BILL: A Financial Consultant for the Less Fortunate

Luyi (Louis) Huang, Winn Cui, James Young, Richard Xu, Dongjoo (Jay) Shin
Electrical Engineering and Computer Sciences
University of California, Berkeley
{mister.springroll, winn.yc, jyoung96, richardxu, sdjinn111} @berkeley.edu

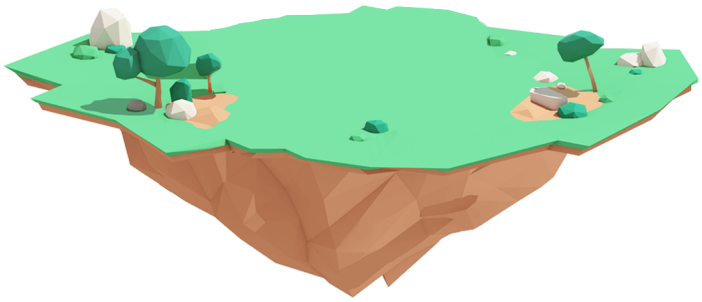

Figure 1. Three-Dimensional Virtual World. This view is created by Javascript Animation library. After setting up a financial goal, an animated object will appear in the virtual world with a progress bar. Users could visit this mode and keep track of their goals easily.

ABSTRACT

Many of us need help to manage finances. Finances can be boring for some people, and financial advisors can be costly for lower-income people. Thus, our goal is to make finances more fun and more accessible for people like blue-collar workers and stay-at-home people who struggle more to find financial help.

This is where BILL comes in. BILL is a virtual financial consultant geared for lower-income workers, free of charge. BILL provides new ways for users to manage their personal finances by: 1. providing personalized conversational interactions, and 2. allowing the user to keep track of their purchases in a virtual world. Finally, users can store cash, credit cards, and receipts in a "smart wallet" that automatically sends this information to BILL, providing a more natural interaction for users to handle their money.

Author Keywords

Virtual reality; finance; dialogue agent; ubiquitous computing; data visualization; smart wallet.

ACM Classification Keywords

H.5.m. Information interfaces and presentation: Miscellaneous; D.2.2. Design Tools and Techniques: User interfaces.

INTRODUCTION

Money is undoubtedly one of the biggest stressors in our lives, and getting personal finances in check is no easy feat. Therefore, people need serious app to help manage their money. From tracking daily spending to planning new investment strategies. Most of financial app on the market do not meet all of the user need at the same time, they either do not provide users a motivation to use them continuously or does not take the responsibilities as a financial consultant properly. In our implementation, we will mainly aim to target and solve the issues which exist in the current financial consulting services, which are time, cost, and lack of fun. Through human-centered design and iterative design cycles, we have developed a high-fidelity prototype of BILL, a virtual financial consultant. Through the three modes of scanning, consulting, and virtual world, users could easily input

and get the needed information as well as keep track of their finances conveniently.

RELATED WORK

There are a variety of companies and organizations who have developed or are developing a financial app. We describe some of the work below and discuss our inspirations from these apps.

Penny

Penny is a basic budgeting app for users to better manage their finances[1]. We drew heavy inspiration from this app, especially the idea of a virtual AI consultant. However, it was limited to a basic chat system, thus we wanted to expand upon an immersive world concept.

Starbutter

Similarly to Penny, Starbutter is also a financial app which mainly bases on a chat window[2]. Users type in textual information to interact with the machine learning based intelligentized chat bot. Even though it solves the issues of time and cost, there is still not a strong motivation to continuously use a financial app.

Mint

Mint is an all purpose financial app. Unlike Penny of Starbutter, it does not have an AI consultant mode. Instead, it displays a predetermined number of views that parses your bank transactions in an intelligent manner[3]. Mint is where we drew inspiration from for figuring out how to display financial information through graphs and statistics. This is especially pertinent towards our AI/Reports mode.

