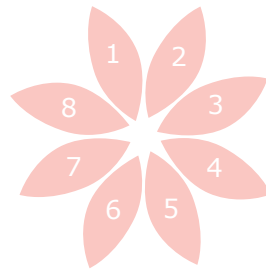


'Water Crisis in Rafflesia'

An game based on the Subprime Crisis



by Shipra Gupta

Studio Faculty: Marko Tanderfelt

Writing Faculty: Loretta Wolozin

Advisor: Catherine Garnier

A thesis submitted to the faculty of
Parsons The New School for Design,
in partial fulfillment of the requirements
for the degree of Master of Fine Arts
in Design and Technology, 2009.

Copyright 2009 Shipra Gupta
All Rights Reserved

ACKNOWLEDGEMENTS

I am grateful to the following individuals for their guidance and inspiration.

Marko Tandefelt
Loretta Wolozin
Catherine Garnier

Katie Salen
Nick Fortugno
Ritu Kothari
Sonam Saxena
Joe Mauriello
Rishi Sharma

ABSTRACT

'Water Crisis in Rafflesia' is a flash based, online, single-player game that contextualizes the U.S. Subprime (Credit) Crisis of 2007 for everyday people, who are not well versed with the economic terms and systems that are core to the understanding of the event and its aftermath.

Set in the popular narrative – Jack and the Beanstalk, the player can view the crisis from the eyes of Jack the borrower, Giant the lender, or as Fairy Greenspan the government character. The thesis project deliverable implements the game from the Giant's perspective.

Once familiar with the scenarios, the player will be able to draw parallels in any further commentary on the topic.

CONTENTS

Abstract	i	
Table of Contents	ii	
List of Illustrations	iii	
CHAPTER 1 - INTRODUCTION		
1.1 Concept Statement	1	
1.2 Context of Use	4	
1.3 Impetus	5	
1.4 Design Questions	6	
CHAPTER 2 - DOMAINS AND PRECEDENTS		
2.1 Subprime Crisis & Financial Markets	8	
2.2 Financial Literacy	12	
2.3 Game based Pedagogy	14	
CHAPTER 3 - METHODOLOGY		
3.1 Deciding the Form	16	
3.2 Evolution of the Game	17	
3.3 Final Iteration of the Game	20	
3.4 Implementation	25	
3.5 User Testing	27	
CHAPTER 4 - EVALUATION		
4.1 Successes	28	
4.2 Design Challenges	29	
4.3 Implementation Challenges	31	
4.4 Plan for the Future	32	
Appendix A - Subprime Crisis		v
Appendix B - The Water Cycle		xviii
Appendix C - Info-Architecture Diagram		xix
Bibliography	xxi	

LIST OF ILLUSTRATIONS

- Fig01. The three game perspectives (page 01)
- Fig02. Concept Drawing from the Giant's perspective (page 02)
- Fig03. Bank Run (page 02)
- Fig04. Concept Drawing from the Jack's perspective (page 03)
- Fig05. User Profiles (page 04)
- Fig06. Cover of National Geographic Magazine (page 05)
- Fig07. Foreclosed Home from the Subprime Crisis (page 05)
- Fig08. Credit Crunch - board game from the Economist (page 08)
- Fig09. Screenshots of video - Crisis of Credit Visualized (page 09)
- Fig10. Marketplace Whiteboard series (page 09)
- Fig11. What's a CDO - interactive application screenshot (page 10)
- Fig12. Visualizing Economics blog (page 11)
- Fig13. Poster from 'The Debt Trap', NYTimes (page 11)
- Fig14. Screenshots of Fed 101 (page 13)
- Fig15. IOUSA Movie poster (page 13)
- Fig16. Screenshot from 'The Story of Stuff' video (page 14)
- Fig17. Games and Learning design heuristics (page 15)
- Fig18. Board from 'The Landlord's Game' (page 15)
- Fig19. Detail from the 'Redistricting Game' (page 13)
- Fig20. Early concept drawings (page 16)
- Fig21. First iteration of the game (page 18)
- Fig22. Second iteration of the game (page 19)
- Fig23. Components of the second iteration (page 19)
- Fig24. The Water Cycle (page 20)
- Fig25. Screenshots from the final iteration (page 23)
- Fig26. Component - clouds (page 24)
- Fig27. Component - jack field (page 24)
- Fig28. Component - loan flowers (page 24)
- Fig29. Component - tranche flowers (page 25)
- Fig30. Component - cloud condenser (page 25)
- Fig31. Component - power card/ golden harp (page 25)
- Fig32. Component - descriptive text (page 25)
- Fig33. IA Diagram detail (page 26)
- Fig34. Screenshot of last phase of the final iteration (page 31)

- FigA.1. Jack's Icon (page v)
- FigA.2. Schematic of the Home Loan Industry (page vi)
- FigA.3. Disparities in Subprime Mortgages (page viii)
- FigA.4. Giant's Icon (page ix)
- FigA.5. Schematic of the Home Loan Finance Market (page ix)
- FigA.6. Diagram of Tranches of a CDO (page xii)
- FigA.7. Screenshot from 'Whats a CDO ?' (page xiii)
- FigA.8. Fairy's Icon (page xv)
- FigA.9. Prime and Fed Funds Rate (page xvi)

CHAPTER 1 - INTRODUCTION



Fig1: The player can role-play from three perspectives of the Home Loan Financial System - Jack the borrower, Giant the lender and the Fairy the government character. The flower in the center represents a mortgage loan, the driving component of the Home Loan Financial Market.

1.1. Concept Statement

1.1.1. The Water Cycle

1.1.2. Giant's Perspective

1.1.3. Jack's Perspective

1.1.4. Fairy's Perspective

*Water Crisis in Rafflesia*¹ is a flash based, online, single-player game that contextualizes the *U.S. Subprime (Credit) Crisis of 2007*² for everyday people who are not well versed in the economic terms and systems that are core to the understanding of the event and its aftermath.

1.1.1. The Water Cycle³

The game adopts metaphors from the popular fairy tale, Jack and the Beanstalk and is set in the land of Rafflesia . It approaches the event from three crucial perspectives: (i)'Jack' is the borrower of the mortgage loan; (ii) the 'Giant' is the banker character who lends to Jack; and (iii) Fairy Greenspan, who mirrors the government character and takes her name from Alan Greenspan, the chairman of the U.S. Federal Reserve (1987-2006), whose policies have had an effect on the playing out of the crisis. Together the three contribute to the 'Water Cycle of Rafflesia' .

1.1.2. Giant's Perspective

For the thesis project, I am building out the game-play from the Giant's perspective. This perspective focuses on the lending and trading practices of bankers and Wall Street investors that aggravated the credit crisis. The crisis could've been contained, had special purpose financial products been responsibly traded. The game illustrates how those products increased the perception of low risk even with Subprime properties and magnified the monetary damage eventually caused.

¹ *Rafflesia is the land of giants. It's also the largest flower on Earth.*

² *See Appendix A*

³ *See Appendix B*

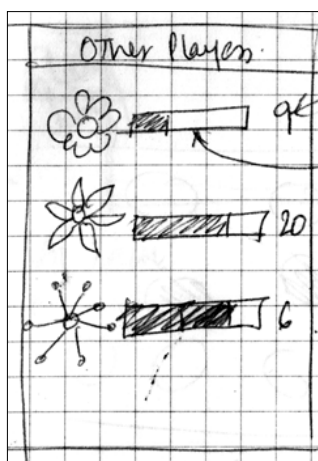
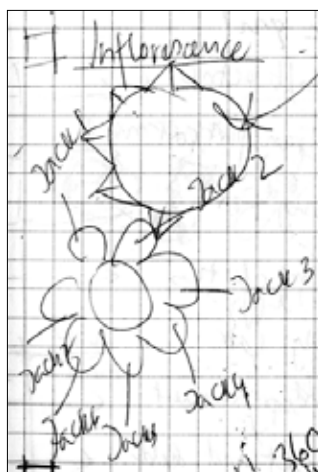


Fig2: Concept drawings from the Giant's perspective. See Appendix B.



Fig3: Bank Run. Bank run at the American Union Bank, June 1931 (above). Bank run at Indymac in July 2008 (below).

The goal of the above game is to become as wealthy as possible with the resource of the land, which in Rafflesia, as the story informs its players, is water. The Giant (player) is a lender who loans water (resource) and beans (mortgage) to various kinds of borrowers (Jacks). In return he receives flowers (principal and interest), which he repackages (financial products) and trades with the Greater Giants (investors). To safeguard those products or make money from them, the player will need the purchase of a special kind of insurance called a Credit Default Swap (its a kind of *derivates*⁴ that *Warren Buffet*⁵ calls *financial weapons of mass destruction*⁶).

How wisely the player determines which Jacks he should give the loan to, how he should repackage the flower and whether or not he should assign them an insurance before selling them to the Greater Giants, will determine success in the game, which is, making a net profit on his water supply.

The game also hints at negligence with loan underwriting practices and the unscrupulous dealings made with the government to ease banking regulations that were laid out during the bank of the *Great Depression*⁷. This feature is manifested in the game's 'Power Club' where a player can choose to change certain rules of the game to his favor. For example, if originally the player was playing with the initial water provided to him by the game and subsequent water generated by him in the game, after invoking a power card he would also be able to use water from Jack's savings. The game gives rationale to this by providing the player links on the *Glass-Steagall Act of 1933*⁸ and the *Graham-Leach-Bliley Act of 1999*⁹. The first prevented him to use Jack's personal savings, while the latter repealed the first act, providing fuel for competition between financial institutions. (*Related Links*¹⁰).

4 See Appendix A

5 Warren Buffet is a renowned investor and CEO of Berkshire Hathaway

6 From Berkshire Hathaway's Annual Report of 2002

7 The Great Depression was a severe global recession during the the 1930s

8 Established the FDIC and reforms designed to control speculation

9 Repealed seperation of commercial and investment banking

10 For more links on de-regulation, see Bibliography.



Fig4: Concept drawing from Jack's perspective. See Appendix B.

1.1.3. Jack's Perspective

When played from Jack's perspective, the game focuses on the trials and tribulations of being a person who must borrow resources to achieve his dream of home ownership. In the game, as Jack, the player borrows water (loan) from the giant to grow a type of bean (home/ mortgage). The goal is to payback the loan as soon as possible. The player does this by tending the bean into a healthy beanstalk. If the processes of tending (such as watering, removing weeds etc) are being performed correctly, the beanstalk will release clouds and payback the giant. While tending, the player will face hurdles that mimic real life, like paying off other water debts (credit card payments), chance health problems, mishaps or emergencies. Success is not only dependent on resource management, but also on whether or not you have taken the loan most suitable for you and kept yourself safe from swindling peddlers (mortgage brokers). The player may face circumstances where walking out of the loan is better than paying the giant back. Through the process, the various reasons why homeowners defaulted would become apparent.

1.1.4. Fairy's Perspective

As Fairy Greenspan, the goal is to keep the water cycle of Rafflesia running smoothly, which means, neither have excess rain, nor draught. In real life terms, it means balancing the amount of money flowing in the economy. The point here is to explain the role of *Fed Funds Rate*¹¹ as the determinant of the interest rate that banks charge for various loans, credit cards and mortgages. And also, how Fed Funds itself is affected by external events such as the 9/11 tragedy in 2001. The lowering of the Fed Funds rate during 2001 was the cause behind excessive bank lending that led to the housing *bubble*¹² of 2005. The game will hint at populist policies such as *the Community Reinvestment Act of 1977*¹³, and the role of *financial deregulation*¹⁴ in creating the competition that further increased bank lending.

11 Interest rate at which depositary institutions lend to each other overnight

12 High volume of trade at inflated prices in a particular sector

13 Introduced to reduce discriminatory credit practices such as redlining

14 Refer to footnote 8, 9 and 10

By playing through all three roles, a holistic picture of the circumstances that gave momentum to the credit crisis emerges. Elements like a mortgage loan (in the game, represented as a kind of bean) are featured in all three games as the thread that connects all three narratives. Yet, even the single perspective of a Giant that is implemented for the thesis, allows a comprehensive peek into the workings of a sub-system and hints at connections with the other two. All metaphors in the game allow parallel viewing of actual people, events and terminology, and provide links to the associated resources, for immediate grounding in context.

1.2 Context of Use

Packaged as a game with pedagogical intent, ‘Water Crisis in Rafflesia’ is focused towards the educated, working, tax-paying US citizen, both young and elderly. At a personal level, this citizen may have taken a mortgage in the past or may consider doing so in the near future. After the Subprime debacle, this person wants to be more cautious in dealing with mortgage lenders.

