Financial Literacy through Gameful Design

by

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Author's declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

This thesis consists of studies that were co-authored by myself, my supervisor, Dr. Lennart Nacke, and others. I was the sole author for chapters 1 and 6 which were written under the supervision of Dr. Lennart Nacke (providing editing, proofing, and research advice).

This research was conducted at the University of Waterloo by John Yoon and me as primary student investigators within a Mitacs Accelerate Internship, under the supervision of Dr. Lennart Nacke partnered with colleagues at TD Bank. Other student investigators working on the project include Maximillian Altmeyer and Ekaterina Dumanova.

Maxmillian Altmeyer and John Yoon performed and completed literature reviews informing gamification and visual rhetorical accommodation guidelines. I reviewed all literature and summaries to ensure appropriateness of material. I designed the study-testing platform and screenshots using Figma, and organized scheduling within UserInterviews.com. I and John Yoon co-conceptualized and co-designed the study through creating procedural protocols, Maximillian Alymeyer reviewed procedural protocols. I worked on obtaining ethics approval and application, I, Ekaterina Durmanova, and John Yoon, conducted the 45 minutes–1 hour interviews; I conducted 27 interviews, John conducted 15, and Ekaterina conducted 18. I and John Yoon conducted the thematic analysis, I conducted the majority of the codifying, sorting, and compiling of the final results. John worked on the majority of the writing of the final report towards our Mitacs Partner: Toronto Dominion (TD) Bank. I edited and filled in the result findings. John Yoon and I collaborated on the compilation and decision of major findings/results. I wrote the majority of the discussion with the exception of the findings from the previous chapter.

Abstract

Canadians have been found to have little to no expendable income and find debt management difficult. Alongside the growing push towards digital service platforms replacing traditional brick and mortar solutions within the financial industry. Using this motivation in partnership with Toronto Dominion (TD) Bank—as a part of a Mitacs Accelerate Internship—I studied methodologies within gamification and visual rhetorical accommodation to create potential digital solutions that alleviate problematic user experiences (UX) in financial situations. More specifically, I inquired how we might use personalization and visual rhetoric design within financial tools and services, in this case credit cards, to assist users in knowledge translation of financial status, which I hypothesized would alleviate negative user debt and spending behaviours.

In this work, I conducted an online study with colleagues following a semi-structured interview with 60 participants. Participants were recruited via an online user recruitment platform, UserInterviews. Participants were equally distributed across four conditions and a control group. The interview process began by probing participants about their current behaviours within their online banking and credit card platform. The interview then presented each participant with a condition-affected replica of TD's online banking platform *EasyWeb*. They were asked for initial impressions, and presented a scenario in which participants cognitively walked through using the potential platform. First impressions and qualitative UX data were then collected for analysis.

Through the analysis, we discovered that users demonstrated positive attitudes in response to goal-setting-oriented solutions, and simulations of real-world consequences of their actions. In summary, our work opens up a venue for exploration for gamification in financial settings, and provides UX designers with a set of guidelines that could inform gameful designs within financial settings.

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Chapter 1: Introduction

1.1 Motivation for this Work

Gamification is the process of using "game design elements in non-game contexts" [22] or improving services with affordances for gameful experiences that enable users' value creation [36]. It is a user experience (UX) design approach that allows us to create engaging digital interactive systems that can foster behaviour change. Gamification has been researched and employed in different domains [28, 15, 48], such as education [4, 23, 48, 40, 59], health [23], and travel technology [94, 23, 59]. Despite its continued popularity, gamification has just begun to become important in the financial services and applications space [27, 14, 46, 37]. With the growing need to educate younger generations about financial literacy and decision-making to make educated spending decisions and tackle other financial concerns [62, 49, 18, 6, 61], and it's researched and proven success in other domains, such as education [35] and others as mentioned above, it is important to research how gamification can be employed in financial settings to improve these human behaviours. By conducting some preliminary work into this industry, we can establish the groundwork to understand gamification's effects within the financial industry and establish theoretical design guidelines for other UX designers.

Rhetorical accommodation is a process where complex information is "translated" or simplified to be consumed by a general audience. Visual rhetorical accommodation is the same process using an image component to simplify complex concepts. This is similar to the concept of knowledge translation, where academic knowledge is translated for practical use. In other words, it changes difficult information into simpler forms for non-experts. While rhetorical accommodation first dealt with scientific knowledge [24], it has seen been applied to scientific knowledge to the public through both written and online media [43, 56].