DESIGN OBJECTS

In order to better deliver our design to targeted group, we have created a hypothetical persona to avoid design for everyone and emphasize on the needs of a specific group. Furthermore, our design is set around the three main targeted issues, which are cost, time, and fun.

Target User

Our target audience consists primarily of lower -income or unemployed citizens such as blue-collar workers and stay-at-home spouses or parents. Blue-collar workers typically cannot afford a financial advisor with their income, and stay-at-home people do not have time to meet with financial advisors in-person[4]. Thus, BILL will be provided free-of-charge and will operate online, providing 24/7 availability anywhere with an internet connection.

Persona Definition

Justin Nguyen, age 35, business analyst assistant at a local startup. Justin has been a business analyst assistant for eight years, after working at multiple startups and other companies after graduating from a community college with an associate degree in business. Originally, he was an immigrant from Vietnam, having moved to the United States with his parents at the age of 6. Their family moved to the United States due to financial hardships in Vietnam and used all of their assets to start a small restaurant business in Hayward, CA. The family's financial struggles compelled him to try hard in school and due to the complicated financial situations, he ended up to get an associate degree in business that he thought would give him a fast route to financial freedom that his family tried so hard to attain. Justin eventually plans to go back to school to get his bachelor degree in business or a professional certificate in business administration to fulfill qualifications for a higher level job or to start his own business respectively.

Although Justin was studious in high school and college, he was also very sociable and met a plethora of people. Some of these connections lead him to his first startup jobs and got his foot in the door at the current company he was working at, but most of them were friends he made through the different organizations he joined in college like model UN and consulting clubs. Financially, his friend Sheldon helped him plan out his budget and assets in college and encouraged him to make wiser financial decisions such as cooking more to eat out less and not spending as much money on wants rather than needs. Even after college, Justin has asked Sheldon for help with his finances regarding onboarding pay, asking for raises, and planning for his own 401k and investments and his family's financial future.

Justin is currently married with no children and no plans in having children for the next couple of years.

His wife of 6 years, Samantha Nguyen, is 33 and also has a job as an office worker for a local startup. They still live in Hayward, CA because both of their parents live there but enjoy their physical freedom and have an apartment about 20 minutes away from their parents. Occasionally, Justin has had to lend his parents some money to renovate their business and some emergency funds to help them through difficult financial times, for example through the financial depression in the early 2000s.

Currently, both Justin and Samantha and their respective families, but apart from a small emergency fund, they're living check by check. Justin is trying to save up in the case that he decides to go back to school for a higher education degree, most likely a master's. They prefer to talk about their finances between themselves occasionally asking their friends, such as Sheldon, for advice. Their main costs, come from rent, groceries, and other cost of living things which is pretty high in their area, but they have enough funds to occasionally go on trips and recreational activities.

Narrative Scenarios

We have sketched the following narrative scenarios to better implement our human-centered design and design features to meet the needs under different scenarios.

Scenario I: Evaluate Financial Situation

Justin is working and his boss calls him into his office; surprisingly, his boss offers a raise with some additional responsibilities. Unfortunately, he doesn't know how much about being offered raises so he asks for some time to think about the offer. That night he brings it up to his wife, Samantha, and they try to weigh the costs and rewards of the situation and even call up Sheldon to discuss some advice. Unfortunately, the cost of talking with an actual financial advisor is too high so they would prefer just to keep it between themselves. Ultimately, after dwelling on the raise for a couple of days, he responds to his boss and accept the raise.

Scenario II: Information Sharing

Justin wakes up and gets a call from his mom asking for some temporary funds to do some renovations and improvements to their family restaurant. He tells her to let him talk to her wife about it, although his parents have done this many times in the past and has always paid Justin back within 3 months because asking Justin is easier and cheaper than getting a loan from the bank. When talking to his wife, she brings up the fact that they've been doing this a lot recently, but ultimately agrees to help out without much resistance.