In the larger scheme of things, this person wants to know the motivation for banks to invest in risky loans, since he or she as a tax-payer, has to now bail them out of the failed investments. This person has been browsing news, articles, videos, cartoons, that try to explain the crisis as it is, or via metaphor. But the issue has remained elusive; as all avenues fall into the danger-zones of either over-simplification, or the telling of crisis as is, which requires some finance background. All of these factors hinder his understanding of explanatory content.

Apart from the focused group described above, the game may also find an audience amongst history or culture enthusiasts around the world, who are curious to know more about the origin of the global credit crisis, and yet are ignorant of necessary language or frameworks to understand on-going media explanations. From a pure gaming perspective, the kind of player interested in the game



Fig5: Possible user groups - At office (top); at home (center); student checking out the game out of curiosity (below).

prefers online casual gaming, puzzles or board games, as opposed to hardcore video games. They want a slow paced game that gives them a rich visual and meaningful experience. The player maybe found behind office computers or at home, taking a break from chores and browsing the Internet.

After playing the game, a player would have either gained a new understanding of the home loan financial system, and/or would have found a valuable resource that simplifies his study of the issue.

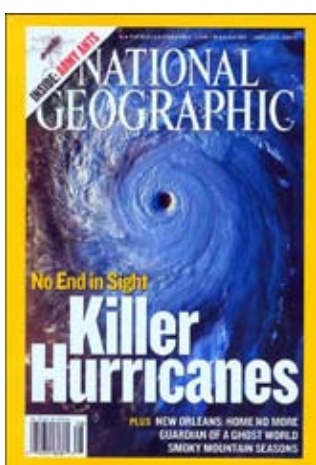


Fig6: National Geographic is an exemplar in 'making content easily understood'.



Fig7: The Subprime Crisis saw a nation-wide default on home loan mortgages in the U.S., leading to panic in global financial markets.

1.3 Impetus/ Why it matters

My journey has been about 'making content easily understood'. This is especially relevant to our information heavy times. While information on various subjects is readily available, most everyday people may not necessarily understand the content. For a case in point, I decided to tackle the Sub-Prime Mortgage Crisis. After the Housing Bubble collapsed in 2007, the credit crisis that could have been contained locally became global due to certain trading practices of Wall Street. There is speculation over who is to blame for the economic downturn. Explanations have been presented online, in newspapers and magazines. Yet the economic jargon evades even the most learned of people not related to finance. It therefore provided me an ideal domain, in which to apply my information design skills.

On a personal level, the case was topical and coincided with my arrival in the United States. For awhile, I lived with friends who happened to be investment bankers. They would come back home each day, and narrate stories of colleagues who had lost their jobs. Being an economic illiterate, I wouldn't understand these discussions. As the crisis progressed and transcended the boundaries of Wall Street into everyday life, my confusion was mirrored in the ignorance of many who were uninitiated in the financial world. This thesis, thus has been created as a tool to bridge the comprehension gap between some aspects of the financial world and those standing outside of it,

yet suffering its effects. It's a tool to help understand media reports, to understand how mortgages work and thereby gain the ability to safeguard oneself. It also is a tool for understanding related financial concepts such as financial bubbles that have been the cause of previous recessions in this country. Being aware of their creation would enable citizens to avoid certain practices, prepare early for aftermath and more actively voice their opinions on policy decisions that could help prevent financial downturns in the future.

1.4 Design Questions

The broad design questions of this thesis revolve around content and dissemination.

1.4.1. What is key to the credit crisis and important for the audience?

1.4.2 What is the best form and dissemination of that content?

1.4.3 What aspect of the crisis could become a viable game mechanic?

1.4.1. What is key to the credit crisis and important for the audience?

The goal was to contextualize the crisis. My research broke down the available material into a systemic relationship of parts of the home loan financial system. The process culminated in identifying four core perspectives of the system. For details, see Appendix A.

- Homeowners who take the mortgage
- Banks who give mortgages and resell them to investors
- Government that creates laws under which the above function
- Aftermath - the system's feedback towards the system's actions

1.4.2 What is the best form and dissemination of that content?

To discern what could be the best form and method for dissemination of that content, I focused on avenues of information design for financial literacy that also catered to a mass media. I came across animations, videos, data visualizations, and websites. Inspired by Monopoly, I settled on designing a game, as it was about money, extremely engaging, and a tried and tested product with mass appeal. Secondly, studies that map cognitive psychology and game design point towards games as an effective heuristic for instruction. I

decided to make a flash game, since it is a widely accepted platform, and can reside online, which will enable it to easily reach as many people as possible.

1.4.3 What aspect of the crisis could become a viable game mechanic?

Inquiry revolved around mechanic, interface design and implementation.

On Mechanic:

- How did the content translate into a viable game mechanic?
- Is the content presented in one go, or distributed in levels?
- Is the game single player or multi player?
- What are the learning outcomes of the game?

On Interface Design:

- What is the narrative? For that matter, is a narrative required?
- How are the characters and elements represented?
- Are representations helping or hindering game play?

On Implementation:

- What platform should the game be developed in?
- How does the platform inform interaction design?
- How does one play test without having the game fully coded?
- How does one present the game to an audience that hasn't had a chance to interact with the game?

For more information about how these questions were approached and answered, please refer to Chapter 3 on Methodology.

CHAPTER 2 – DOMAINS AND PRECEDENTS

2.1 Sub-prime Crisis and Financial Markets

During the concept formulation of my thesis, the *crisis*¹⁵ had just started to unfold and relevant precedents for the project were lacking. Today, almost eight months since then, there have been several attempts to either explain or mock the crisis. Some interesting precedents are as follows:

2.1.1. Credit Crunch

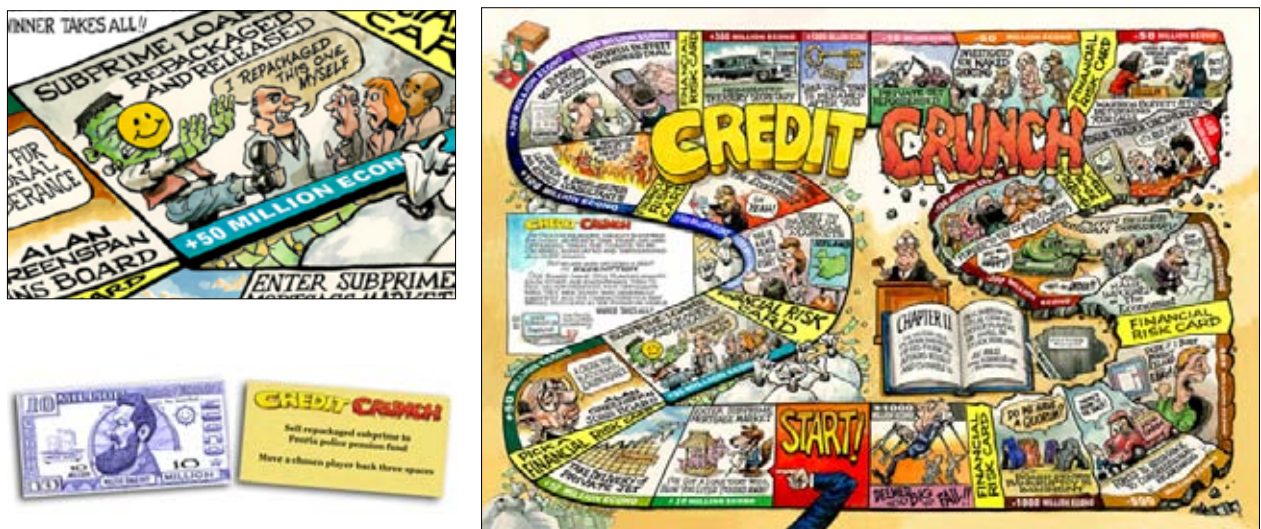


Fig8: Detail (top left), Complete board (right), currency and risk cards (below left) from the board game 'Credit Crunch'

Credit Crunch¹⁶ is a board game from the Economist magazine. It is designed as a satire on the events of the Sub-prime Crisis. Targeted specifically at The Economist readership, its tongue and cheek comic strip character requires some familiarity with the ongoing events to get the jokes. The mechanic is simple – you get crazy amount of currency called the 'Econo' when on the left side of the board, and you lose a similar mad amount when on the right side of the board. Landing on the Financial Risk Card sector enables you to play a risk card and mug your fellow players. It throws around a lot of jargon in a fun way and makes light of the accompanying serious articles.

15 See Appendix A

16 http://www.economist.com/displayStory.cfm?story_id=12798307



Fig9: Screenshots from 'Crisis of credit Visualized'



Fig10: Paddy Hirsch explains the 'payment waterfall' of a CDO in 'Uncorking CDOs' (top); The Bernanke led bailout is explained in the 'Credit Crisis as an Antarctic Expedition' (below).

2.1.2. Crisis of Credit Visualized

A very recent addition, 'Crisis of Credit Visualized'¹⁷ is a motion graphics piece (and also a thesis project) that explains the same topics that I cover in my game. The difference is that this video is a monologue narrative that doesn't incite much engagement from the viewer, while my game seeks player initiative to browse through the content, and thus incites greater engagement. Nevertheless, the project is excellent as it is tightly scripted, has clarity of concept and well designed and animated graphics. It's the first work in the line of Sub-prime crisis explanations that connects investors to the everyday person and talks of Fed Funds Rate. Also, it's a successful example of viral communication, since being a video makes it easy to display on one's website or blog.

Yet the project misses how the Community Reinvestment Act and Financial De-regulation fueled the competition for Sub-prime lending. CRA was introduced to mitigate the detrimental effects of redlining. Redlining is when banks lend at higher interest rates or refuse services to lower income, minority or racial groups. With the introduction of CRA, banks were obliged to include such communities. The packaging of Subprime loans into CDOs was devised to profit from the aforesaid risky loans. When due to CRA, GSEs like Fannie Mae and Freddie Mac opened their doors to Subprime Loan Securitization, it indicated a market for such a loan and the competition soared. De-regulation added fuel to fire as it removed the boundaries between commercial and investment banking, freeing more money to be at mercy of the risk inherent in financial markets.

2.1.3. The Marketplace Whiteboard

'The Marketplace Whiteboard'¹⁸ contains many amazing videos created by the Marketplace section of American Public Media, a distributor of public radio and programming. I learned many of my

¹⁷ <http://crisisofcredit.com/>

¹⁸ <http://marketplace.publicradio.org/videos/whiteboard/>

concepts from this website. The videos consist of Editor Paddy Hirsch standing in front of a whiteboard with a black marker. He draws in stick figures as he talks and unravels financial concepts wrapped in engaging metaphors. While the videos were initially created for explaining the Sub-prime crisis terms, they have now gone beyond into other realms and generally cater to financial terms, since the site is devoted to financial news and targeted at people who track financial on-goings in general. While brilliant for people who are also my user group, the videos tackle one concept at a time and do not provide inter-relationships. Hopefully, my project will be able to provide that connection between the different aspects of the crisis.

2.1.4. What's a CDO?

‘What’s a CDO¹⁹’ illustrates the concept of a payment waterfall in

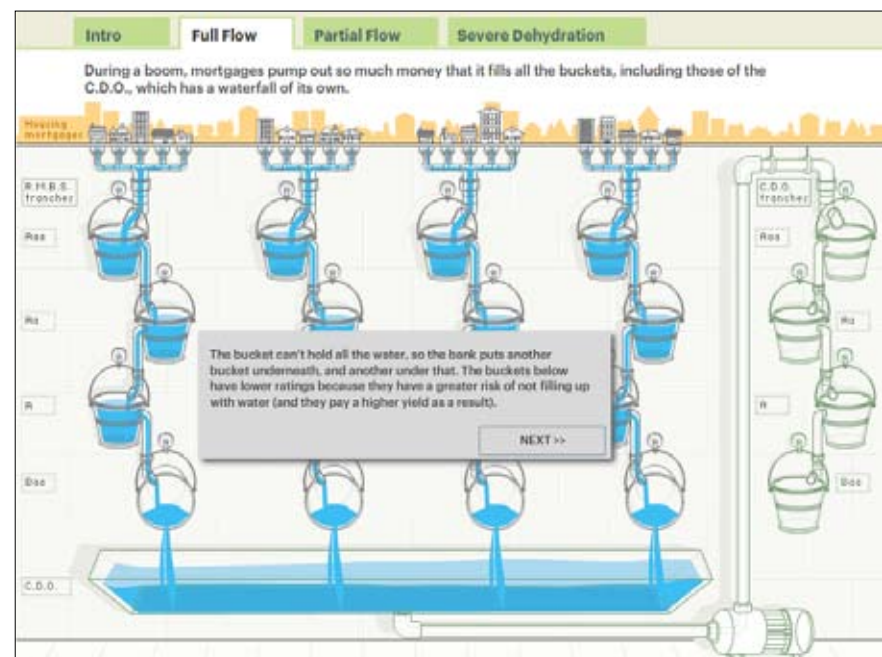


Fig11: Screenshot of “What’s a CDO?”

