*Game Development Guidelines - Deliverables*

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### ***1 > Incubation Stage (deciding whether to develop a game)***

DELIVERABLE: Brainstorming culminates in a 2 page “**Core Game Design Document**” for each proposed game or upgrade (1 page for the game idea and 1 page for research), articulating the::

* Core Game Idea
  + Identifies core user choices and interactions and how the game responds.
  + Identifies how choices/interactions promote or test specific training objectives.
  + Describes how play evolves as users advance or struggle.
* Game Design References
  + List of existing games with mechanics or aesthetics that provide inspiration.
* Questions
  + Concerns warranting testing or further consideration (for example this might identify issues translating an idea into other languages or across platforms).
* Research Basis (Science)
  + Summarizes research findings related to the training objectives and informing or constraining the design of interactions and progression.

QUESTIONS DELIVERABLE MUST ANSWER:

* Who are we targeting? And how will this appeal to the target audience?
  + Average adult (5-7th grade math level)
  + Common core - grade 7, understanding probabilities of events, finding the probability of events. Finding probability of compound events (heads 2x in a row) probably will have to scaffold
  + 9th grade - independent and conditional probability, knowing the addition and multiplication rule of probability ( could use some scaffolding )
* Where would this game fit in our games catalog -- is it a compliment? A replacement?
  + Math suite, 1 of 3 math games going out, Applied skills, compliments
* What is the core game mechanic?
  + Requires users to understand an analyze an initial prompt
  + Placing items in a space to create a probability outcome that was requested
* What are the training objectives and why do we believe this game promotes them?
  + Improving users understanding and ability to use basic probability techniques - promotes them bc it allows them a chance to practice them in a concrete way and better understand the concepts (Creating level of bloom's taxonomy, highest level, using info to create somthing new) In this game you design and build and plan actions
* How will this specific training help the targeted users in the real world?
  + Weighing possibilities, risk/reward decisions, general decision making

SIGNOFF: Science, PM

### ***2 > Prototyping Stage (rapid proof-of-concept testing)***

A small team (usually engineer and an artist or designer) brainstorms and quickly builds and iterates on the proposed core game mechanics. A science team member also contributes, digesting research and facilitating continued consideration of training objectives.

By the end of prototyping the game’s core mechanics, input methods, and feedback mechanisms are tested, refined and initial directions for artistic theming identified (but not necessarily rendered).

USER FEEDBACK: User-testing begins in this stage, at least internally (with staff or invited Lumos users), and will continue to be used to test and refine the design until release. Users may be engaged in many ways, including through UserTesting.com, TaskRabbit, CraigsList, etc. In this stage user testing focuses on gauging player interest, understanding and overall viability.

DELIVERABLES:

* **Prototype** – developed with the minimum code and art required to illustrate the core mechanics, with a focus on quick iteration.
* **Expanded Game Design Doc** – the core game design doc. updated with:
  + **User Walk-Through (1 short paragraph/diagram each)**
    - Describes a new user’s experience or play at a relatively easy level
    - Describes a user’s experience playing at a relatively high level
  + **Game Design**
    - Describes game mechanics, progression and adaptivity
    - Introduction of loose “Pie-in-the-sky” ideas for how the game could be improved beyond the core, if production costs were no issue.

QUESTIONS DELIVERABLE MUST ANSWER:

* Can our target audience engage with the game (is it intuitive and accessible)?
  + Yes, creation is very high on engagement. Playtests were found really interactin and engaging. \*Wording and dialogue are focal points and need to be tuned carefully
* How will the game help a user figure out how to complete the task?
* Do interactions promote training (eg. are interactions aligned with objectives)?
  + Yes, creating the probability in a practical real sense after understanding the mathematical implications of the situation
* Will the target audience want to engage with the game?
  + Playtests were very positive, creation is a highly engaging mechanic. Placing items creates autonomy users found rewarding
* How do we envision the target audience staying engaged over time?
  + Increasing difficulty, introducing new objects (unlocking with gameplay), \*language not being repetetive but staying clear
* How does play evolve? What are the game’s extremes (i.e. easiest and hardest) like?
  + Easist - setting probability to requested amount (75%)
  + Relative probability - set it so that the probability is 2x that of blue
  + Addition rule - OR keyword means ad it together
  + Multiplication rule - IN A ROW keyboard means mult
  + Independent conditional probabilit - items have multiple characteristics