Scenario III: Keeping Track of Financial Goals

Justin is starting to think more seriously about higher education, especially after experiencing the responsibilities added on because of his raise. After looking at options online, talking to college advisors, asking Sheldon and his wife for advice and options, he decides to start an extra savings account for his prospective master's programs. Looking at the rate of interest and probable income, he will probably get enough to start applying in 3 years, which he is slightly dissatisfied with but sees no other options for.

USER STUDY

With current goal is to address cool media and social issues by designing a virtual public financial consultant, we have various ideas for the central computational component, such as an intelligent dialogue agent for financial consulting, or an in-app virtual environment to visualize one's goals for financial pursuits. In this section, we address our structured interviews, observational studies, task analysis, defining a persona, and draw several sketches for our potential app.

Interview Protocol

Setup

We conduct a total of 4 interviews. Our interviewees range from 24 to 67 with a mean of 43 years old. All interviewees are randomly chosen from Starbucks located in Berkeley, CA. Before the interview, we first briefly introduce ourselves and the guideline of the course project. After obtaining the permission to conduct the interview, we ask users structured interview questions, which are mainly about the employment status, financial situation, whether they use have a financial consultant, and the degree that how much they believe an AI financial consultant

could replace human labor some day. After validating the responses and thanking to the intreviewees, we reformat the interview notes and synthesize the following interview insights.

Insight 1: Time is Money

For the first two interviewees, they understood that some of their current financial investments might not be optimal (i.e. spending money to repair an old car). However, it would take too much time to consider alternatives. Time is a valuable resource, and it's one that people constantly take into account for their financial endeavors.

Insight 2: The Medium is the Message

Often, the medium through which an idea is conveyed is more important than the message itself[5]. All three interviewees admit that presenting data in a simple and clear manner is the best option. Finances are an important matter for people, and not something they make too complicated. However, if one is to learn to manage finances, then the interaction becomes more important.

Insight 3: Privacy is Unignorable

The other important part we conclude from the interview is that it is important to protect users' privacy as well as information safety. Since financial information could be someone's most secret information, it is suggested to have technology-based methods to protect the information.

Observational Study

Set Up

With a variety of available financial apps in the market, we want to identify user interactions with the current existent financial apps. In this observational study, we have invited two participants to participate in the study during which process participants will use the financial app Penny, which is an application based on natural language processing and machine learning, and tell us about their thoughts while using the app. The think aloud process helps us to get the real time feedbacks about user interactions with the current financial app.

Insights

While users are using the app, they think it is convenient to interact directly with machines because they think machines do not have slips and could get the answer efficiently. However, the major concern is that Penny is based on a chat window so that users could easily lost interest in using the app because of the monotonic routine. Thus, concluding from our observational study, we finalize the idea of gamifying financial app, which means to make financial app fun and attractive.

Task Analysis

Using task analysis in design could reduce biases from the designer. We first collect preliminary data about personal financial activities, then identify knowledge representations, apply focused knowledge elicitation methods to predict user behaviors, verify the behaviors, then document it.

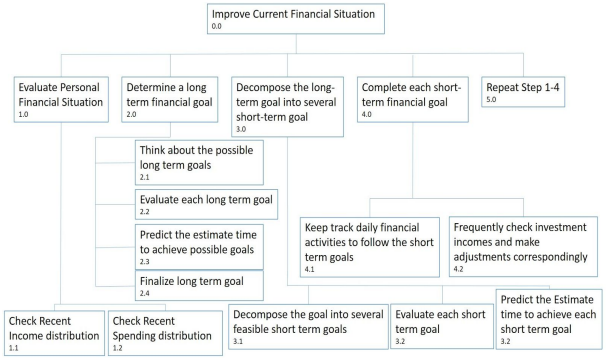

Figure 2. Tasks Analysis Tree Diagram. It shows the expected behaviors users have when thinking about financial goals.

IDEATION

At this stage, our current goal is to address cool media and social issues by designing a virtual public financial consultant. We have various ideas for the central computational component, such as an intelligent dialogue agent for financial consulting, or an in-app virtual environment to visualize one's goals for financial pursuits. In this report, we synthesize our insights from interviews and observations into design ideas.