CDO design. Hosted on a business website, the interactive application is inspirational in terms of its excellent graphics and animation. Yet again, it provides no context with respect to the socio-political climate of the credit crisis. My project not only will define a CDO, but broach upon the wider issues of risk transfer and why this form of security was chosen to package Subprime loans.

¹⁹ <http://www.portfolio.com/interactive-features/2007/12/cdo>

2.1.5. Visualizing Economics



Fig12: The Visualizing Economics Blog.

‘Visualizing Economics²⁰’ is a blog hosted by Catherine Mulbrandon who has a background in Economics. She creates her own data-visualizations and posts materials found on other websites. While resources to interesting sources of information are provided, this site is more for people who are already well-versed in the subject as source material is not explained and its up to the viewer to investigate further.

2.1.6. The Debt Trap



Fig13: Home equity loans are often advertized with suggestions for using the cash, such as paying for college tuition, taking a vacation, remodeling a house, or even paying for braces. (1991 poster from Chase bank. Caption from the series).

‘The Debt Trap²¹’ is an interactive feature by the NY Times focuses on the surge in consumer debt and the lenders who made it possible. It’s a mix ‘n’ match of slideshows, charts, articles, tied into one application, which makes it the first contextually complete piece I have come across. Especially amazing were vintage posters of banks giving away home equity loans. They give the rationale for why people were buying so many houses. At the other end, the banks were killing two birds with one arrow – the borrower took the first loan for the house itself and the second for home equity to either payback the first loan, or for useless expenditure.

Either ways, one can clearly see what killed the buyers when the house prices fell.... home equity decreased and homes were worth less than the loan they took out and now had to payback. Home equity loan is like living on “speculation - bubble” money. Its worth is only for people who want to sell their house soon after gaining from it, much like an ARM loan. Most regular people don’t need that because they want a house to live in!

20 www.visualizingeconomics.com/

21 www.nytimes.com/interactive/2008/07/20/business/20debt-trap.html

2.2 Financial Literacy

Quoting the Wikipedia entry on *financial literacy*²² (even detractors would appreciate its brevity!):

Financial literacy is the ability to understand finance. Raising interest in personal finance is now a focus of state-run programs in countries including Australia, Japan, the United States and the UK. An international OECD study (Organization for Economic Co-operation and Development) was published in late 2005 analyzing financial literacy surveys in OECD countries. A selection of findings included:

- *In Australia, 67 per cent of respondents indicated that they understood the concept of compound interest, yet when they were asked to solve a problem using the concept only 28 per cent had a good level of understanding.*

- *A British survey found that consumers do not actively seek out financial information. The information they do receive is acquired by chance, for example, by picking up a pamphlet at a bank or having a chance talk with a bank employee.*
- *A Canadian survey found that respondents considered choosing the right investments to be more stressful than going to the dentist.*
- *A survey of Korean high-school students showed that they had failing scores - that is, they answered fewer than 60 per cent of the questions correctly - on tests designed to measure their ability to choose and manage a credit card, their knowledge about saving and investing for retirement, and their awareness of risk and the importance of insuring against it.*
- *A survey in the US found that four out of ten American workers are not saving for retirement.*

Several independent groups are working towards financial literacy for the above-mentioned reasons. In the context of the credit crisis,

22 http://en.wikipedia.org/wiki/Financial_literacy

financial literacy holds value since a lot of people have lost their savings owing to devaluation of financial securities. This especially is the case in United States, where financial trading is encouraged even amongst people not from a financial background. The following examples are most relevant to my project for either being related to the concepts intrinsic to the credit crisis or as a successful communication tool in the realm of economics.

2.2.1. Fed 101



Fig14: Screenshots from the Fed101 website. Main screen (top); Examine a virtual bank application (below)

*Fed 101*²³ is a site hosted by the Federal Reserve. The content deals with a myriad of issues ranging from federal monetary structure to personal banking to mortgages. The Fed 101 section has an activity called 'Examine a Virtual Bank'. The activity walks you through the process of underwriting a loan application. It outlines the importance of capacity, collateral, condition, capital and character (of borrower). In the walk through, one can read information submitted by the borrower, and also get to know what the experts say on the side. The interactivity is surprisingly engaging, though the graphics are very textbook like making its content appear didactic, even though its not so. Nevertheless the website is really good and I'm surprised that its not that well publicized.



Fig15: Movie poster for IOUSA

2.2.2. IOUSA

*IOUSA*²⁴ is a movie by Peter G. Peterson Foundation , on USA's rising national debt situation. Though more far reaching than the Sub-prime Crisis, it brings forward issues toward the urgent need for financial literacy and presents successful initiatives taken by the foundation and sister concerns like the Heritage Foundation (Fiscal Wake-Up tour). Some initiatives other than the movie are the game Budgetball (made at Parsons's own PetLab) and a personal savings game called Debt Ski from the website InDebtEd.

23 <http://www.federalreserveeducation.org/fed101/>

24 <http://www.iouasatthemovie.com/>

2.2.3. The Story of Stuff



Fig16: Scene from ‘The Story of Stuff’

‘The Story of Stuff’²⁵ is an animated narrative by Annie Leonard, the story of stuff tells the life cycle of ‘stuff’ from its natural state to its produced form to its consumption and then its end as toxic trash. The story narrates how businessmen create and feed our consumer lifestyle to make big money. It presents a one-way cycle that destroys natural resources. The end of the movie suggests a cyclical sustainability model as the way to go. Though primarily an environmental and lifestyle improvement campaign, the Story of Stuff manages to convey important financial concepts of how goods are produced and consumed to create an economy. It’s an interesting precedent as its clear, exhaustive and divided in sections. While a viewer can watch the whole movie at a go, he can also choose to see a section, enabling more focused learning.

2.3 Game based Pedagogy

My thesis is an endeavor to explain the origins and perpetuating causes of the Sub-prime crisis. It’s a case of designing instruction. Design of Instruction focuses on strategies that lead to learning, in other words, the construction of pedagogy. In the book ‘How People Learn’²⁶ by John Bransford and team, the theory of Anchored Instruction is proposed. Its emphasis is on the use of technology based

25 <http://www.storyofstuff.com/>

26 http://www.nap.edu/openbook.php?record_id=6160

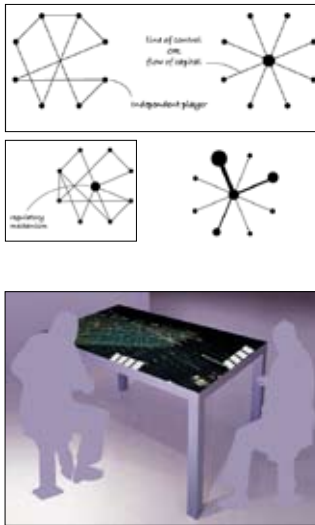


Fig20: Some early concept drawings for the project

3.1 Deciding the Form

My initial concepts revolved around data-visualization, akin to Ben Fry's³⁰ experiments with the Processing programming language. I was looking at cause and effect relationships - where users could change small values to see bigger changes in the system. The forms could be projected indoors on an interactive-tabletop or outdoors on Wall Street near the Bull Sculpture as a sound and light show. This idea was dropped, as the scale of such a project was ambitious and fraught with time constraints and a steep learning curve (in financial cause-effect relationships).

I eventually focused on a game, since, as discussed before (in the domains section), games are an effective educational tool. They engage the player actively through presenting challenges and opportunities for critical thinking. Instead of a passive point and show, the player witnesses effects as the result of his actions, gaining a more intimate understanding of the issue and the ability to empathize with its characters through role-play.

The methodology in developing the game was an iterative back and forth between mechanic, interface design, implementation and user testing. The prime game design questions were – What aspect of the home loan financial system lends itself as a playable mechanic? How could I show the interconnections between people involved in the home loan financial system, while at the same time focus on the sub-systems at work? Continuing research in various domain areas was an integral part of this process. The methodology section does not cover that aspect, since it has already been discussed, particularly by the representation of precedent work, in the previous chapter.

30 <http://benfry.com/>

3.2 Evolution of the Game

3.2.1. Content to Concepts

From my understanding of the Subprime Crisis, two game concepts were developed. At this early stage of concept exploration, the game was multi-player, as I envisaged it more on the lines of Monopoly. Monopoly epitomized a financial game with mass appeal.

Days of Depression

‘Days of Depression’ was one of the concepts that envisaged a collaborative game where players play against the board (which is a collapsing economy). The players take on the role of the executive political branch, taxpayer, banker, investor, media activist – to carry out a rescue plan, and yet profit from their actions. What constituted a profit for each person was pre-determined, so that players would play towards that aim. Player actions would have been mapped in a graph, probably reflecting a stock market index progression. The goal of the game was twofold (i) To save the economy from recession. Players would win if their graph was healthier than the graph of current US economy (ii) A player who has performed better at arriving close to his profit requirements will be said to have fared better/ or played more strategically than other players.

Deep Freeze

‘Deep Freeze’ was another concept that explored the dynamics of a competitive game where players alternatively act as bankers and investors dealing in Mortgage Backed Securities. The goal of the game was to (i) maintain liquidity of your own bank (ii) not become bankrupt. The winner was the player who held maximum equity (real money) at the end of the game. The game concluded when all players, or all except for one player went bankrupt OR, when all players stopped lending, thereby stopping the game from moving forward.

A quick survey decided that the second concept was more favorable for further development. The game allowed for focused research due to lesser number of characters and scenarios. It was also felt that

diverse roles and goals in the first concept would have led to player confusion, and a game with a common goal for all players would afford a more competitive and fun game-play.

3.2.2. Concept to Mechanic

The first iteration of the game revolved around the Sub-prime timeline that culminated in the bankruptcy of investment banks, right before the federal bailout. While building mechanics for the game, I realized that playing according to a set timeline would lead to a repeat in game-play each time the game was played. An analogy would be a level of Super Mario, where after playing it three-four times, a player knows exactly how the game would respond at different times. In my game, thus for example, a player would know the exact sequence of interest rates that the government would set in a particular year, since we're following the historical timeline.

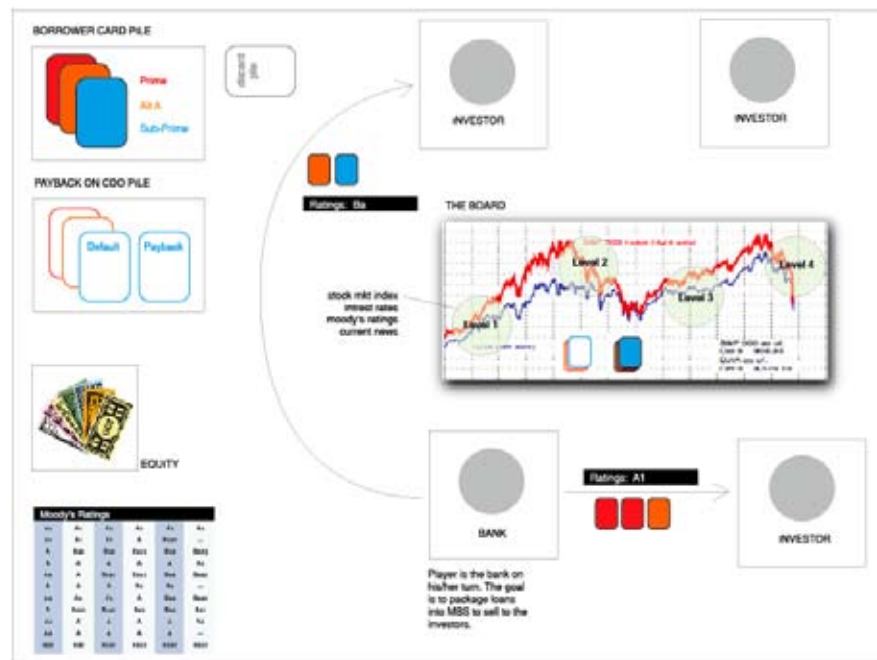


Fig21: First Iteration

The second iteration looked at the core mechanics that were unique to the debacle and then strip them away from a rigid timeline, letting out the mechanics to play out on their own. While the drawback of this approach was that the 'housing bubble' could not be generated (since interest rates were random and not according to the Subprime

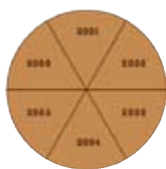


Fig23: Component details of the 'Consignment Capitalist', from top to bottom: Clock, Interest rate and payback chart, borrower cards, loan tokens, interest rate tokens, franchise coupon, money, insurance ownership and amount indicator. For more details, visit illiquid.wordpress.com

timeline), the advantage was that it would at least give the game some element of diversity every round of play. The game was renamed 'The Consignment Capitalist', since the players on Wall Street were dealing with consignments of mortgage-backed securities.