CRITERIA TO ADVANCE:

* Consensus that the core mechanics feel engaging and can offer continued challenge.
* Core mechanics adhere to sci principles and promise effective training.
* Hypotheses and research convincingly explain how and why the training will be effective.
* Consensus around how task dimensions will scale for difficulty, and that they’ll scale high enough for the best players and be easy enough for new/elderly ones to learn.
* Consensus about how or if the game will work cross-platform and worldwide.

SIGNOFF: Science, Game Systems, PM, Engineering, UX

### ***3a > Pre-Production Stage 1/2 (completing core game design)***

Pre-production begins with a continuation of game design, closely followed by the start of visual design. Game design focuses on detailing core mechanics, progression and feedback loops. This will be expanded upon in production. Meanwhile, visual design begins by establishing a theme and planning ­the layout of every screen, touch point and feedback mechanism (See Pre-Production 2/2). Both efforts are to be completed and approved before production begins.

USER TESTING: Used to test and continue refining prototype mechanics and feedback loops.

GAMES DELIVERABLE:

* **Game Design Document** – the Core Game Design Documentation is updated with:
  + Game Flow - Mapping out screens and play flow, with user interactions identified.
  + Meta Data List – initial list of data likely needed to assess user performance.
  + Scoring and Progression Algorithms – initial pass, to be optimized later.
  + Level Configuration or plan for advanced play mechanics - if applicable.
  + Debug Functionality (QA) - list of debugger features needed for QA testing

QUESTIONS DELIVERABLE MUST ANSWER: (in addition to game specific requirements)

* Is the user’s input platform-specific?
  + Know limitations of screen size MOBILE for content amount
  + Playtest people's understanding of dragging vs click vs other
* Is the user’s input scalable/skinnable at all difficulty levels?
  + Non-issue: still doing the same interatction even at high levels
* Are the game’s feedback loops complete/comprehensive, concise and clear?
  + What happens when they get it wrong. Simple nope, right answer (difficult bc multiple correct answers)\*\*\*\*
* Are the feedback mechanisms in those loops intuitive? Do they convey all info/imagery needed to promote an understanding and ease of use (minimizing text)?
* \*\* see above open question
* Is the game’s content dynamically created or based on a repeatable mechanic, as opposed to having fixed content or levels?
  + Question of how many numbers and grid size allows
* How will the game’s difficulty and/or mechanics adapt as players succeed and progress?
  + Increase in Shelby’s ranked list of probability techniques and mechanics
  + More complex probability fractions
* What parameters will be exposed to configure the game’s difficulty per-level?
  + Shelby’s ranked list of techniques, complexity of fractions, locked spaces, complexity of attributes being weighed, number of options of items to place
* How will we ensure there will be enough content to satisfy players after hundreds or thousands of gameplays?
  + Are we able to dynamically create enough elvels per bucket that are precieved different and interesting by users
* How will the game measure and score a player’s performance in a positively reinforcing way (w/o any possibility to cheat or avoid training and still get good scores)?
  + wrong/right, time?
* If scoring is dependent on timing, does this conflict with the way we expect the target audience to engage with the game? If so what other solutions are there.
  + Time may take away form the creativity and autonomy and force people to seek the most efficient answer rather than engage with all the options presented to them
* How granularly can this game be scored? Will most users always have an opportunity to continue improving little-by-little?
  + \*sort of open still, difficulty levels granular enough (combo difficulties and see how difficult they are). Should see a difference in score between games played on different levels
* Does this design have low variance/luck factors in scoring?
  + Low luck, gets harder to be lucky with higher levels. Varience could be different depending on if they understand/dont understand certain probability techniques and get them more/less than average.
* How and when will new concepts be introduced?
  + \*\*\*BIG OPEN QUESTION
* Are there any additional Science team concerns/requirements to keep in mind as we move forward with full production of the game?
  + QUESTION: should grid boxes count for differnt sizes and you have limited resources to use. EX: you need a 50% chance of green and only have 1 green flower so have to put that in the big box
  + Very interested in how to teach new concepts, what does a session look like?
* How will we architect the game’s source code and files to allow for full production to run efficiently, allowing for possible future changes/iteration, and making it easy for cross-game consistency changes to be integrated painlessly?
  + \*\* need to know more about the full game design before considering eng
* Has QA reviewed the game design and provided a list of required debug functionality?
  + \*\*\* no dont have a game design fully done yet