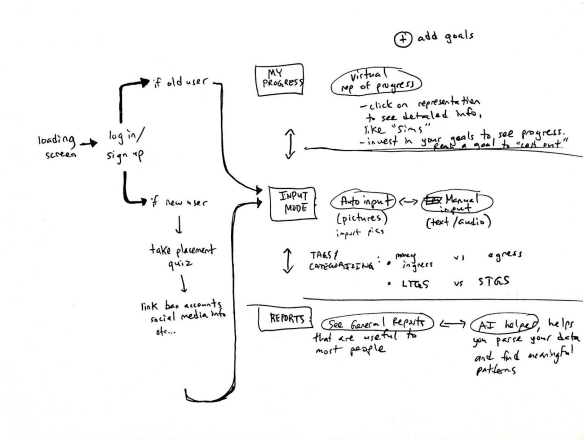

Figure 3. Outline of User Interface Relationships. Created using Adobe Illustrator. In our initial sketch, we have decided to include three major modes, the mode for data inputting, the mode for financial consulting, and the major mode for building a virtual world and keeping tracking of financial goals.

LOW-FIDELITY PROTOTYPE

During the early stages of developing, we have used low-fidelity prototypes, such as wireframes, storyboards, and paper mockups to examine our user interface design ideas and get feedbacks from our targeted users, who are randomly chosen at Berkeley public library.

Ideation Sketch

We identified three main modes that would be important to a financial service app. The method of input, the visualization of progress, and the aggregation of meaningful data to see spending habits, saving habits, and more. For the image above, we did two very quick sketches for each mode to try to encapsulate the essence of the mode. That is, to try to capture most of the features relevant to that mode.

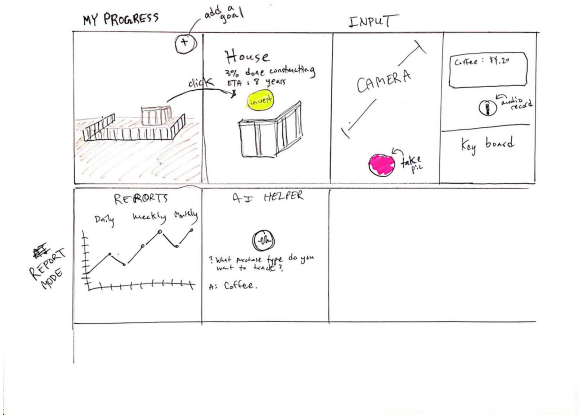

Figure 4. Low-Fidelity Ideation Sketch. It shows some key features of different modes, such as the virtual object in virtual mode, the voice and camera input method, and the graphical representation of numerical data.

World Mode - Wireframe

The World Mode is meant to give a visual indicator of savings progress. A User can add a goal, and watch their goal build, grow, or evolve as they save more money into each corresponding bin. The unique feature of this mode is that once a User invests or spends money on their goal, they agree to restricting access to that money until they hit their goal amount.

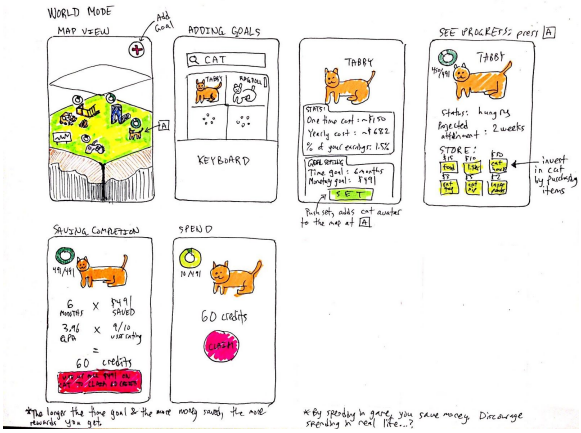

Figure 5. Low-Fidelity WireFrame - World Mode. It shows that how users interact with the virtual world and after users choose a virtual object, how detailed information are displayed.