Fig22: Second Iteration, called 'The Consignment Capitalist'

The game at this stage was developed as a board game since it was easier to test it as a paper prototype. Since many board games have recently been developed as online or mobile-based games, I was not worried about the game's translation onto a digital platform, but more concerned with refinement of game-play. Play-testing revealed that the economic content was still overpowering the game, making it didactic and more accessible to people from economic backgrounds instead of the intended everyday population. It was suggested that either I change my user group or break the game down into levels, affording step-by-step learning. Secondly, minute interactions were drowning the larger concept of how tricky capital gains were generated off the ideals of an American dream (housing). It was felt that the game instead of being a structural representation of the system, should incorporate a narrative that would enable tying up of the mechanics with the overview of the home loan financial system.

The third and final iteration of the game, which I analyze below, has been successful in incorporating feedback from the previous version. It's also designed to be a single player game, taking into account its

pedagogical intent. The player plays against the game making the learning self-timed and independent of the presence of other players. The single-player mode also allows for parallel content exploration which is provided on the website where the game is hosted. The game is being implemented in Flash for ease of viral dissemination online.

3.3 Final iteration of the Game

3.3.1. Concept

'Water Crisis in Rafflesia' is a Flash based, online, single-player game that contextualizes the U.S. Subprime (Credit) Crisis of 2007 for everyday people, who are not well versed with the economic terms and systems that are core to the understanding of the event and its aftermath. Set in the popular narrative – Jack and the Beanstalk, the player can view the crisis from three core perspectives – as Jack the borrower, Giant the lender, or as Fairy Greenspan who is the government character. Once familiar with the scenarios, the player can draw parallels in any further commentary on the topic.

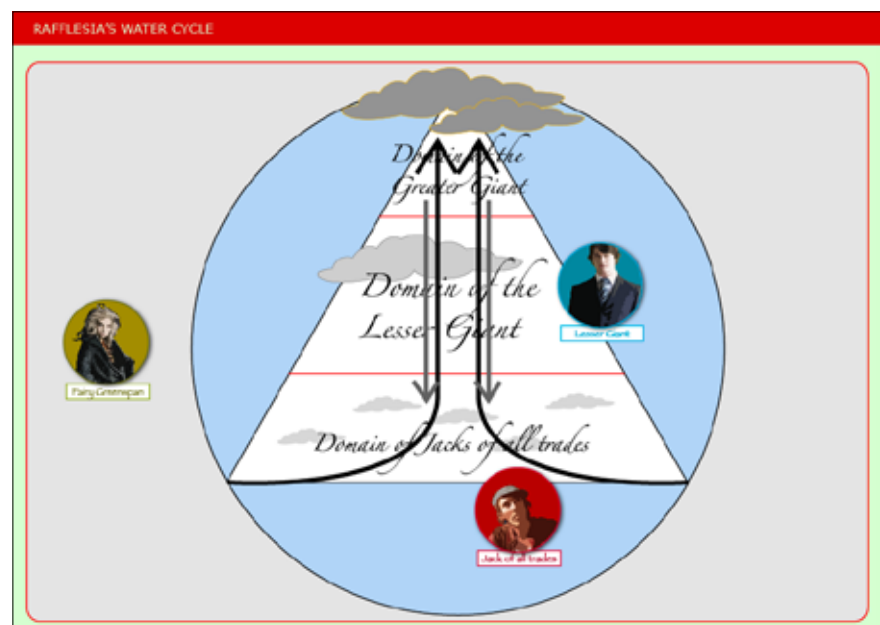


Fig24 (above) shows The 'Water Cycle'³¹ and the three characters of Rafflesia - Jack the borrower, Giant the lender and Fairy Greenspan the government character

3.3.2. *The Narrative*

The narrative provides an umbrella to the three perspectives – it provides a snapshot of how the characters, though living their separate lives, are connected to one-another's fate. It's a continuation of the popular fairy tale – Jack and the Beanstalk. The story was apt for the setting as it combined two features that I was looking for. One, I had been working with the flower as a metaphor for a mortgage-backed security because the latter is a pool of mortgages and a flower is a collection of petals. The beanstalk could produce the promissory flower I was looking for. Two, the characters in the story matched the personalities of my protagonists. For example, Jack's condition could be tailored to depict the ideals of an American dream (housing), while at the same time you could see him as a fiscally irresponsible youth who got fooled by a peddler, in a way, by the mortgage brokers. The Giant in the story represents the rich, the one with the golden hen. He also lives on a higher plane, amongst the clouds, which stated in real life terms, is an indication of social status based on economic standing.

3.3.3. *Scope and Learning Outcomes*

The scope of the thesis project revolves around the Giant's perspective. This perspective was chosen for implementation for two reasons. Firstly, its mechanic was well developed in the previous iteration. Secondly, it makes familiar the obscure connections between the financial markets and us. It's a subject more obscure than what is covered in the other perspectives. By the end of the game, a player will know:

(a) *How banks control money flows from individuals to investors and vice versa?* In the game, as a banker, the player lends water to Jacks and make a profit on that loan. He receives a flower from a Jack he has lent to as a promissory note that outlines how much remuneration can be expected from Jack over time. The player can either keep the flower himself and profit from it or sell the flower to another giant (investor) for instant returns with minimum profit.

(b) Who is an investor and what is an investment? The player can sell the flower to another giant (investor) in the flower exchange. The flower exchange will display a range of giant types and their specific needs with regards how much water they want to make and how long they are ready to wait for it.

(c) How does Collateralized Debt Obligation (CDO) increase money flow from investors to individuals and vice versa? A CDO is essentially the mixed and matched flower. They better suit investor needs and thus are easier to sell. If the player is able to sell his transformed flowers, he will have more money to lend to Jacks. As the number of Jacks who borrow increase, the amount of investment that a giant can make also increases.

(d) How the CDO increased the perception of low risk investment even when the investments consisted of Subprime mortgages? In the CDO flower, a player will find petals from Prime flowers mixed with Subprime flowers. Together they have reduced risk than just a subprime flower but more payback than just a prime flower (since Subprime flowers payback greater interest).

(e) How the structure of a CDO spreads risk? CDO flowers are mix-and match of other flowers, so each petal loses the origin of the flower it came from. In the game, if a Jack defaults, the flowers will experience a drop in value based on their hierarchy of risk (rating). If few flowers default, its not a concern as the risky flowers get more return for their risk and can shoulder the burden. But a massive default will lead to even the higher rated flowers to downgrade.

(f) What makes a Credit Default Swap, essentially insurance, a tool for speculation that can bring down heavy losses upon a bank? In the flower exchange, an investor may purchase a special flower if insurance is also offered. Other investors may want to purchase insurance for the same. It up to the player to concede or deny. In case of default, the player will shoulder loss in water. If too many CDS are sold, it can bring down the player's water resource causing him to go bankrupt.

3.3.4. The Goal

The player is a Giant in the land of Rafflesia. The explicit goal of the game is to create more clouds than the clouds the player owned to begin with. The player does that by lending Jacks water for their beanstalk and receiving a flower with eight petals as a collateral. Each petal denotes a payback of some of the original clouds borrowed and the interest on it, thus enabling a net profit. The implied goal includes discovering how to keep water running in the system by borrowing water from Greater Giants and re-lending it to Jacks. Other goals are to create successful Tranche flowers (see components for detail) and apply Power Cards strategically.

3.3.5. The Rules

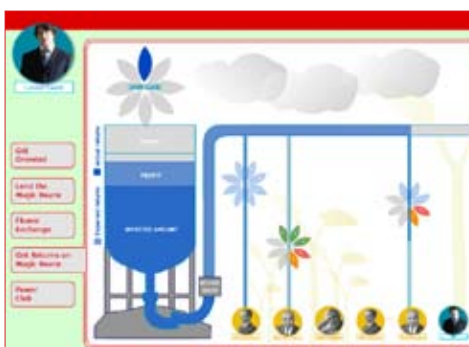


The rules of the game are fairly simple, as the game pops up prompts that guide the player to act in a certain way from time to time, or provides hints by making analogies to the real world. The basic rules that will be provided at orientation are:

(a) Give rain to a Jack's seedling by clicking on his symbol.



In exchange you will receive a flower with eight petals. Each petal signifies the amount of clouds the beanstalk will produce each successive year. If the Jack is credible and tends his stalk properly, it will produce enough moisture to return the number of clouds promised by the flower. If the beanstalk is being neglected, the petal will wither away.



(b) While you give away water instantaneously, you don't get back the clouds instantaneously. Rather, you get them back after eight years. To be able to lend more, you need to generate more water. The quickest way of doing that is to sell the flowers to other giants in the flower exchange.

(c) The giants may not accept the flowers as is. Reconfigure the flowers by combining petals that would give clouds in the same year. Be careful about how you reconfigure.

Fig25: Screenshots from the game. Lending Screen (top); The Flower Exchange (center); The Cloud Collector (below)

Amongst the new flowers formed, some will be more profitable than others. This process requires skill.

(d) Keep track of water you possessed from the cloud counter.

(e) Use the power club to influence other Giants and the Fairy. It will bend some rules of the game.

(f) Click on the Flower Clock for the beanstalk to reap clouds. The cloud counter will indicate whether you replenished Rafflesia with moisture or pushed it towards draught.



Fig26: Clouds

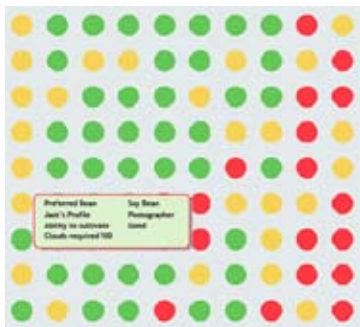


Fig27: Jack Field



Fig28: Loan Flowers (Colored according to borrower's Fico Score - Sub-prime is red; Alt-A is yellow and Prime is Green)

3.3.6. The Interface Components

- Water (as Clouds or rain): It represents money/ resource in the land of Rafflesia.
- Jack Field: An area that represents the number of borrowers the player can loan to in the game's duration. Each borrower needs some amount of clouds (money), a kind of bean (or loan that determines the rate at which clouds will be paid back) and has ability to payback (that determines his probability of cloud return or default). Based on this ability, he has a color. The player lends water to a borrower by clicking on his spot.
- Loan flowers: Consisting of petals numbered from one to eight, the flowers represent the number of clouds the player can receive from the borrower over a period of eight years. While in real life mortgages are paid back over a period of thirty years, the number eight has been chosen to condense time in the game. It may not be an accurate reflection of the paybacks but it conveys a sense of different payments coming in each year. The Loan flowers take their color from the Jack they came from.
- Tranche Flowers: These are flowers created when the player mix-and matches the petals from Loan flowers according the year

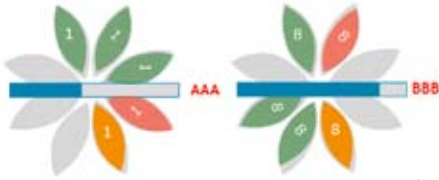


Fig29: Tranche Flowers

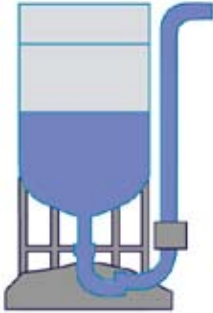


Fig30: Cloud Condenser



Fig31: Power Card/
Golden Harp



Fig32: Greater Giants



Fig33: Warning, a kind
of descriptive text

of petal's payback. Tranche flowers are sold to Greater giants (investors) in the Flower Exchange.

- **Cloud Condenser:** Keeps track of how many clouds (or much water) you possess. It will indicate whether you are making a profit or undergoing a loss. It will also trigger the final message at the end of the game based on your performance in generating clouds. The final message will sum up the aftermath (Chapter1; section 1.4.1; Point 4 – The Aftermath).
- **Power Cards:** Found in the Power Club, these cards can be played to modify certain rules of the game. For example, an investor can be coaxed into purchasing riskier loan by clicking the corresponding power card. Also known as Golden Harps.
- **Greater Giants:** Found in the flower exchange, greater giants represent investors who will give you more clouds in exchange for Tranche Flowers. Each giant has his requirements and the player must match those requirements for the transaction to be successful. The more clouds generated can be used for further lending to Jacks.
- **Descriptive Text:** From time to time, text may pop up as a description or a warning. This text is to provide further information on a component, a feedback or a warning based on player action. For example, if the player tried to sell a tranche flower to a Greater Giant who doesn't want it, the Greater Giant will convey so to the player.

