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| Nathan Chapman |
| SDD Major Project |
| Part I: The Defining, Planning & Designing of S-kuru |

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# Defining the Problem and Its Solution

## Initial Ideas

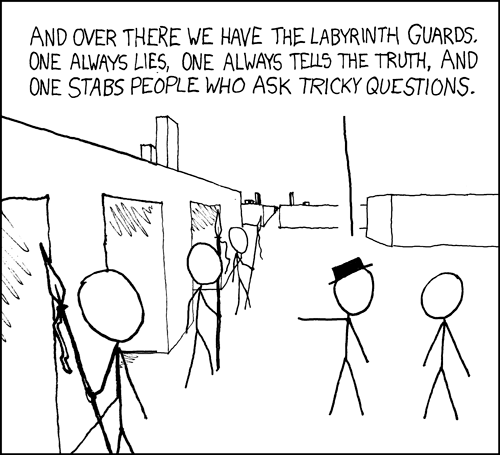
In starting this project I knew fairly early on the genre (or type) of game that I wanted to create: a puzzle game. This would satisfy the 'educational' criteria for the solution as a game requiring logic and specific thinking processes would be stimulating for all ages, including our target market, which is High School Students.

Figure 1: "Labyrinth Puzzle", from XKCD (http://xkcd.com/246/)

In the discussion amongst the class, we went through a variety of games that we could make. Many of these suggestions, however, did not appeal to me as they were merely remakes of existing games. Some of those mentioned were Minesweeper, a game bundled with Windows since 1989[[1]](#footnote-1); Tic-Tac-Toe, a well-known game played on paper and computers, and featured in the film War Games; or Solitaire, another game bundled with Windows.

What I was looking for was an original concept that would challenge the user into actually thinking about their next move. S-kuru was in a few parts inspired by World of Goo, a puzzle game concerning the building of towers using goo balls that stick together. Some of the aspects I liked about this game were the lack of a time limit. Many puzzle games are only difficult because they feature by an overly restrictive time limit which creates pressure on the user. This pressure makes the game in question far less enjoyable than one that is difficult purely because of its puzzles or an ungainly *core mechanic*.

Throughout this report I am likely to refer to the term *core mechanic* so I will define it now. A game's *core mechanic* is its major premise and way of working. For example, Minesweeper's *core mechanic* is the number in each cell that reveals the number of surrounding mines. The term comes from Dungeons & Dragons, where the *core mechanic* simply refers to its use of a d20 (a twenty-sided die) to determine success or failure of an action. Because of the importance of the *core mechanic* to any game, but particularly a puzzle game, I spent some time brainstorming it and getting it just right. Actually brainstorming on paper, here is the *core mechanic* that I finally came up with:

The aim of Sākuru is to get every ball on the screen to its exit. There are multiple coloured balls and exits; blue ball will only use the blue exit. Circles placed on the screen by the user can be travelled through by balls, and thereby get to their designated exit.

This is Sākuru's *core mechanic*, and I feel that it is simple enough to grasp fully after a single tutorial level or README file, yet it is complex enough to provide flexibility for the creation of difficult levels. The introduction of different coloured balls and circles was not made until fairly late in the process, but it adds much to the game that will prevent any repetition in levels. Another reason that this game appeals to me is because I would play this myself. The concept intrigues me and the name Sākuru would pique my curiosity (by the way, Sākuru is Japanese for "Circles". Using a Japanese word for the name of a project is commonplace within Ruby programming circles; however I thought it could be spread to Python without much trouble from the community).

## Investigate

### Needs of Users

I conducted a survey amongst both specifically chosen participants that were spread across several age groups (respondents were grouped into age brackets between 12 and 20 years old) and an open invitation to participate. Differentiating between these two sets of data, it becomes evident the differing requirements of a game for both High School students and adults. The survey received a total of 18 respondents over a three-week period.

For a copy of the survey questions and full results without interpretation, see [Appendix I].