Report Mode / AI Mode - Wireframe

In our reports section, the user is presented with two input fields: a way to view spending in a certain category and a way to specify how they want the data presented. Once the options are chosen, a resulting data visualization will display. From here, the user can specify how far back they want to see trends in different time frames. The image on the left shows flow from one screen to another, while the image on the right shows nicer examples of potential data visualizations.

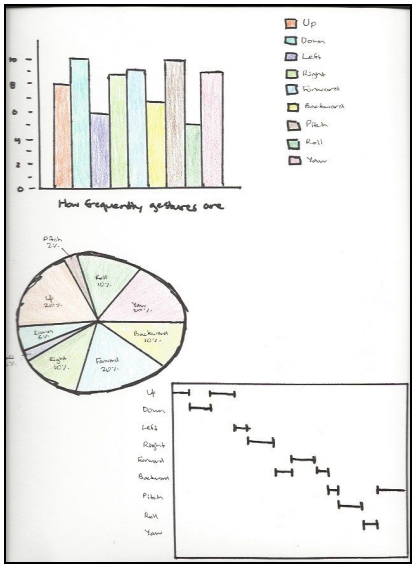

Figure 6. Low-Fidelity WireFrame - Report/ AI Mode. It shows how numerical values could be represented into graphs.

Input Mode - Wireframe

Input mode will default to the camera screen, so the user can take or import a picture of a receipt to analyze its contents. The User can also access the AI Assistant to input more details about a specific purchase. The status screen keeps track of all transactions as reported by the bank. Each transaction requires a further linking of a receipt or other proof of purchase. If all transactions are accounted for, a streak counter will start.

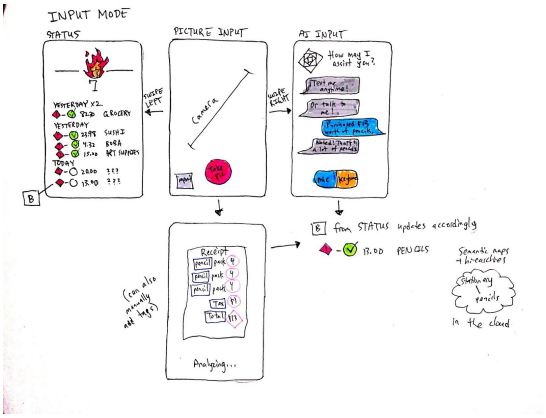

Figure 7. Low-Fidelity WireFrame - Input Mode. It shows how users could switch between different input methods.

Storyboard - Scenario II

This storyboard details the interactions between two users of a joint account, Justin and Samantha. In the first row, we can see how users could retrieve their recent financial report from the app. After verifying their identification for safety check, all users from a joint account could view the information in their shared account. The second row of the storyboard shows how users could request to send a summarized copy to all devices they own. Users could easily access the information from every device through a network. In the next box, we can see how financial data could be represented into graphs for better understanding of the users. In the scenario, users acquire the mutual agreement after evaluating their financial situation together then agree to provide their mom temporary funds.

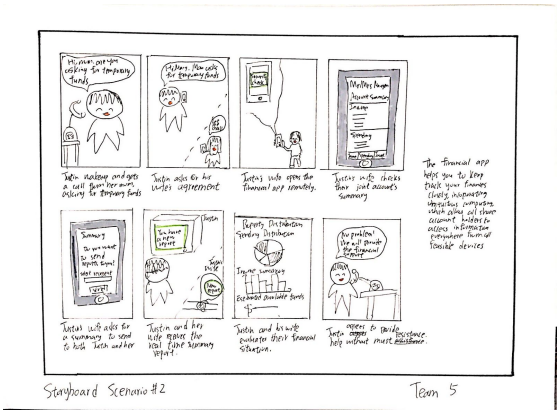

Figure 8. Low-Fidelity Storyboard- Scenario II- Information Sharing

Feedback

During the critique, our potential users suggest that it will be better to allow users from have a privacy setting to allow some personal privacy for finances. In addition, users also suggest that for the three modes for our design, it will be better if users could achieve summarized information quickly from a graphical interface. When users want more information, they could ask the detailed information from the intelligent AI financial consultant.