3.4. Implementation

The game is coded entirely in Flash CS3 and Actionscript 3.0, since Flash is the most widely used platform for web-based content. The game actions mostly require point-click and drag-drop functionality, thus speed was not the concern while choosing the coding platform.

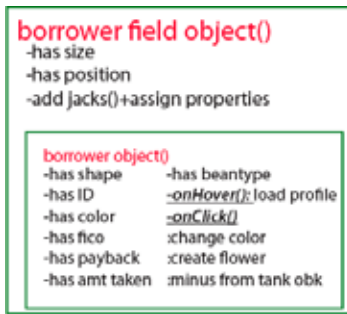


Fig34: Detail of IA Diagram.
For complete diagram, refer to Appendix C

Even though I was familiar with basic programming concepts, I was new to object oriented programming, and hadn't priorly worked with classes. I worked with the resources provided by my advisor for understanding the core concepts of the programming language. We also focused on developing the structure for my game - an information architecture diagram that chalked out the framework and the minute nested details of the hierarchy of elements in the game. Interestingly, the information architecture diagram has undergone several changes as I found more efficient ways of nesting the code as I went along. The final iteration of the diagram can be viewed in detail in Appendix C.

Thus, the first step towards coding the game was to identify each object or component in the game and determine its hierarchy, properties and functionality. Once I was comfortable with packaging and creating classes, I started coding the elements in the sequence of the game-play, since the results of interaction with those elements would determine the fate of elements that came later. Yet at the same time, it was possible to lay out the non-interactive graphic elements like screen border and common buttons in the beginning itself.

The greatest challenge I faced during the process was actually pretty early on. The game dynamically generates the Jack Field, meaning, that each time a new game is loaded, the field is created anew with different behaviors for Jacks (in terms of the amount they loan, their capacity to payback or default, etc). The trouble was that each time I switched between the screens of the game, the field would refresh, even though the game was not new. My attempts at creating a database were not working as irrespective of how the classes were nested, somewhere a new database would instantiate. It was then while discussing the problem with a colleague that I discovered the Singleton pattern. Its a design pattern that tells the program to implement an instantiation only once from within itself. With this pattern in place, I did not need to call the database from any other class in the game, thus preventing the Jack field from refreshing itself.

The second interesting aspect I came across was in terms of creating the memory for the game. Again, if I selected a Jack in the Jack field, a flower would be created. On switching screens, the memory of the selection disappeared from the game and I would find a blank screen where a flower should have been present. I solved that by creating multiple databases that handle different dynamic elements based on the unique ID they inherit from their parent Jack. Now my game not only creates the Jacks, but keeps track of selections, flowers created, flower created in the flower exchange, cost of those flowers, the greater giant they were sold to, and whether or not their value has been repaid in clouds in the last stage. All the databases are created once with the Singleton Pattern and elements are added to or subtracted from the lists at every instance of action taken.

3.5. User testing

A survey was conducted to check the validity of of interface design. The survey method used a non-digital method of video demonstration of the game-play scenarios. The feedback from my user profile has been very positive in terms of relevant and interesting metaphor. A clear analogy between the flower and mortgage-backed securities is recognized and is seen as a solid game-play mechanic since it not only conveys the composition and value of the securities, it affords itself to a puzzle-like game-play experience. The analogy between the narrative and the Sub-prime Crisis is also very clear and well-received. I have also received a thumbs-up from some finance professionals for the validity of content delivered by the game.

In terms of game-play, I have received several invaluable suggestions for improvement of the play experience, which will surely add to the re-playability factor of my game, thereby indirectly influencing not only learning but revision of content, which reinforces the game's pedagogical role. For more information on user-testing results, please refer to Chapter4 - Evaluation.

CHAPTER 4 – EVALUATION

4.1. Successes

The process of making the game has been successful in several areas. In terms of my original intention of ‘making information meaningful’, through the thesis process, I have been able to demonstrate my ability to crunch complex information and present it in a more accessible form. This has come across from the feedback I have received via informal interviews with various people, from both experts in the domain of finance and the uninitiated alike. Their reactions have validated the authenticity of content and appropriateness of metaphor used in the game. For example, one of my class-fellows very aptly described the making of CDOs as making ‘more expensive flowers’, reflecting through the language of my game, a newly gained understanding of why a CDO was preferred over other products.

In terms of game design, I think the strategy of simplifying the game via metaphor as opposed to editing complex processes has worked, since the essence of the crisis is in the complex processes. The core mechanic of the giant’s perspective was creating and selling CDOs, thus my focus was on how to ‘explain’ that aspect in a more palatable manner, and the enquiry led me to arrive at the flower and petal analogy. The flower-petal interface (teaching tool) and its potential for puzzle-like game-play is the strongest aspect of my thesis.

Wrapping the game in the Jack and the Beanstalk narrative has helped increase the accessibility value of the game since the player no longer needs to interface with unfamiliar financial terms, yet at the same time is experiencing the financial processes in the language that the player knew in pre-school itself. The narrative is also acting like an attention grabber. Strangely when I used to discuss the game with peers in its previous avatars, they would sleep off. Now when I discuss it in the way of giants and fairies, they actually find it poetic or funny and want to hear more.

I consider the creation of the game in Flash platform as a good choice

as it affords online presence. It helps not only in the viral dissemination of content, but the game website also hosts resources that can be browsed in the game's components' language simultaneously. In the same vein, while the game concept fits a multi-player avatar quite smoothly, making the game single-player helps in the player's self-led exploration of content and enables the game to fulfill its pedagogical mission more successfully than a game where a player is more focused in beating fellow players.

Last but not the least, I am much more financially literate than I was two years ago.

4.2. Design Challenges

While it works as a pedagogical tool, there are certain aspects of game design that need further work to make the game truly fun and with re-play value.

To begin with, the Jack field needs improvement. The rationale on which a player chooses a Jack to give loan lacks depth. The players' choices are predictable. They would largely gravitate towards a safe (prime) Jack, especially since everyone now knows that sub-prime is risky. The game at this point needs to be able to demonstrate the reasons for investing in Sub-prime properties by making such a Jack a valid strategic choice. The present game does so only by suggesting greater returns on a loan given to a Sub-prime Jack.

While, this situation is not a problem in a multi-player game as Jacks are limited and so players have pressure to loan quickly if they need to make any returns on investment, in a single-player mode, this is not enough incentive. A work around this problem may be to include something that makes player choice dependent on rising home (bean) prices, a factor that was kept out of the game after it was decided that the game will not follow the crisis timeline.

At present each kind of borrower has risk attached to it. For example, only 10% of the prime borrowers will default, 20% of AltA may default, while 50% of Subprime will default. In the next iteration, the risk factor should be applied to the entire population that changes with time (or as presented as different game levels). While house prices are increasing, the risk factor will be low. At some point they will decrease and the risk factor will be high leading to increasing defaults. This approach will also show why the CDO strategies worked in a boom phase and failed in tougher times.

Game designer Nick Fortugno suggested another improvement for my game. After looking at the Redistricting Game and Climate Change, I felt there was a push and pull in both the games, an act of balancing, an effort required by the player to make all parties happy and come up with the most appropriate solution. That feeling of conflict that makes both the games re-playable, is still wanting in my game. In our discussion, Nick also discovered this lack in my game and suggested that the conflict could emerge from how much risk a player wanted to indulge in. This factor would also provide the rationale why a player would deliberately choose a Sub-prime Jack from the Jack field.

His solution is as follows: In the actual Sub-prime crisis, lender's went crazy with risky loans not just due to issues of self-greed, but because of pressures from investors and stake-holders to generate more capital, or else they would approach a different lender to invest with. Thus the conflict was - whether to succumb to competitive pressure or go slow with building assets.

In the game, we see in the last phase a row of investors reaping water from their investments. Nick's suggestion is that the amount the investor makes should come up as a ticker on the interface. The investor with lowest returns is dropped out of the game. This investor can be a Non-player Character or the player himself. The player, to stay in the game, will then be pressurized to make risky choices.

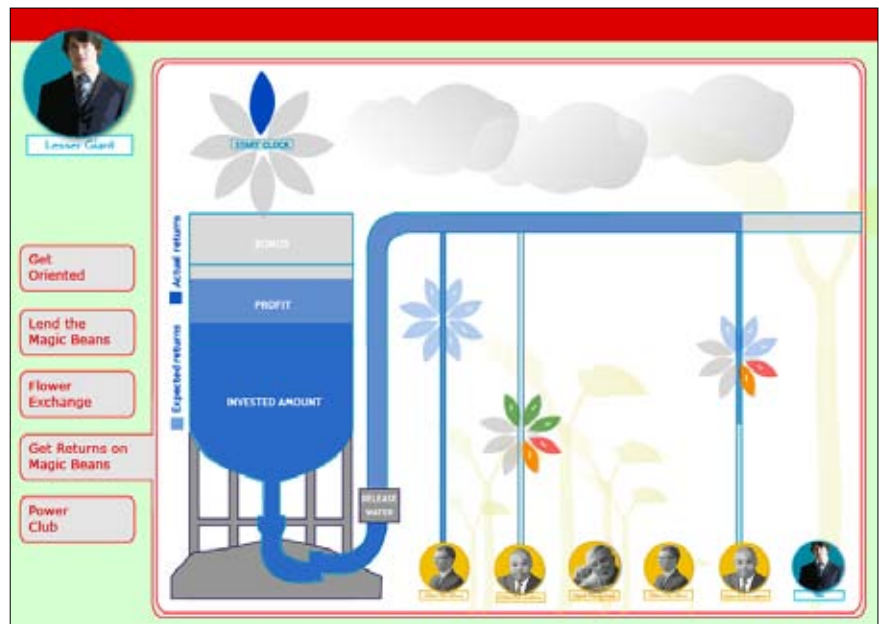


Fig35: The last phase of the game. Each giant can have a ticker that tells his net worth. The least performing character would be dropped out of the game each year.

The second scenario is in the flower exchange where the player is selling repackaged flowers to the investors. If the goods are not risky enough, the investors will abandon the flower exchange. If no one is purchasing the flowers, the player will not have enough water to give loan to more Jacks, and in turn not grow in net worth. This will make shareholders yell down the player's throat for not taking part in the piece of risky action.

4.3. Implementation Challenges

I started programming the game pretty late in the thesis project, partly because my platform was undecided and partly because I wanted to concentrate primarily on information and game design aspects. Unfortunately one cannot test just a part of game-play in a game, as it's a response of all its parts together.

Not having much coding experience I felt that building a whole game and play-testing would take enormous amounts of time, and thus I spent time testing with paper prototypes and interface diagrams. That also was not wise as the paper versions of the game have taken away from the larger game experience as my players needed to do the required math themselves, a situation that could have been avoided

had the game been tested digitally. Apart from an evolved game, the digital version is a complete redesign from prior iterations since navigation and interface considerations differ widely in digital and non-digital forms.

Secondly, this was my first time building a complete game and I have had trouble with planning workflow for its production – what to code and how much, for play testing? To what extent generate the graphics? For example, most game designers would agree that functionality is paramount over graphics in the developing stages of the game (especially so, if you are a one-person development team, working on research, game design, illustration and coding!).

Yet, in presentations or while talking to people I have found that showing only a part of the game confuses people towards its greater goal and not having compelling graphics disappoints them as graphics play an important role in player engagement. Also, learning the game involves reading bits of information and warning signs that are not directly required to play the mechanic but are necessary to play the mechanic meaningfully. The game cannot be played as an isolated mechanic.

Despite the challenges, what I found most interesting about my implementation experience is the breakdown of larger pieces of the whole into miniscule parts till you discover the one part that is of utmost importance, both technically and conceptually. In my game, contrary to what I thought, its not the flower, but the petal. While it originates from Jack as a part of the flower, the journey of each petal in the game is distinct from the others and is the only link that affects the dynamic changes occurring in all other elements of the game.

4.4. Plan for the Future

In terms of game development, the game needs to undergo thorough play testing and improvement in design as discussed in the ‘design

challenges' section of this chapter. The second step would be to include Jack's and Fairy's perspective. Nick suggested that a flower-trading version might even make a fun Facebook game since it would directly mimic online trading. Lastly, I want to have stringent standards for content on the accompanying website

Accomplishing the above would be an ambitious task and even though I have become much more comfortable with programming, the implementation will require further investigation into using Actionscript for game development, especially when it comes to more complex parts like the AI needed to generate investors that respond to player actions, developing user profiles for monitoring progress/ learning and scaling the game into more tough game-play. For example, a harder level would include making a synthetic CDO. Infact, harder levels can even support more serious, institutional learning for economics.