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Within the financial industry, credit card debt is one of the most serious problems to tackle, especially for Canadians. The Financial Post reported that 53% of surveyed Canadians had little to no expendable income and a quarter of correspondents find debt overwhelming [53]. The Canadian Mortgage and Housing Corporation reports that the household debt-to-income ratio is near a record high [57]. Although much research has been done on the effects of credit card debt and spending [91], its payment and usage [55, 7], and student credit card debt [20, 29, 76], none of the work researches the application of theoretical approaches to alleviate these negative behaviours. This is arguably as important as theoretical research produces actionable outcomes that need to be tested for validity before real-world implementation. Thus this project looks to improve existing services through a combinatory approach of synergizing gameful ways to aid TD customers to avoid credit card debt by researching methods to encourage timely repayments and responsible spending habits through improved visualized feedback of customer spending habits.

The driving research question in this thesis asks **if and how applied gameful design can increase customer's knowledge of financial services and aid banking customers to make more informed decisions about their spending behaviour.**

As banking continues to move towards being digital and online, especially during the COVID-19 pandemic, thereby removing direct interaction between customers and bank representatives, financial service providers need to improve customer satisfaction, experience, and service by exploring methodologies to provide the same services online. More specifically, this is because current consumers are faced with restrictions and are discouraged to meet physically. Due to the pandemic COVID 19, there is now a strong push for creating digital solutions for end consumers [1]. Such affected services are financial advisors and debt-management specialists. This set of current events provides extra motivation for our broader work. We propose a set of gamified and visually rhetorically accommodated experiences within credit card spending applications to help users manage debt and spending. Specifically, this project set out to help consumers change their spending habits and understand debt management, it can be beneficial to Toronto Dominion (TD) Bank by assisting consumers in making educated spending decisions and help promote healthy spending. Currently, TD's web-based banking platform EasyWeb shows only rudimentary information such as current balance, pending transactions, and credit limit in plain text.

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With this work, I propose an approach to utilizing applied gamification and visual rhetorical accommodation in financial applications to assist knowledge transfer and observe how this might affect a user's behaviour.

Financial decision making and understanding how financial products work is a tedious/arduous process, it requires learning high-level jargon to convey simple tasks. This barrier to entry makes for a confusing experience. It can often deter people from using these services that could benefit them or cause them to misjudge how to use their finances[31, 26, 12]. My work seeks to build upon how visually accommodated rhetoric and gamification can improve user experiences. However, this project expands on current research by moving beyond its original scientific context and using digital platforms to help transfer knowledge into practical applications. This was done in two ways: first, the context for gamification and visual rhetorical accommodation is focused on credit card spending and debt management and second, the project will use visual methods and personalization to translate knowledge to the user through the use of icons and graphics. Employing visual information was deemed to be critical to financial decision making based on the concept of "presence" as interpreted in work by Christa Teston[80], also explored and defined in work by Slater as "subjective experiences of being in one place or environment even when one is physically situated in another" [73, 72]. In this, we understand that presence describes the process through which an action can be taken based on abstract ideas. As concepts are made concrete through visualization, users are better equipped to process information and make better decisions based on that information. It was thought that presenting credit card spending information through presence would allow users to make better informed and healthier purchase decisions. Alongside utilizing visually accommodated rhetoric, we explore the use of gamification as we dive into our related works that research and demonstrate gamification utilized in educational settings proven to increase user's retention of information and engagement with materials [59, 48]. Our work explores suggestions that through the use of visually accommodated rhetoric and gamification, these burdens can be alleviated through higher engagement and motivational affordances by using gameful design.

1.2 Research Questions

As mentioned above, this thesis's main research question explores if and how gameful design can increase customer's knowledge of financial services and support banking users to reach more informed decisions about their spending behaviour.

This work is broken up into three sub-research questions that focus on different gamification elements that could be applied. My work will seek to answer these questions by performing an online between-subject study designed around these sub-questions as goals of the study. We detail this approach in chapters 3 and 4. These sub-questions are as follows:

RQ1 Do gameful design elements have an effect on controlling credit card spending?

> **RQ1.1** More specifically in our study, does the gamification element of personalization and customization, through customisable icons and appearance, have an effect on controlling credit card spending?

RQ2 Which effect does visual rhetorical accommodation have on the perception of gameful applications aiming at controlling credit card spending?

RQ3 Does personalization of visual metaphors help to increase their relevance and thus make credit card spending more concrete?

1.3 Aims and Goals of this Thesis

This thesis aims to build preliminary groundwork into how we can consider the applications of gameful design elements within the business-finance sector. This work aims to complete this through 1) exploring, through literature reviews, secondary research in gamification, financial education, visual rhetorical accommodations and 2) building and proposing guidelines for designing gamified experiences within credit card services in the financial sector. A research study was designed to implement these guidelines to explore their implementation and viability. An analysis of results and discussion will conclude our summary of findings.