Storyboard - Scenario III

This storyboard details the interactions between the virtual assistant and Justin, the user. In the first row, we can see the common voice interactions between Justin and the assistant to find the optimal choice, in the example breakfast options, that aligns with the financial goals that he has set out. In the next boxes we can see examples of the report, world and input modes and how Justin would interact with each. Below, we can see how to change modes and along with the visual impact of the modes, how he would interact vocally with the agent as well. We can also see a short example of the input feature to itemize a recent purchase.

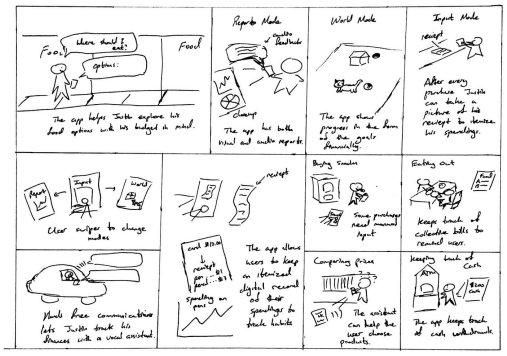

Figure 9. Low-Fidelity Storyboard- Scenario III - Keep Tracking Financial Goals

Feedback - Storyboard Scenario III

Some feedback some potential users gave us about this storyboard was that it seemed somewhat burdensome to talk to the app especially in public where they wouldn't want their financial information disclosed. They also suggested that the input mode could be somewhat streamlined to incorporate less steps for the user when dealing with cash, venmo and group purchases. Overall, the users did enjoy that the app acted as a personal agent rather than an unemotional app.

COMPUTATIONAL BACKEND

We have used a Javascript animation library (anime.js)[6], Jquery library, and websocket to build a functional prototype. Due to the limited time to develop the intelligentized features, we used websocket to send Jquery data to trigger different events.

FEATURES

World Mode Design

World Mode acts as both the Home page and the primary view of our app contains the majority of our interaction. Every time the user wishes to interact with a certain feature (i.e. the camera or the AI mode), they would click the icon in the world and it would take them there. This simulates a user interacting with an environment.

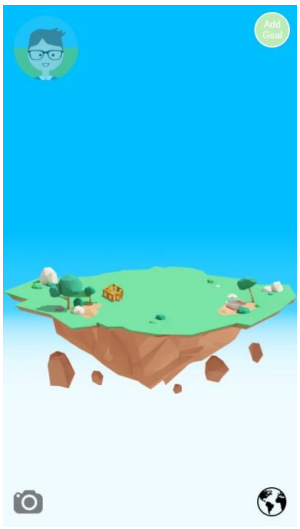

Figure 10. World Mode User Interface. Developed using HAML, CSS, Coffeescript, and Anime.js.

Artificial Intelligent Agent Mode Design

AI/BILL Mode allows users to ask questions about their transactions, request data visualizations, or ask for set reminders about when to pay certain bills (no pun intended). It is set up like a chatbot and users can

interact with BILL either through voice or text input. Meanwhile, Bill responds with either text or photo feedback.

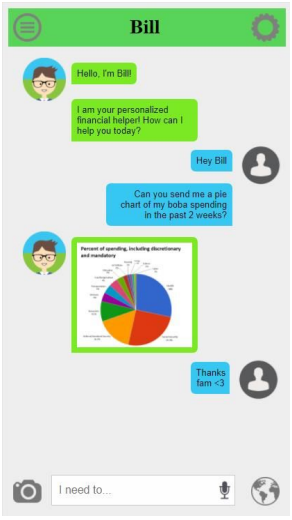

Figure 11. Artificial Intelligent Agent Mode User Interface. Developed using HAML, CSS and Coffeescript.