APPENDIX A – SUBPRIME CRISIS

To reiterate the points covered in Chapter 1, in the game, the player can role-play as Jack the borrower, or Giant the lender or Fairy Greenspan the government character. The game-play of each perspective was driven by a set of questions pertaining to the Subprime Crisis, which are dealt in greater detail in this section.

Disclaimer: This documentation is provided to state the principles on which I have made this game. The information provided is my understanding of the research I have done on the Subprime Crisis. This is not the writing of an expert and should be read with that kept in mind.



FigA.1: Jack's icon in the game

A.1. Jack's Perspective

Jack's perspective deals with the homeowners who took a mortgage loan. The key to understanding this perspective is asking the question - why was Jack the borrower delinquent on his mortgage that eventually led to foreclosure and him declaring bankruptcy?

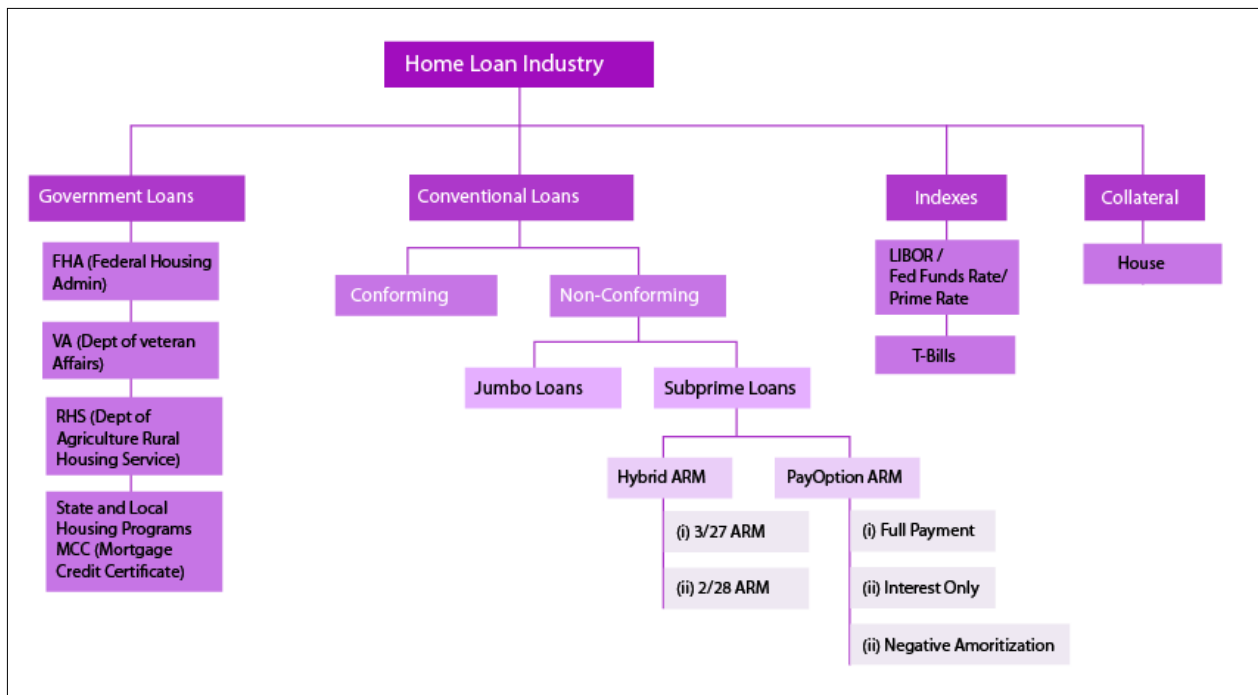
- *He picked a wrong kind of loan (What kind of loans are there?)*
- *He was tricked into a wrong kind of loan (Predatory Lending)*
- *He was fiscally irresponsible (Credit Cards, Home Equity debts)*
- *He suffered unforeseen financial obligations (Health, no job, etc)*
- *The price of his house became less than the loan he owed to the bank, so it was no longer a viable investment (bubble burst)*

He picked a wrong kind of loan

Loans¹ can be classified according to their *credibility*² and their cost to borrower. By credibility, US Citizens have access to Government loans and Conventional loans. Government loans are easier on the borrower. They have lower down payments than conventional loans and are assisted by the issuing authorities. Furthermore, mortgage

1 <http://mortgage-x.com/library/loans.htm>

2 Refers to ease of repayment of loan and level of risk assumed by its lender



FigA.2: Schematic of the Home Loan Industry

backed securities made from these loans are securitized and guaranteed by the GSE³ Ginnie Mae.

Conventional loans can be conforming or non-conforming. A conforming loan fulfills the guidelines set by the GSEs Freddie Mac and Fannie Mae, which also securitize and guarantee such loans. If a loan is non-conforming, a borrower must approach a private lender, such as a broker or a bank, to secure a home loan. Conforming loan limits have changed ever since the crisis. The current loan limits can be found at Fannie Mae's *website*⁴, and issues pertaining to loan limits under Obama's new economic plan are being blogged at *The Mortgage Reports*⁵ blog (The inclusion of the blog as a resource is not intended as a validation of the quality of its content, but only the fact that it's pretty comprehensive with respect to mortgages).

By cost to borrower, home loans can be classified as Fixed Rate, Hybrid ARMs and PayOption ARMs. The right mortgage for the borrower depends on how long they plan to live in the house and the maximum monthly payment he or she can comfortably afford. Fixed rate mortgages have a fixed rate of interest for the entire loan

3 http://en.wikipedia.org/wiki/Mortgage_GSE_controversy

4 <http://www.fanniemae.com/aboutfm/loanlimits.jhtml>

5 http://themortgagereports.com/conforming_mortgage_guidelines

duration. While down payments and interest rates are high, the paybacks are preset. These loans are typically best for people who have a fixed source of monthly income and wish to buy a home for living in it themselves instead of reselling. But they are difficult to qualify for and require the borrower to show a solid credit history.

Hybrid and Pay Option ARM have an adjustable rate of interest depending on the current *Fed Funds Rate*⁶. These loans have a fixed rate for a set number of years after which the rate resets higher depending on the fluctuating Fed Funds Rate. They also may have features like zero down payment or reduced payments for a couple of years followed by a lump-sum payment at the end of the loan period. While lower initial interest rates and attractive zero down payments make these loans easier to qualify for, they can reset to an extremely high and unpredictable interest rate in the future. Unless the borrower is market savvy, prepared for a high monthly payment, or does not intend to keep the home for too long, cashing on these loans is not advisable.

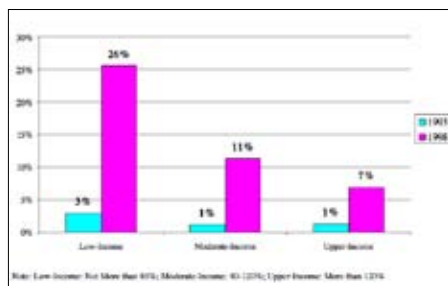
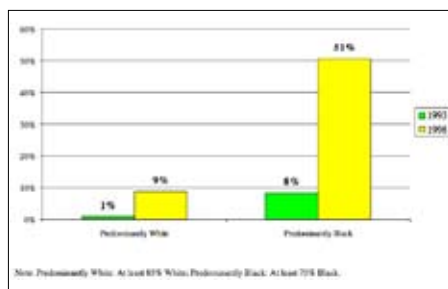
The game based on Jack's perspective will ask the player to choose his profile (occupation, earning, lifestyle expenses) and pick a loan. The goal of the game will be to pay the loan back in stipulated time. He will be only told the advantages of each loan, not the disadvantages, much like a broker's advertisement. If the player chose a loan that he could not handle, the end game state will inform him why the loan was wrong for him. If the loan picked was correct and yet the player performs poorly, the game will inform the player why his choice was correct and whether it was his lifestyle choices or emergencies that caused him to not keep up with the paybacks.

*He was tricked into a wrong kind of loan – Predatory Lending*⁷

A borrower can be said to be tricked into the wrong kind of loan if he was not provided adequate information on the loan, or was offered

6 http://en.wikipedia.org/wiki/Fed_funds_rate

7 http://www.affil.org/consumer_rsc/what-is-predatory-lending



FigA.3: Subprime share of Refinance mortgages by Neighborhood Race (top) and Income (below). From “Unequal Burden: Income and Racial Disparities in Subprime Lending in America (April 2000, 15 p.)

an ARM even when the borrower qualified for a fixed rate mortgage. The latter scenario has been a concern as it has reflected *racial disparities and bias against minorities*⁸ in the process of providing affordable housing to American citizens. Finally, a borrower is ‘tricked’ into a wrong kind of loan if the underwriter quotes false value for borrowers income without the borrower’s knowledge (*mandatory arbitration*⁹) to secure a loan the borrower cannot payback.

The game may randomly assign a predatory lending mode to the player’s choice. The possibility of being tricked will be higher if a player chooses a controversial ethnicity, minority or sex, or if he plays the ‘boom’ phase of the game where all brokers are vying to get ARM mortgages through to the borrowers (This phase has been suggested as a design improvisation in Chapter4 - Evaluation).

He was fiscally irresponsible

In the game a player is fiscally irresponsible if he signs his mortgage papers without understanding the fine print or researching the loan options available to him (in other words he doesn’t pick the right bean to grow his beanstalk). He is also irresponsible if spends beyond his means via unsustainable lifestyle choices leading to excessive credit card spending etc.

Suffered unforeseen financial obligations

This can include events like loss of job, accident or health problems.

Price of their house became less than the loan they owned

If the player is playing the ‘Bust’ mode, the house prices will be declining and he will have trouble refinancing his mortgage. In

8 <http://www.huduser.org/publications/fairhsg/unequal.html>

9 <http://www.givemebackmyrights.com/>

which case, he might go bankrupt and the game will end declaring foreclosure. (This ‘Bust’ mode has been suggested as a design improvisation in Chapter4 - Evaluation).

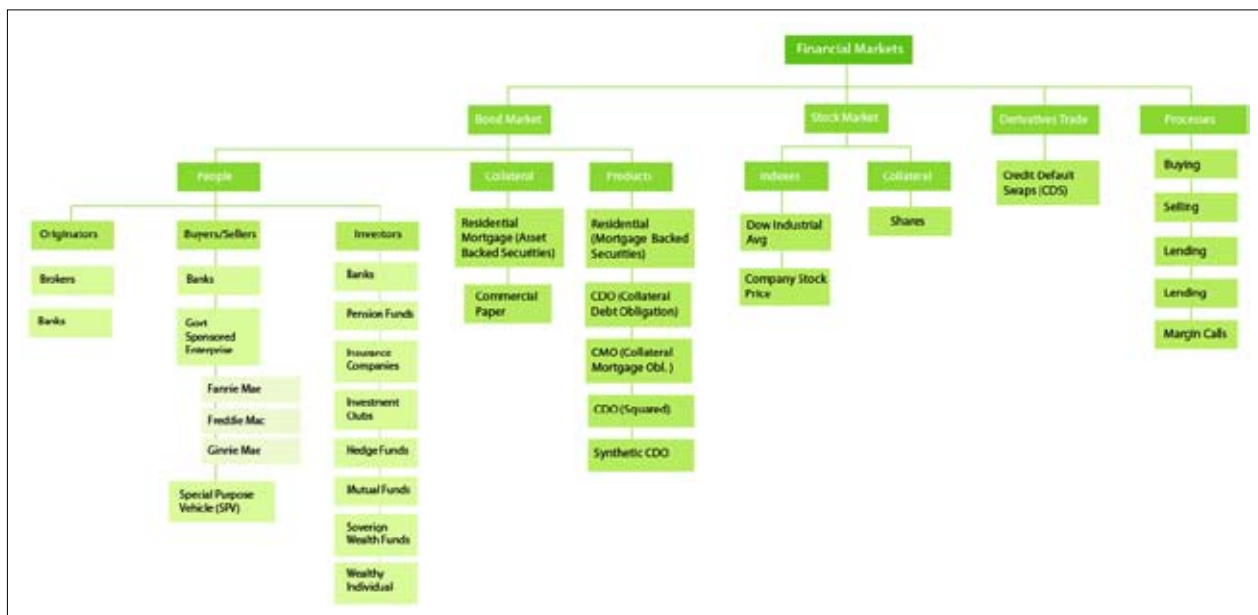


FigA.4: Giant's icon in the game

A.2. Giant's Perspective

The Giant's perspective deals with the banks that loaned mortgages and resold them to investors. This perspective addresses the following questions - how did large banks expect to profit from subprime loans? why did they become bankrupt? Why did the process lead to losses instead of the profits envisaged? how did the losses spread to other investors? The questions can be broken down to the following smaller enquiries that the player will eventually take away from the game.