The survey was in three sections as follows:

#### General Gaming Statistics

As the project specifications indicated that the software solution had to be a game, it was logical for the survey to ask how the potential users play games, and for how many hours each week. This would help to determine how the game should progress and the difficulty curve.

Question 1, which asked about the gaming habits of respondents, gave a clear answer to this (See Figure 2). From the results 71% of people play less than 6 hours per week (which I would classify as a 'casual' gamer), so the game has to have easy save/load points, to enable users to put down the game and come back at a later date/time.

Figure 2: Hours spent gaming per week

The next two questions were to gauge the possible audience for Sākuru: the first was to find popularity for various 'genres' of gaming, and the second asked specifically regarding puzzle games.

Diving the gaming world into genres is a difficult task, as it poses problems similar to literature, where the previously separate genres of Sci-Fi and Fantasy have merged now to such a degree[[2]](#footnote-2) where they are indistinguishable and have warranted the creation of an ‘umbrella genre’: Speculative Fiction[[3]](#footnote-3). In the same way, game genres vary; however for this survey I labelled games according to their gameplay style as opposed to their content. In this way, I came up with nine major categories that I felt were sufficient to categorise most games. This question was structured as a ‘matrix’, meaning that each option could be given a rating out of 5 according to how much the respondent plays or enjoys that genre of games.

From this matrix I have assigned each possible answer from 5 (“I live for these games “) to 1 (“I don’t play this type of game”) a score between 4 and 0. This creates their rankings as presented in the graph below. From the results (See Figure 3) it becomes plain that although the long-form RPG game is the most popular game (although only by two points, scoring 23 and beating Puzzle and FPS on 21). That Puzzle games ranked the second highest in this question is promising as it shows that the target audience for my Major Project will actually be interested in playing the game.

Figure 3: Ranked scores of popular game genres

The last question in this section asked specifically whether they liked and played puzzle games. This question also allowed for a long-response answer to justify or explain their response.

From the closed-answer part of this question (See Figure 4) it is very obvious that respondents enjoy this form of gameplay. The individual responses that accompany this question also tell a similar tale. Almost all of the open responses were positive along the lines of this one:

I like that feeling of accomplishment you get from solving a well-made puzzle. That and I like seeing the clever things people can do based on what are fairly simple mechanics. For example Braid would take something simple like mapping the passage of time to the player's position on the horizontal plane (you walk forwards, time goes forwards, you go backwards and time, well you get the point) and build all these elaborate puzzles around it that you really had to think to solve. So keep a minimal amount of mechanics and do something cool with them.

Figure 4: Do you play or enjoy puzzle games?

Most of the responses, in fact, all commented on how puzzle games are played differently to any other genre. For example, one respondent described first-person shooters as “HEY LOOK I SHOOT YOU NOW BANG BANG BANG”. The only negative open response that I received was this:

requires too much thought...

This response was in direct contrast to the rest of the open answers. With both questions 2 and 3 showing such a positive reaction and appreciation of puzzle games, it was a logical step to further plan and to finally begin creating S-kuru. There is also emerging evidence amongst the scientific community that a well-developed puzzle game can help children’s (and teenagers’) brain development, including deep analytical problem-solving skills[[4]](#footnote-4).

#### Aspects of Effective Game Design

This section had several questions that asked the impressions potential users got from some Photoshop mockups of the user interface during the game. These questions were just for my reference, I didn’t plan to get any statistical data from them. Question 4, however, was important in working out what appealed most to users when playing a game.

Another matrix-style question, the ranked scores are as in Figure 5. From this we can see that the most important thing to consider when creating a game (and specifically a puzzle game) is the Gameplay (or ‘*core mechanic*’, as I’ve called it above). The visual style of the game came as a close second concern for users, and I have spent much time developing a coherent and intuitive visual style for the game that helps to convey the purpose of each element whilst retaining a comprehensible feel.

