbed "arcade sims"
		• Flight
		   o F-15 Strike Eagle
		   o Microsoft Flight Simulator
		• Driving
		   o San Francisco Rush

Casual Games	• Typically an adaptation of non-computer games
	• Players expect game to parallel traditional game
	• Games are typically easy to pick up
	• Interface is typically very simple
		• Board Games
		   o Chess, Go
		• Card Games
		   o Solitaire, Poker
		• Game-show Games
		   o You Don't Know Jack, Who Wants to Be A Millionaire

Puzzle Games	• Purpose is for intellectual challenge of problem solving
	• Puzzles are end in themselves and are not integrated into a storyline
	• Time or time-based score may be added to create additional challenge
		• Mind Games
		   o The Castle of Dr. Brain, The Incredible Machine
		• Action Puzzles
		   o Tetris

Appendix F: Technologies to Build Games

The following are common tools and technologies you can use to build computer-based serious games:

Type	Title	Genre	Graphics	Delivery	Learning Curve	Dev Time	Price
Mod'ing a Game	Quake (www.idsoftware.com)	FPS	3D	Disk	Easy-Medium	Low	$*
	Never Winter Nights (nwn.bioware.com)	RPG	3D	Disk	Easy-Medium	Low	$*
	Civilization 4 (www.firaxis.com)	Strategy	3D	Disk	Easy-Medium	Low	$*
Multimedia Authoring Tools	Web/HTML Editors	Flexible	2D	Web, Mobile	Easy	Low	Free+
	Flash (www.adobe.com)	Flexible	2D	Web, Mobile, Disk	Moderate	Medium	$$
	Director (www.adobe.com)	Flexible	2D, 3D	Web, Disk	Moderate	Medium	$$$
Game Authoring Tools and Middleware	GarageGames (www.garagegames.com)	Flexible	2D, 3D	Disk	Moderate to Expert	Medium	$
	Virtools Dev (www.virtools.com)	Flexible	3D	Web, Disk	Moderate to Expert	Medium	$$$$
	Unity (www.otee.dk)	Flexible	3D	Web, Disk	Moderate to Expert	Medium	$$$
	Wild Tangent (www.wildtangent.com)	Flexible	3D	Web, Disk	Moderate to Expert	Medium	$
	Panda3D (http://www.panda3d.org/)	Flexible	3D	Disk	Moderate to Expert	Medium	Free
	3DState (www.3dstate.com)	Flexible	3D	Disk	Moderate to Expert	Medium	$
	Unreal Engine (www.unrealtechnology.com)	FPS, Flexible	3D	Disk	Moderate to Expert	Medium - Long	$$$$$
	RenderWare (www.renderware.com)	Flexible	3D	Disk	Expert	Medium - Long	$$$$$
Integrated Development Environments	Microsoft Studio .Net Apple Xcode CodeWarrior Java IDE	Flexible	2D, 3D	Disk	Expert	Long	Free - $$

* Sale and Distribution may be restricted or require a very costly licensing fee.
+ Can develop Web/HTML with free tools, though you will often purchase web authoring tools to speed development and reduce the learning curve.

NOTE: Game console development, such as Xbox, Playstation, etc… requires you to obtain a proprietary development kit from the console manufacturer (Microsoft, Sony, Nintendo). Prices often vary based on who you are and what you are developing. However, in most cases, the devkits are quite pricey (>$10K). Further, what games get released for the console systems is completely controlled by the respective console manufacturer. That is, you must work closely with the console developer to bring your product to market. Therefore, there is no such thing as an "independent" or "hobbyist" console title market. There are very few serious game titles for console systems with most being either kid edutainment titles or military-themed titles, such a Full Spectrum Warrior.