- *On Money flow from individuals to investors & vice versa*
- *On Investor and Investments*
- *How does CDO design buffers losses from Subprime loans, and makes the location of risk difficult to track?*
- *What circumstances pushed the boundaries of the buffer?*
- *How did the Credit Default Swap accelerate the fall of banks?*



FigA.5: Schematic of the Home Loan Financial Market

On Money flow from individuals to investors & vice versa

Banks provide services to customers and in turn charge a fee. If the service is a mortgage loan, the fee is the interest rate charged on the loan. To provide such a loan, a bank should have money. But a bank can have only a limited amount of money. If it needs to grow its business, it needs a greater supply of money, which the banks get by borrowing money from a third party or an investor. The amount of external party debt held by the bank is known as leverage. Yearly cash flows are generated by the interest received from the bank's customers (who had taken mortgage loans). A part of this cash flow is paid to the investors as the bank's payback to the loan taken from the investor by the bank.

Under normal circumstances, the cash flow would not only payback the bank and investors; both parties would make a net profit on the amount they lend. During the Sub-prime crisis, the cash flow decreased as borrowers defaulted on their payback. Since the banks had borrowed beyond their net worth from investors, they were unable to payback the investors.

In the game, players can experience leverage by selling more and more flowers to the greater giants in the flower exchange. The more flowers they sell, the more probability for bankruptcy if the Jacks default on their loan. They will be able to see how much they actually own in the last step of the game where they have to payback the investors and will see a loss of water.

On Investors¹⁰ and Investments

An investor is someone who has money and wants to put that money in a saving which will increase that money over time by paying an interest. What differentiates an investment from putting money in your bank's savings account is the fact that the interest rate received is usually higher, but the amount of time one has to commit the money for is also of a longer duration. You cannot claim it at any time,

10 <http://en.wikipedia.org/wiki/Investor>

like you can from a savings account. Investments also have a rating assigned to them by a rating agency such as *S&P and Moody's*¹¹. The ratings help an investor decide whether or not he wishes to commit money to the investment.

While many investors are institutions or high net worth individuals, everyday people also contribute to investments either directly through mutual funds or indirectly by their payments to pension funds, education funds, municipality taxes or health insurance. These investors seek investments that maybe low risk but pay less interest or high risk with higher returns on interest. They can also be classified according to the duration of time for which they wish to commit their money to the investment. For example, a pension fund doesn't need to payback its clients that quickly, so it might prefer to put than money into a long-term investment.

In the game, the player can sell his flowers to other giants (investor) in the flower exchange. The flower exchange will display a range of giant types and their specific needs with regards how much water they want to make and how long they are ready to wait for it.

How does CDO design buffers losses from Subprime loans, and makes the location of risk difficult to track?

How much the investor receives depends on the type of cash flow the investor has subscribed to. This subscription is known as a *security*¹². A security can be of different types depending on how it represents its monetary value. A debt security is a type that is issued for a fixed term and can be redeemed after the term is over. Depending on when they can be redeemed and other characteristics, they go by different names. For example, consider the dollar bill. It's a security that says it's worth a dollar and no more and it's instantly redeemable. A security that depends on mortgage payments (Mortgage-Backed Security or MBS) is redeemed after a stipulated period of time and pays more

11 <http://www.investopedia.com/terms/r/ratingservice.asp>

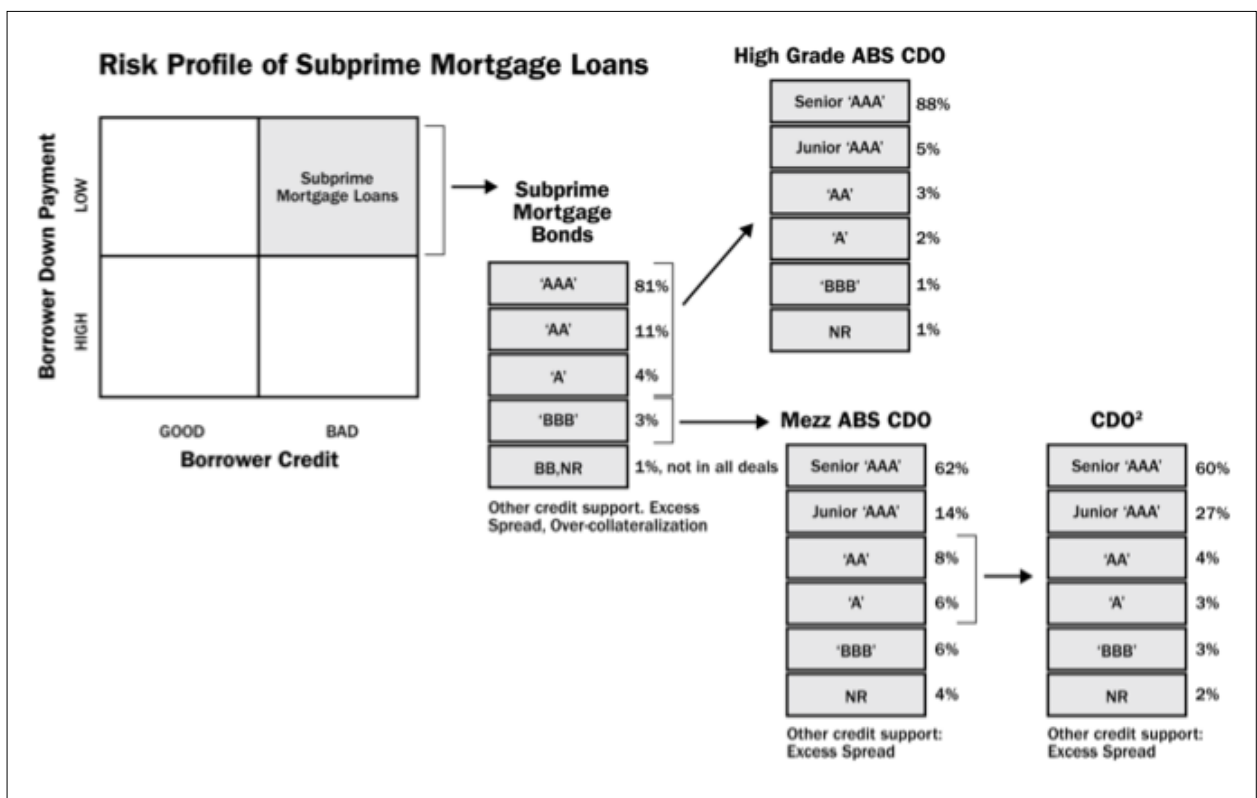
12 <http://www.investopedia.com/terms/s/security.asp>

than you put in it as interest. A dollar bill also loses or gains value depending on how the US economy is performing. Similarly a MBS gains or loses value depending on how the mortgages payments that provide it cash flow are performing. So if someone defaults on the payment, the value of the security will deteriorate.

Another way of creating a security that depends on assets as its source of cash is the Collateralized Debt Obligation (CDO). But the security and mortgage payments are not directly related. Money earned from a CDO depends on the cash generated by MBS pools that receive cash from mortgage loan payments. This indirect relation allows for:

(a) *Tranching - flexibility in terms of rating and time of maturity*

Tranching allows for flexibility for the investor in terms of rating and time of maturity and returns on the security. It also means that irrespective of where the tranche is getting money from, if you have purchased a higher rated tranche, you will get your money back as a higher rated tranche will get paid first from a 'pool' of loans backing



FigA.6: Tranches of a CDO (Diagram from 'The Panic of 2007' by Gary B.Gorton (Pg 35); <http://www.nber.org/papers/w14358>)

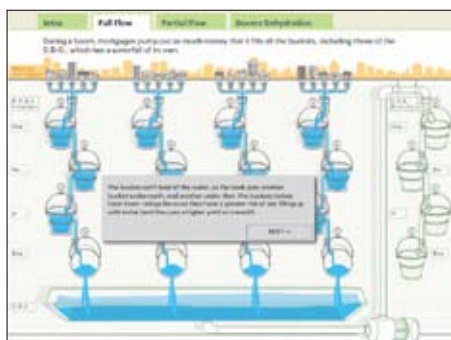
it. These investors were secure about their investment because they only concerned themselves with the rating, not the loans from where the money was coming.

In the game, the player receives a flower from a Jack as a promissory note that outlines how much remuneration can be expected from the Jack over a period of eight years. A couple of such flowers together are like an MBS. The player is expected to mix and match the petals from the flowers according to their payback capacity or borrower type (reflected by color), and by the year of payback (reflected by their number) to make a new flower that resembles a tranche of a CDO. The tranches will have a rating determined by the composition of colors and will be redeemable in the year that is stated on the petal.

(b) Diversification and Credit Enhancement – cushioning defaults

Now, a higher rated flower will have more green petals (indication of a Prime borrower). It may be mixed with a yellow flower (Alt-A borrower) or red flowers (Subprime borrower). Together they have reduced risk than just a red flower but more payback than just a prime flower. This mix and match reflects the concept of Diversification.

The red flower will pay more interest than green flowers owing to the lender assuming greater risk in case the borrower defaults. This process reflects the concept of Credit Enhancement.



FigA.7: Screenshot from “What’s a CDO?”. The interactive application from Portfolio.com demonstrates the concept of a ‘Payment Waterfall’.

(c) Payment Waterfall – Higher rated tranches are paid first, or the lower rated tranches absorb the risk of payment default;

In the last phase of the game, greater giants (investors) with the higher rated flowers claim the clouds first.

What circumstances pushed the boundaries of the buffer?

Diversification and credit enhancement cushions the payment waterfall model from defaults only when defaults are few. The model breaks when a nation defaults as even higher rated tranches suffer from reduced cash flow, as witnessed during the Sub-prime crisis.

In the game, if a Jack defaults, the whole flower will experience a drop in value based on their hierarchy of risk (rating). If few flowers default, it's not a concern as the risky flowers get more return for their risk and can shoulder the burden. But a massive default will lead to even the higher rated flowers to downgrade since it's the whole flower downgrading, not just the petal.

The conditions for a massive default were created as lenders ignored underwriting practices and/or did not keep a check on the underwriting practices of brokers whom they hired to market the loans. Some of the lenders themselves, like *Countrywide Financial*¹³ indulged in rash underwriting. Secondly, the whole model was dependent on rising home prices. If a borrower defaulted, the bank would still hold an asset that was more expensive than the loan taken out. Yet the reckless lending led to supply becoming greater than demand and house price declined. That led to foreclosed homes costing less than the value the bank initially provided homeowners with. It became a negative investment for the bank.

How did the Credit Default Swap accelerate the fall of banks?

Credit Default Swaps are a kind of insurance. The difference is that in a regular insurance, say a car, the person owning the car pays for the insurance and holds claim to it if a car undergoes an accident. In the case of a Credit Default Swap, people unrelated to the car can also purchase an insurance on it, based on their belief that the owner will crash the car someday. Thus, a CDS is a tool for speculation. It's also unregulated, so no one really knows how many claims to a financial security are floating around. Lastly, the responsibility for paying a CDS claim can also be traded. So the institution one purchases a CDS from may not be the institution that pays the claims. Locating the agency from whom the claim needs to be reimbursed can become tricky for an investor.

During the Sub-prime Crisis, AIG had issued many CDS for the

13 www.nakedcapitalism.com/2008/01/goldman-sued-on-countrywide.html

securities held by Lehman Brothers. Claims on those securities made AIG bankrupt, a day after the collapse of Lehman Brothers. This idea in the game is modelled in the flower exchange. An investor may purchase a special flower if insurance is also offered. Other investors may want to purchase insurance for the same. It up to the player to concede or deny. In case of default, the player will shoulder loss in water. If too many CDS are sold, it can bring down the player's water resource causing him to go bankrupt.



FigA.8: Fairy's icon in the game

A.3. Fairy's Perspective

The Fairy's perspective deals with the government's rules and regulations that affected the home loan industry and the financial markets supported by it. This perspective addresses the how events effect the Fed Funds Rate, formation of bubbles and financial de-regulation in context of the Subprime Crisis.