Input Mode Design

Input mode allows users to take pictures of receipts, account transactions, etc. and store them in the app if necessary. From here, they can also access the World Mode by clicking on the icon in the bottom right corner. On the top left, users can click on the BILL icon to access the chat mode.

Figure 12. Input Mode User Interface. Developed using HAML, CSS and Coffeescript.

Summarized Changes

Initially, we identified three key features that we believed would be necessary to create our intended financial service. We identified that 1) the method of inputting financial data into our system is key to our service's accuracy; 2) the intuitiveness and ease of use of our service by users is key to lowering the barrier of entry towards financial literacy; and 3) to maximize the positive effects of our service, we need to build habits and encourage the use of our service in everyday life. These three features led us to initially develop three "modes" of our app: 1) Input Mode; 2) AI/Reports Mode; 3) World Mode.

After receiving feedback, we decided to try to combine the different modes to increase intuitiveness of our application. Since World Mode was the most unique and open towards modification, we made World Mode our default screen, and incorporated more seamless ways to access the other Modes from the default screen.

LOGO DESIGN

Initial Logo Design

The character in the logo is named Bill, who is our virtual financial consultant. The animated character means our app adopts a human-centered design and is user-friendly to use. The white circle represents the new insights and the beneficiaries of the new technologies we bring to the users. The grey background represents professionality and justice without biases. The dark grey frame means the stability of our financial app[7].

Figure 13. Initial Bill Logo Design. Created using Adobe Illustrator.

Final Logo Design

The logo represents our AI agent/financial consultant helper named Bill. From the first draft, we kept

several features including the general face structure (looks professional yet approachable), the encompassing circle (stability), and the gray background (justice without biases). However, we added many new ideas that incorporate color theory, semiotics, and HCI theory.

Figure 14. Latest Bill Logo Design. Created using Adobe Illustrator.

Summarized Changes

In the latest iteration of our logo, The circle is now blue and green instead of white. This conveys the idea that the circle symbolizes the world (the blue sky on top and the green grass on the bottom). Blue and green often represents many world icons too. The rounded corners on the gray background convey a more welcoming environment[8]. The combed hair shows an organized, slick intention behind the app. The collared shirt in the logo is blue and white to represent the fact that Bill can be used to help both blue-collar and white-collar workers, not just one financial class.

EVALUATION: FINAL IMPLEMENTATION

Before the evaluation, we will ask users for their permission to participate in the study as well as introduce the project to them. We will ask users to think aloud when they use the app. After experiencing the app, we will ask the users to answer the following Likert scale based questionnaire.

Participants

We invited 10 people, who are randomly chosen from Berkeley public library, to participate in the final user evaluation. Among the participants, 60% are male and 40% are female. The age ranges from 25 to 45, with a mean of 33.

Evaluation Protocol

For each category of the heuristic evaluation, users will rate each statement of a category on a 1 to 7 scale based on Likert's Scale according to the level of their agreement. The questions could be classified into the following categories: Automate unwanted workload, Reduce uncertainty, Fuse data, Present new information with meaningful aids, Names that are conceptually related to function, Limit data driven tasks, only information needed by the user at a given time is displayed, Practice judicious redundancy. After the questionnaire, we will ask participants open questions about potential improvements they want to see on our app, then thank participants for their time and then complete the evaluation.

Evaluation Results

We received positive feedback for the world mode and wish to make this more central to our app. Our next goal is to integrate a more seamless transition between modes, with the World Mode acting as our "home" screen rather than simply swiping or clicking a logo to move between modes. Right now, we are trading off intuition for innovation.

	Rating
Automate Unwanted Workload	5.7 ± 0.7
Reduce Uncertainty	4.8 ± 0.5
Fuse Data	5.3 ± 1.2
Present New Information with Meaningful Aids	6.7 ± 0.4
Names that are Conceptually Related to Function	6.7 ± 0.4
Limit Data Driven Tasks	5.8 ± 0.5
Only needed information is displayed	5.6 ± 0.7
Practice Judicious redundancy	6.3 ± 0.5

Table 1. Qualitative Final User Heuristic Evaluation. Responses are semantically anchored on a 7-point Likert scale, positive responses = 7.