Figure 5: Importance of aspects of a game

This trend that is evident from this survey corresponds to real life and large-scale, triple-A titles also. Editor in Chief of Edge Magazine, Tony Mott had this to say about game design, which could also be interpreted as being true for any software solution[[5]](#footnote-5):

Ocarina of Time is nearly ten years old, but its position at the top slot in Edge’s 100 Best Videogames shows that great game design does not age. In visual terms, it obviously cannot compete with today’s Xbox 360 and PS3 productions, but, as with many classics, its appeal is about so much more than its appearance.

### Objectives of the Software Solution

From the results given during the survey I am able to formulate some measureable objectives that I was S-kuru to achieve. I do not feel that these are easily obtainable (otherwise all software solutions would implement them), however it is not outside my reach by any means.

1. **Simplicity of Use** – the game must flow and play smoothly, and the controls must be intuitive. Not only in which button does what, but in (for example) how fast a circle grows as the user holds their mouse down. More measureable aspects of this include:
   1. Simple and feedback about progress of a level. Clear feedback about progress through the game.
   2. Anything that is ‘clickable’ throughout the game should be labeled or designed in such a way as to make it visually so.
2. **Complexity of Thought** – the game should provoke thought within the program’s use and force the user to consider each move and its implications within the game.
   1. Puzzles (i.e. individual levels) should provide a differing experience as they progress. They should not be repetitive.
   2. There should be multiple solutions to puzzles, even if some of these were not originally considered by the level designer.
3. **Consistency whilst constantly evolving** – the game should shift and change constantly so as to be become stagnant and dull. Throughout this change, however, the gameplay *core mechanic* should remain the same, as will level design. This allows for a consistent user experience throughout a varying game.

## Proposed Solutions

There are several possible alternatives that would still fulfill the objectives that are outlined above, as well as address the opinions of the potential users in the survey.

Any computerized remake of an existing puzzle game, such as Sudoku, Scrabble or a Cross-Word would achieve both of these objectives. The appreciation of puzzle games that is evident in the survey, however a game created from the single most popular genre, a Role-Playing Game, would present the most appropriate alternative solution.

To still fulfill many of the objectives above, the game would have to be structured in a similar way to Legend of Zelda: Ocarina of Time. In this game, a mix of puzzle and adventure all tied together with a compelling and strong storyline create a fantastic game that is among the best of all time.[[6]](#footnote-6) To create a game on such a scale as Ocarina of Time would be a grand undertaking; however it would accomplish everything above, in addition to satisfying the desires of the potential users from the survey.

## Feasibility Study

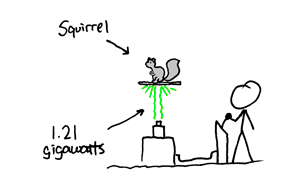
To help evaluate these two proposed solutions, each solution will be assigned a score out of 10 for each dot point in addition to the written appraisal.

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| Point to Address | S-kuru | | RPG | |
| Is the solution technically feasible? | Once the physics ‘engine’ is coded and completed, the rest of the solution is easily put in place. Level design will depend more upon skill and ideas of the creator, rather than the program’s technical aspects. | 8.5 | Featuring (by definition) a large variety of possible interactions with the environment, the sheer amount of events to cater for would make the task a major undertaking. An engaging story, similar to the level design in S-kuru would depend on the skill of the writer. | 5 |
| Is it operationally feasible? | As a 2D puzzle game, the hardware requirements for the game are little. Preliminary tests with unoptimised code have showed that the physics engine can run at 60fps with 3 circles and 25 balls without lag – far outside the operational requirements within the game. | 9.5 | Depending on whether the game would be 2D or 3D based, the hardware requirements would vary. Having said this, even low-end modern computers can run semi-complex 3D games (as most new computers come with on-board graphics), so this would be of little issue. | 9 |
| Is the project financially feasible? | For a small development studio, a game on this scale could be pushed out within a few weeks, and depending on the publicity for the game would make some profit. In this way, the game could be financially feasible. For a student to develop, the program will be an exhaustive process over several months, as the engine and level framework that the puzzles work from would take time to develop. | 6 | This game, because of the epic scale, would require a large development studio (which is expensive), though it would be practically guaranteed of commercial success. | 8 |
| Can it be completed in the required time frame? | Development will take several months, however once the physics engine and the game framework is created, levels can be created both by the Programmers and by dedicated level designers, shortening development time. | 8 | Due to the nature of the Structured Development Cycle that is required when working with a large team of developers, the time frame for this solution would be immense[[7]](#footnote-7). | 4 |
| Are there any social and ethical issues to address? | Possible issues would include:   * Cheating will be easy, as levels are stored as plain-text files * Viruses could use vulnerabilities in programming language (Python) or used modules (PyGame, YAML) to infiltrate system as these are open-source * Incorrect use of licenses for these software packages | 6.5 | Possible issues would include:   * Pricing of such a game * Gender bias * License Agreements * Workplace environment for development team (ergonomics) * Piracy * Virus distribution | 5 |