### ***3b > Pre-Production 2/2 (planning look and feel)***

Once a game’s screens, mechanics, user interactions and progression are anticipated, it is time to plan the look and feel, including the art style, implied narrative, usability and how mechanics will be introduced and feedback communicated. Reviews of the proposed flow and usability should include UX, Science and QA to familiarize them with the vision and identify concerns.

USER TESTING: Used to gauge interest and usability related to art in addition to mechanics.

ART DELIVERABLES (LISTED IN ORDER OF COMPLETION)

* **Art Theme Reference Board** (Art) – a quick compilation of found art providing inspiration and ideas for possible visual themes prior to creating mock-ups.
* **3+ Theme Mock-Ups** – quick sketches of how the game might look in different themes.
* **Screen Explorations** – continued sketching or lo-res exploration of:
  + Game screens – showing how selected theme will look on each screen/pop-up.
  + Visual presentation of game mechanics – planning their visualization/animation.
  + Visual presentation of interaction feedback – planning visualization/animation.

QUESTIONS DELIVERABLE MUST ANSWER:

* What theme will we apply to this set of game mechanics?
* What does that theme look like at the major touch points of a game (e.g.: Splash screen, level select screen, low level, high level)?
* Are there any special case animations or design elements that need to be proven out for this theme concept to work (e.g.: The masking of animals in River Ranger or the 3D trains in ToT)?
* How will we teach the game’s mechanics to players? What actions will we teach to the player, and in what order?
* How will we ensure the game provides clear, timely, and positively reinforcing feedback to your interactions w/ the game’s training mechanics?

CRITERIA TO ADVANCE: To progress the team and stakeholders need a shared vision for what the finished game will be. Consensus is needed on how the game’s difficulty will adapt, in what ways players’ cognitive ability will be measured and performance scored, and how we’ll ensure the game will continue to offer effective, engaging training even after hundreds of play sessions. Essentially the full game design should be complete, planned, well-scoped and ready for scheduled production, without large outstanding design or production questions remaining.

SIGNOFF: Science, Game Systems, Engineering, PM, UX, QA

### ***4 > Production***

In production a team builds the game for the intended platform(s), either implementing for one platform at a time, or multiple simultaneously. The Science team now has checks-in at least every 1-2 weeks to ensure on-track compliance with the agreed upon requirements. Similarly, the art team starts weekly reviews of progress, style and the scalability of art across device sizes. UX and QA, if not already up-to-date, will ramp up on science requirements and plans for the game’s flow, mechanics and feedback systems. This may include an evaluation of the game to determine likely usability issues related to game flow, messaging and/or user interaction.

DELIVERABLE:

* User tested, UX and Science approved build for each platform with no P1-P2 Issues.

QUESTIONS:

* Does the design require game state tracked across game sessions?
* What’s the length of a single play through of the game?
* How much can we tune now and through playtests vs. collecting data in beta?