LIMITATION

In this work, we showed that gamified interaction could motivate people to engage more with financial activities. Due to the limited time to develop the project, some of the features have not been implemented yet. To enable a fully functional prototype, we have used websocket to remotely change the state of our project during the user evaluation.

FUTURE WORK

One thing we would like to do is incorporate ubiquitous computing into the app. For example, we would like to build a smart wallet that enables users to store receipts, credit cards, and cash, and send this information to BILL. One problem we encountered was how to record cash transactions without receipts. A smart wallet would solve this problem by being able to detect how much money is removed or added to the wallet at a given time.

We would also want to enable more investment features into our app. For example, BILL could guide users on how to best invest their money and receive more income, much like how financial advisors currently invest money for their clients.

CONCLUSION

In the financial app, Bill, we improve the human computer interaction through a virtual 3-dimensional world. By setting goals in the virtual world, users could keep track of their financial goals by looking at the virtual animated objects. Through our final evaluation, we have demonstrated that users have an overall positive attitude towards our design, which attracts them to start to use a financial app. Unlike the common financial app, we have introduced a variety way for users to input the information, including typing, speaking and taking photos, helping users to engage with the financial consulting process more conveniently. Given the positive user evaluation result, we have shown that how cool media, which combines many senses less completely compared to hot media, could benefit the user experience. Thus, we contribute design principles for expanding the usage of cool media, which gives users the opportunity to engage with more senses, rather than engages with a sense more completely, in order to leverage users' involvement in a streaming of content, rather than considering the effects.

ACKNOWLEDGEMENTS

We thank all the volunteers, who devoted their time into the user study for this project, and UC Berkeley Summer CS160 course staff, especially Cesar Torres and Amy Pavel, who wrote and provided helpful comments on previous versions of this document.

ARCHIVE

Cloud9 Workspace Link
https://ide.c9.io/dongjooshin/bill

Slides Link
https://drive.google.com/open?id=1EyZvlAM39-VGnyCCHF9OY8BV0M2ppG8opAFuaXtOu3M

Medium Article Link
https://www.youtube.com/watch?v=8esrIvVVVR0

Paper Mock Up Video Link
https://youtu.be/Vzl8148NU1o

Final Video Link
https://youtu.be/8esrIvVVVR0

Poster Link
https://drive.google.com/open?id=0BxX0QeYJisdYUHE1VjFRMnBNcE0

REFERENCES

1. Ken Yeung. 2017. Penny Takes on Mint with a Bot to Manage Your Money. (15 March, 2017). Retrieved August 10, 2017 from https://venturebeat.com/2017/03/15/penny-takes-on-mint-with-a-bot-to-manage-your-money/

2. Starbutter. 2017. Starbutter AI - Our Stories. (2017). Retrieved August 10, 2017 from https://www.starbutter.com/ourstory

3. Mint. 2017. Manage your money like never before (2017). Retrieved August 10, 2017 from https://www.mint.com/how-mint-works

4. Kathryn Hauer. 2016. Excerpt from Chapter 5 - Retirement (2016). Retrieved August 10, 2017 from https://www.financialadviceforbluecollaramerica.com/chapter-5-excerpt

5. Marshall McLuhan. 1964. The Medium is the Message (1964). Retrieved August 10, 2017 from http://web.mit.edu/allanmc/www/mcluhan.mediummessage.pdf
6. Julian Garnier. 2017. Anime.js. (2017).
7. Jacob Olesen. 2016. Gray Color Meaning – The Color Gray (2016). Retrieved August 10, 2017 from http://www.color-meanings.com/gray-color-meaning-the-color-gray/
8. Yoni Heisler. 2016. Why are Apple's iPhone icons shaped as rounded squares? (17 May, 2016). Retrieved August 10, 2017 from http://bgr.com/2016/05/17/iphone-design-rounded-squares-explanation/