1.4 Structure of this Thesis

This thesis is organized as follows: The current chapter 1 offers an introduction into the problem space. The 2nd chapter summarizes and provides a background to the current research and concepts conducive to this work, including gamification and visual rhetorical accommodation. The 3rd chapter is a literature review that explores existing work in visual rhetorical accommodation and gamification, this work helps us generate proposed principles/guidelines to help us design for gamified visual rhetorical approaches within financial settings. The 4th chapter presents the study design and methodologies. The 5th chapter presents the results of the study, the 6th chapter discusses the implications of the results, the limitations of this research, future work, and will conclude this thesis.

Chapter 2: Related Works

First, I review the definitions and concepts of gamification and continue to explore current work applying gamification in finance. Then I explore work in the design of user interfaces (UI) and its intersections within financial settings. The next section of this chapter introduces thematic analysis and its multiple approaches to analyzing qualitative data. Finally, I explore and review literature that informs a potential list of guidelines from gamification and visual rhetorical accommodation to be used a basis for designing gamified visually rhetorical experiences in credit card services within TD Bank Easyweb application. Using these lists I uncover commonalities to create a list of combined guidelines that informed our study.

2.1 Gamification

Gamification is the "use of game design elements in non-game contexts" [28, 15, 22]. Rising in popularity in the past decade, gamification has proven to have shown positive effects [36] in a variety of situations as per a literature review by Hamari et al. Studies conducted exploring gamification in education and training demonstrated positive correlation in an individual's understanding of material, and benefits from maintaining learning attitudes. At the base of gamification is behavioural changes using motivational affordance, in simpler terms, the goal is to inject fun elements to incentivize users.

Studies conducted examining the use of gameful design within education [59, 48, 40], health [23], and tourism [94] demonstrate cases of positive behavioural changes in participants [4], and also posit positive effects in their systematic/literature review of gamification work. In a series of studies examining gamification within education, two literature reviews concluded with positive reviews of gamification, stating that gamification creates a fun and

engaging experience without undermining the credibility of the education [59, 48]. One study design [4] compared the same course over several years with the final two years gamified. All the course evaluations/testing methods were conducted the same, the final two years offered a gamified leaderboard, experience points (XP) that students could earn, and collectible badges. Results of this study showed significant differences in effects between the gamified vs. non-gamified course. Students showed an increase of 133% in engagement via posting on forum boards. Key findings in this study also include the point that students demonstrated an increase in engagement with non-rewarding material, material that didn't grant them achievements or progression feedback within the gamified elements. This finding can prove to be useful as we explore how we can engage critical content within banking applications and entice users to explore other areas without the use of gamifying the entire system.

In another set of studies we can take a look how gamification has been employed within tourism and health settings. One study examines how mobile applications can be used to promote health within young people. This application Healthy Jeart employs the use of gameful design to motivate and encourage healthy habits within 7 nominal groups targeting different areas of the health domain (physical activity, nutrition, physical well-being, toxic substances, sex and relationships, and new technologies). Demonstrating positive reception within the app store, 76.5% of participants reported that they believe the app helped them maintain and adopt health habits [23]. The next study findings present a market analysis of tourism applications that employ gameful elements and identifies cases of best practice, concluding that gameful design within tourism applications promotes branding, awareness, and overall cultural engagement [94]. These studies are important as they suggest that gamification can be employed to drive and motivate basic behavioural changes within users, and using these studies as a basis of motivation for our work we can suggest and explore potential gameful design solutions that can be employed in a similar manner to motivate change in user's financial behaviour.

2.2 Visual Rhetoric Accommodation

As introduced in chapter 1, rhetorical accommodation is a process where complex information is "translated" or simplified to be consumed by a general audience. I examine

past research into rhetorical accommodation within science, more specifically rhetorically accommodated visualizations as a form of knowledge translation to be employed in the use of our study. In a study [86] reviewing material and visual scientific information about the ozone layer and how it's presentation was received by its audiences demonstrated that visualizations can be both useful and detrimental to knowledge transfer to audiences. In such cases within the study, it examined people with a lack of knowledge in area could understand the inherent risk of a thinning ozone layer through the timelapse images showing the emergence of a "hole" appearing, via differences of colour from light to dark in a ring shape. On the other side with such images and a lack of understanding between scientists, because the effect was new at the time, proved to be detrimental as the scientist and public could make up potentially harmful speculations. The application of rhetorically accommodated visuals for our study must be crafted with care to avoid the negative effects of such speculations.