- *Fed Funds Rate and its effect on interest rates*
- *Whats a bubble and why did we have a housing bubble*
- *Financial de-regulation and its roots in the Great Depression*

Fed Funds Rate and its effect on interest rates

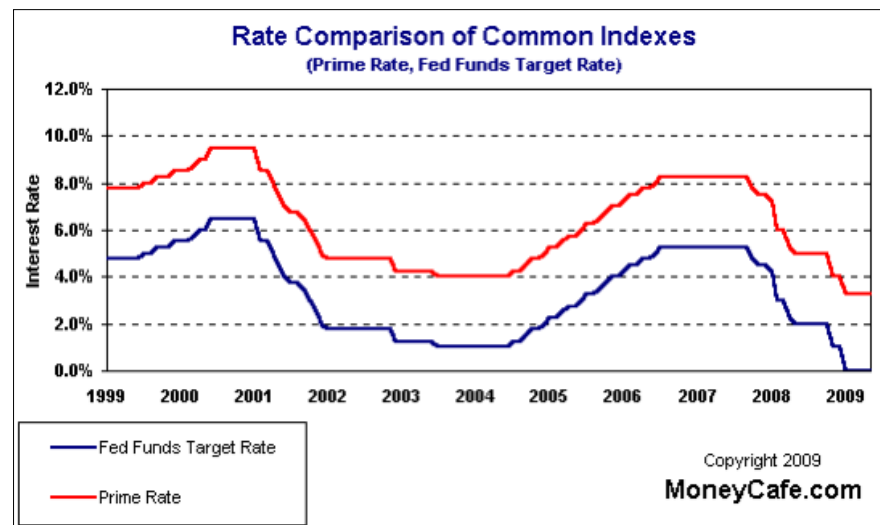
Excerpt from *The Federal Reserve*¹⁴ website, "The term 'monetary policy' refers to the actions undertaken by a central bank, such as the Federal Reserve, to influence the availability and cost of money and credit to help promote national economic goals. The Federal Reserve Act of 1913 gave the Federal Reserve responsibility for setting monetary policy.

The Federal Reserve controls the three tools of monetary policy - Open Market Operations, the Discount Rate, and Reserve Requirements. The Board of Governors of the Federal Reserve System is responsible for the discount rate and reserve requirements, and the Federal Open Market Committee is responsible for open market operations. Using the three tools, the Federal Reserve influences the demand for, and

14 <http://www.federalreserve.gov/monetarypolicy/fomc.htm>

supply of, balances that depository institutions hold at Federal Reserve Banks and in this way alters the federal funds rate. The federal funds rate is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight.

Changes in the federal funds rate trigger a chain of events that affect other short-term interest rates, foreign exchange rates, long-term interest rates, the amount of money and credit, and, ultimately, a range of economic variables, including employment, output, and prices of goods and services”.



FigA.9: Relation of Prime Rate and Fed Funds. Prime Rate plus a margin constitutes the interest rate of a mortgage loan. Its used as the index in calculating rate changes to adjustable rate mortgages (ARM) and other variable rate short term loans.

After the 9/11 tragedy, Alan Greenspan, the running Chairman of the Federal Reserve reduced the Fed Funds Rate to 1%. The low interest rate increased the flow of money into the economy as it encouraged banks to loan money to one another. Yet the low rate deterred investors from putting money in Treasury securities (since their return was only 1%, while investors were looking for higher returns). While this action is not to blame for the crisis, it explains one of the reasons why banks had increased lending.

Whats a bubble and why did we have a housing bubble

Bubbles occur when prices continue to rise simply because enough

investors believe investments bought at the current price can subsequently be sold at even higher prices. They can occur in virtually any commodity including stocks, real estate, and even tulips (from the *Financial Dictionary*¹⁵).

This is not explicitly said anywhere, but my take on the issue is that we specifically had a housing bubble because certain *amendments*¹⁶ (from 1989 to 2007) in the Community Reinvestment Act (CRA) created a market for Subprime securities, a fact that fueled competition. The CRA was passed in 1977 to address the borrowing needs of lower income and minority groups. These groups suffered from discriminatory credit practices such as Redlining. The law, however, emphasizes that an institution's CRA activities should be undertaken in a safe and sound manner, and does not require institutions to make high-risk loans that may bring losses to the institution¹⁷.

As Gary B. Gorton mentions in his paper, "The key security design feature of subprime mortgages was the ability of borrowers to finance and refinance their homes based on the capital gains due to house price appreciation over short horizons and then turning this into collateral for a new mortgage (or extracting the equity for consumption)". This feature led to a flurry of people purchasing homes to sell them off to someone else for a profit. The result - house prices kept inflating.

Financial de-regulation and its roots in the Great Depression

Refers to deregulation as brought upon by the Financial Services Modernization Act of 1999, also known as the Gramm-Leah-Bailey Act. More information at *Wikipedia*¹⁸; at *World Socialist wesbite*¹⁹.

15 <http://financial-dictionary.thefreedictionary.com/bubble>

16 http://en.wikipedia.org/wiki/Community_Reinvestment_Act

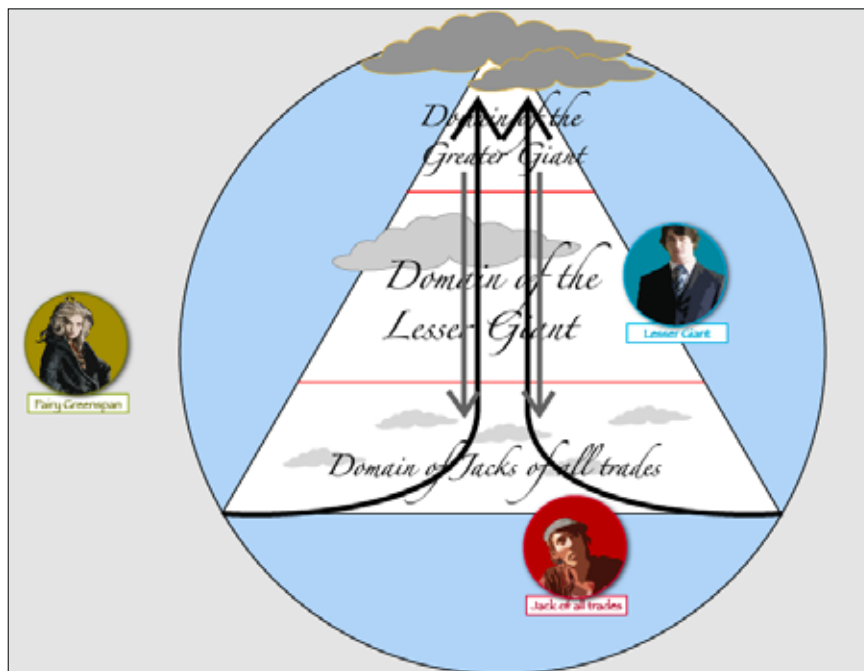
17 <http://www.federalreserve.gov/dcca/cra/>

18 http://en.wikipedia.org/wiki/Gramm-Leach-Bliley_Act

19 <http://www.wsws.org/articles/1999/nov1999/bank-n01.shtml>

APPENDIX B - THE WATER CYCLE

The Water Cycle refers to the flow of water or resource in Rafflesia. Its a metaphor for the flow of money from investors to individuals in a capitalist economy.



In Rafflesia, water is the resource of the land and is transferred amongst the denizens in the form of clouds. Clouds are produced when Jack's tend their beanstalks (go to work). A healthy beanstalk will release clouds which the Jack can use to support his dreams, like a house (refers to what money can buy), or send higher up to be kept safe by the giants (the banker if you're putting money in your savings account, but an investor if you're putting money in your pension fund for example). If a Jack needs clouds for something he doesn't have enough clouds for, the giants can let him borrow from the pool of clouds on the promise that one day Jack will return the clouds.

The Fairy balances the water cycle of Rafflesia, by making sure that all its denizens have healthy beanstalks (or get enough water - refers to the supply of money in the system). Though she has no control of the crazy weather of the land, she makes sure that no one incurs loss of clouds in case of dire stalk-bending calamity (world or local events that affect the economy).

APPENDIX C GAME INFO-ARCHITECTURE DIAGRAM

```

myGame()
onClick()
>> remove current screen
>> addChild newGame()

```

newGame()

```

constructor function()
(created once)

>>generate databases
>> addChild(rules)
>>addChild(lending)
>>addChild(flowerExchange)
>>addChild(powerClub)
>>addChild(reaping)

```

rules()

```

-has graphics
-has static text
-onClick():goto lending

```

lending()

```

water tank area()
-adds water tank

```

```

water tank object()
-has shape (masked)
-has color
-has some amt of water
(that determines height of shape)

```

```

borrower field object()
-has size
-has position
-add jacks()+assign properties

```

```

borrower object()
-has shape
-has ID
-onHover():load profile
-onClick():change color
-has fico :create flower
-has payback :minus from tank obk

```

transparentObject()

```

-shape()
-makes flowerDisplay non-interactive

```

flowerDisplayObject()

```

-displays flowers contained in the flower database
-has size
-has position

```

flower object()

```

-adds Petals
-transfers jack prop to petal

```

```

petal object()
-has shape
-has ID
-onDrag():move
-stopDrag():dont move
-has payback
-snapToTarget():
-has rotation

```

borrowerDatabase()

```

-static
-created once
-gives values to borrowerObj
-gives values to flowerObj

```

flowerDatabase()

```

-dynamic
-gives data to flowerDisplay()
-keeps track of value in each petal

```

cdoDatabase()

```

-gives CDO ID
-keeps track of year of repayment
-keeps track of investor

```

flowerExchangeObject()

```

flowerDisplayObject() -displays flowers contained in the flower database

```

flower object()

```

-petal object()

```

dropTarget obj()

```

-petal object()
-hit test
-snap petal to x,y, rotation

```

CDOobject()

```

-has worth
-has rating
-has ID
-has insurance

```

petal object()

```

-burton()
-send data to CDOdatabase

```

theMarketObject()

```

-has size
-has position
-adds investors
-sends into to CDO database

```

```

investorObject()
-has kind (decides which year he wants)
-has initial worth (static)
-has final worth (dynamic)
-listenForCDO(): hit test. If true(check year OR type owned : its an array)

```

powerClub()

```

power Object()

```

endScreen()

```

cloudObject()

```

reaping()

timer object()

```

flower object()

```

petal object()

water tank object()

springObject()

```

CDOobject()

```

```

petal object()

```

theMarketObject()

```

investorObject()

```


BIBLIOGRAPHY

Gorton, Gary B. *The Panic of 2007*. Working Paper 14358, National Bureau of Economic Research.

www.nber.org/papers/w14358

This American Life - The Giant Pool of Money (episode 355)

www.thislife.org/radio_episode.aspx?episode=355

Federal Reserve Bank of New York (FRED)

www.newyorkfed.org/index.html

Board of Governors for the Federal Reserve System

www.federalreserve.gov/

United States Senate

www.senate.gov/general/search/search_cfm.cfm?q=subprime+&site=default_collection&num=10&filter=0&x=9&y=10

Federal Deposit Insurance Corporation (FDIC)

www.fdic.gov/

Mortgage Information Service - Mortgage X

<http://mortgage-x.com/>

Investopedia - Encyclopedia for finance students and experts

www.investopedia.com/

Community Reinvestment Act

www.policylink.org/EDTK/CRA/action.html

<http://www.ffiec.gov/CRA/>

<http://www.treas.gov/press/releases/report3067.htm>

Calculated Risk - Finance and Economics Blog

www.calculatedriskblog.com/2008/08/subprime-and-alt-the-end-of-one-crisis.html

Irvine Housing Blog

www.irvinehousingblog.com/analysis/

The New York Times - Index of most articles

http://topics.nytimes.com/top/reference/timestopics/subjects/c/credit_crisis/index.html

CBS News - Bubble

<http://www.cbsnews.com/blogs/2009/05/08/business/econwatch/entry5002380.shtml>

Berkshire Hathaway, Warren Buffet

www.berkshirehathaway.com/

Bransford, John. et al *How People Learn*. Brain, Mind, Experience and School. Chapter3 - Learning and Transfer.

www.nap.edu/openbook.php?record_id=6160

Becker, Katrin. *The Pedagogy of Commercial Games*.

www.slideshare.net/becker/the-pedagogy-of-commercial-games

Becker, Katrin. *The Pedagogy of Commercial Games*.

www.slideshare.net/becker/the-pedagogy-of-commercial-games

Becker, Katrin. *Understanding Learning Design in Commercial Video Games*. Phd Dissertation. Chapter4 - Games and Pedagogy

www.minkhollow.ca/Thesis07/doku.php?id=thesis:ch04

Salen, Katie and Eric Zimmerman. *Rules of Play*. MIT Press.

<http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=9802>

Ian Bogost. *Water Cooler Games*. Blog - Educational Games Archive

www.watercoolergames.org/archives/cat_educational_games.shtml

Economics - Classroom Games

<http://people.virginia.edu/~cah2k/papers.html>

User Interfaces - CS1 Spring 2009 - University of Berkeley

http://vis.berkeley.edu/courses/cs160-sp09/wiki/index.php/Main_Page

Webster, Steve, Sean McSharry and Todd Yard. *Foundation
ActionScript 3.0 with Flash CS3 and Flex*. Friends of ED copyright.

www.friendsofed.com/book.html?isbn=9781590598153

Actionscript 3.0 Language and Components Reference

<http://livedocs.adobe.com/flash/9.0/ActionScriptLangRefV3/>