CRITERIA TO ADVANCE:

* QA testing confirms all tutorials, core game scenarios and interactions work as expected.
* Fair, balanced scoring rewards performance and difficulty in a range up to our ~65k limit.
* Production quality art assets have replaced all developer art, even if changes expected.
* All sound effects (SFX) are hooked up with at least placeholder sounds

SIGNOFF: Science, PM, Game Systems, Engineering, Art, UX, QA

### ***5 > QA Testing and Polish***

After production is complete, new feature development freezes, audio/visual (A/V) assets are polished and full QA testing begins. Polish includes optimizing animations, transitions, SFX and minor configuration adjustments to levels and mechanics. QA testing is “exploratory” and “destructive”, now thoroughly testing the full range of possible user behaviors on different platform configurations and reporting anything unexpected. This is followed by iterations of bug fixing and retesting until all high priority issues are resolved and A/V assets finalized.

DELIVERABLE:

* Updated Games Wiki - with complete accounting of the learning/training objective, research basis, game design, scoring, progression, meta-data and supporting screen shots, enough to provide customer service a way to answer all players’ questions.

CRITERIA TO ADVANCE:

* QA confirms all tutorials, game scenarios, interactions and app integration works properly, handling all forms of input, destructive and otherwise. QA signs off on this.
* Art/SFX are final and approved. Art signs off on this.
* In-person/online user testing finds the tutorial and play intuitive, engaging and issue-free.
* Developers verify play metadata is complete and persisting. Science signs off on this.

SIGNOFF: Science, PM, Game Systems, Engineering, Art, UX, QA

### ***6 > Beta (On Single Platform, Usually Web only)***

In Beta we collect data and feedback from subscribers. Subscribers represent a wider range of demographics, platforms and device configurations than tested earlier. Analysis then assesses whether or not the game promises to be a valuable addition to our offerings, varies in its appeal between platforms or demographic groups, and if it requires fundamental redesign, fixes or reconsideration. Additional hypotheses may be tested via split-tests and analysis of data/feedback to answer pending questions about design, user experience, efficacy of marketing and/or business value.

USER FEEDBACK:

* User feedback is collected via platform specific touch points (egs., web beta’s feedback tab or surveys triggered in mobile games).

CRITERIA TO ADVANCE (ONCE SUFFICIENT DATA COLLECTED):

* No major issues discovered.
* Functionality is consistent across OS/browser/platform configurations.
* Game systems like scoring, leveling and adaptivity perform as expected.
* Engagement metrics (including retention) exceed benchmarked requirements.
* Games not needed to expand Lumosity’s coverage must exceed engagement minimums.
* [Redesign] Revisions demonstrate greater engagement than past versions.
* Qualitative feedback finds the game to be intuitive, appealing (drives conversion) and engaging (drives use and retention) across different types of users and platforms.

SIGNOFF: Science, PM, Game Systems, Engineering, Art, QA

### ***v7a > Live - Release***

Celebrate! After launch, once sufficient gameplay data has been collected, the game will be fully integrated into the Lumosity platform, translating in-game scoring to normalized LPI scores.

DELIVERABLES:

* Game is fully integrated into the training session.
* [LPI only] LPI Table – generated from user gameplay data, tested and launched.
* [Redesign only] Older version of the game is deprecated within 3 months.

SIGNOFF: Science, PM, Game Systems, QA

### ***7b > Live - Maintenance/Sustaining***

We continue to collect feedback and can revisit game production or bug fixes and testing as needed. On-going user feedback and data is collected from:

* Customer Service tickets and reports
* Jira bugs (logged by CS & others)
* Continued internal play of the game
* Periodic review of gameplay data & metadata

SIGNOFF: Science, PM, Game Systems, QA

### ***Porting and Adaptation***

Sometimes, existing games are ported to new platforms or inspire the creation of new adaptations that might replace or exist alongside the original, repeating this overall process in either case.