2.3 Gamification in Finance

With its rising success gamification has seen in the deployment in education and other fields. Banks and analysts have pointed out the need to increase their adoption of gamification practices and techniques within their products [79, 32, 42, 63]. Laying out the groundwork a few research groups have conducted to create frameworks, models, and theories about gamification within financial settings [3, 66, 69] and financial education for younger generations [39]. These research studies studying the effects of gamification within financial settings through a series of mobile apps [64, 5] and simulations [34, 2, 95]are useful to explore. One study [34] tested the use of motivational affordances to drive user behaviour to improve retirement savings performances via simulation. The results were positive demonstrating the user's ability to save to a target savings goal in a shorter amount of time and less of a difference between the participants' goals vs. savings.

In another study [64], the researchers propose an application employing parental guidance and the use of motivational affordances/persuasive technologies to build long term saving behaviours into children. Creating a system that encourages parents to be a part of the process by having them set chores, or pay an allowance, the children learn to take this fake money and saves it for points to use towards rewards. Another similar study

utilizing an application aim at providing simulations to participants and allowing them to make financial decisions, with the simulation reflecting these changes. This study concluded that visualized and interactive financial applications can be utilized to assist users in the. decision-making process [2]. Four other research papers address gamification directly. Noting key takeaways to be that when gamified experiences within banking and financial settings are properly designed can create more engaging experiences and satisfaction [3, 5], wherein noting properly design to be taking the user's product demand and preferences to be key [81].

This initial literature review into gamification within financial settings presents a solid case psychological background work into behavioural changes within financial settings, with some preliminary work paving way for gamification/gameful design elements. It also suggests that a gap exists between works of gamification and its uses in the financial domain within existing literature that this thesis seeks to contribute to, in hopes to build a foundation for future work in this area.

2.4 Thematic Analysis

For this work, we decided that it was important to capture both crucial and emerging themes in our work. A variety of approaches were used in the process to help us achieve our results. During study design and data collection to achieve data saturation we ensured that our questions asked followed the same format [30], although the interview was semi-structured, the researchers were instructed to probe to extract information pertaining to the question at hand. Participants were also selected from a variety of backgrounds avoiding the shaman effect [30]. Approaching the data we employed methodologies and styles from a reflexive-like approach. Following the six-step approach from Braun and Clarke [9]:

1. Familiarize ourselves with the data and writing familiarisation notes;

2. Perform systematic data coding;

3. Generate initial themes from coded and collated data;

4. Develop and review themes;

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5. Refine, define and name themes; and

6. Write the report

We follow an inductive-theoretical approach to our thematic analysis with background literature informing our research questions [10] and design guidelines for the study design. Our engagement with the literature along with our willinginess to be informed by the data should yield some interesting insights into other areas or elements that gamification can position itself in financial settings.

Chapter 3: Proposed Design Guidelines

The proposed guidelines were developed and informed through literature reviews of work in financial gamification, and visual rhetorical accommodation. The literature review was divided into two sections to be combined later because the areas of rhetorical accommodation and gamification are in two distinct fields, it would have been near impossible to conduct a single search spanning both concepts. The proposed gameful design guidelines for financial settings were created as a joint effort between the three student researchers on the project (John Yoon, Maximilian Altmeyer, Andrew Cen). The guidelines were designed after conducting a literature review on existing material within rhetorical accommodation and gameful design space within financial settings. The literature was searched for best practices and then a combination of commonly found items were put together. The combined proposed guideline below list our findings and explores practical examples and options currently on the TD bank easy web platform and our suggestions on how this item could potentially be designed or implemented within the system.

3.1 Financial Gamification

The literature review for gamification was narrowed down to specifically be on finance and financially related topics because a general search on gamification would yield much too broad of a result.

Using the search string (`TITLE-ABS-KEY ( gamifi* ) AND TITLE-ABS-KEY ( financ*` `) )` in Scopus, 93 results were found, of which 15 were selected for relevance. Using the search string (`Title:("behavior change") OR Abstract:("behavior change") OR` `Keyword:("behavior change")) AND (Title:(financ*) OR Abstract:(financ*) OR` `Keyword:(financ*))` in ACM, 11 results were found, and 1 was selected. Using the

search string `(Title:(gamifi*) OR Abstract:(gamifi*) OR Keyword:(gamifi*)) AND (Title:(financ*) OR Abstract:(financ*) OR Keyword:(financ*))` 10 results were found, and 3 were selected. Using the search string `(Title:(game*) OR Abstract:(game*) OR Keyword:(game*)) AND (Title:(financ*) OR Abstract:(financ*) OR Keyword: (financ*))`, 177 results were found, and 3 were selected.