## Recommendation

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| Solution | Final Score |
| S-kuru | 38.5 |
| RPG | 31 |

Having considered the two possible solutions using the table above, it is clear which would be a more feasible and effective solution to the problem.

Out of a total possible score of 50, S-kuru scored higher in every category bar financial feasibility. It scored lower in this section because the produced product would not be sold, but distributed free. Having no monetary return (as opposed to a large game like the alternative RPG), it would prove to be less financially feasible for the amount of development time that the game will take.

Even then, the RPG’s higher score for that category assumes that it is being sold and will make a profit. In every other category, the RPG scores lower due to its inherit complexity that is required to make the game engaging.

S-kuru is a far simpler, more easily accomplished solution that also fulfills the objectives from above whilst at the same time looking sophisticated and being a marketable, a cohesive solution to the problem.

Figure : This is not a good recommendation. From XKCD (http://blog.xkcd.com/2008/02/15/the-laser-elevator/)

# Planning and Design

## Time Plan

## Interface Design

From the very beginning of active development, I have worked from an interface mockup (See Figure 7) of what I wanted to achieve as the final product that would become S-kuru. Many of the aspects of this original design constitute good design techniques, although some have been purposely neglected for effect.

E:\S-kuru\01_Design\Sprites\Blue-Ball.jpgE:\S-kuru\01_Design\Sprites\Grey-Ball.jpgOne aspect that has been purposefully neglected was colour: the game is wholly black and white. This is to add a ‘new’ type of puzzle to the game in later stages, where the balls become coloured, and will only travel through circles that are made up of their colour (See Figure 8). This adds a new puzzle element to the game, making it a more complex and engaging experience for the user. Although the low-contrast design of the game may have some effect on colourblind or vision-impaired users, this could easily be rectified by implementing a high-contrast mode that gives the game a new colour scheme.

Figure 8: Differing types of balls

Figure 7: Original Mockup of S-kuru Interface

1. http://www.gamesetwatch.com/2007/02/column\_beyond\_tetris\_minesweep.php [↑](#footnote-ref-1)
2. http://www.depauw.edu/sfs/review\_essays/elkins22.htm [↑](#footnote-ref-2)
3. http://www.writepop.com/writing/naming-a-genre [↑](#footnote-ref-3)
4. http://abcnews.go.com/WNT/Health/story?id=814080 [↑](#footnote-ref-4)
5. http://www.wired.com/gamelife/2007/07/edge-names-ocar/ [↑](#footnote-ref-5)
6. As said by Rhys Powell; also http://www.next-gen.biz/features/the-100-best-games-to-play-today [↑](#footnote-ref-6)
7. The game that this solution got its inspiration from, The Legend of Zelda: Ocarina of Time, spend over 3 years in active development before the Nintendo Entertainment Analysis and Development deemed it ready for release. [↑](#footnote-ref-7)