After excluding irrelevant results, which were deemed so if they did not specifically focus on gamification in finance, resulted in eleven results. The selected papers were analyzed to identify which motivational affordances were used and how effective they were. The studied motivational affordances ranged from simulation, achievements, goals, and more. This literature review was done by Maximillian Alymeyer and Andrew Cen, and was reviewed by both researchers.

3.1.1 Gamification Guidelines

Based on the results of the literature review, we devised a five-point guideline on how to implement gamification in financial contexts, this was done by selecting most common design/methodology approaches that reoccurred and intersected between the literature.

G1 � The use of simulations to explain the impact of financial choices on relevant goals/measures [64, 95, 66, 68]

G2 ➷ Ensure a clear connection between gameful design and real-world actions/impacts (must be grounded in knowledge, or suitable to the audience) [95, 68, 41]

G3 ➷ Use social comparison carefully, especially when addressing inexperienced users (Genre should be accounted for) [5, 34, 41, 67]

G4 ➷ Help users to gain financial knowledge through feedback and discussion using tips [2], avatars giving feedback [68, 41], quizzes [5, 66] and social platforms for communication and knowledge sharing[41]

G5 ➷ Use points, achievements and unlockables to communicate and reward progression towards goals [5, 2, 39, 68, 41, 67]

3.1.2 Visual Rhetorical Accommodation

The literature review on rhetorical accommodation was done by searching the string `((rhetoric of (science OR technology OR health OR medicine)) AND "visual rhetoric" AND communication NOT literature)` in the databases JSTOR, Communication & Mass Media Complete, and ProQuest. The literature review for this topic had a definite starting point, the article "Accommodating Science" by Jeanie Fahnestock, which coined the term. However, the term quickly fell out of use and was replaced by "rhetoric of science/technology/medicine," hence its usage in the search. The term "visual rhetoric" was added because it was deemed that on a web page, the knowledge translation done via visual means would be the most appropriate. The term "NOT literature" was added to exclude the many initial results on rhetoric in literature, i.e. novels. The combined search yielded a total of 189 results and after excluding duplicates and irrelevant results such ones on film studies, yielded 30 results. The included results were analyzed to identify what rhetorical elements and/or techniques were studied. They ranged from various forms of visual rhetoric, use of illustrations, to treatment of genre. This literature review was completed by John Yoon and reviewed by Andrew Cen.

Rhetorical Accommodation Guidelines

Based on the results of the literature review, through the same methodology as the finance gamification literature, we produced a seven-point design guideline for implementing visual rhetorical accommodation effectively.

RA1 ➡ The design should accommodate the audience by using information suitable to the audience[25], translating and adapting the information if necessary[86, 44, 89, 77, 75, 33].

RA2 ➡ A common ground in knowledge and values should be established between the author and the audience[21, 78, 51, 13, 8].

RA3 ➡ Design should incorporate feedback from the target audience[85, 44, 84, 45].

RA4 ➡ Visualization should establish presence, where abstract ideas are made more concrete[21, 80, 93].

RA5 ➡ Genre should be accounted for. Unorthodox media may be an obstacle to conveying serious information[90]. The genre can dictate what kinds of responses are appropriate [71, 84].

RA6 ➡ Visual metaphors are effective[47, 54] . Elements like repetition and iconography are useful[21, 65, 82].

RA7 ➡ Aesthetics are important[44, 89, 78, 92, 45] as is the layout[77, 58, 75] and the use of colour[19].

3.1.3 Combined Guidelines

We created the combined guidelines through the combination of intersectional areas within the two above literature reviews. Below is list along with it's respective references from both literature reviews and a practical example we could potentially explore in a study design, for sake of brevity for this thesis CGL will be used to refer to Combined Guidelines List along with a number that represents items 1-7. Our combined guidelines is as follows:

CGL 1 ➡ A common ground in knowledge should be established between the system and the user [21, 78, 51, 13, 8, 95, 68, 41]

- Practical example: Currently on EasyWeb, the definitions of key terms (Current balance, pending vs posted transactions, debit vs credit columns etc) are mostly non-existent, if it it does exist, they are usually too brief to help users develop a strong understanding. Also, things like explaining the difference between statement dates and payment dates would be useful.

CGL 2 ➡ Make abstract finances more visually concrete by establishing presence through simulations [21, 80, 93, 64, 95, 66, 68]

- Practical example: Ratio of current balance to available credit to credit limit. EasyWeb only lists numbers in a column, a more engaging visualization could help users connect better to their spending habits. A slider or bar chart that would show a overall budget/credit limit, if a person was to make a current

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purchase it would represent X% of their current limit. The current purchase plus their current spendings would present x-amount of monthly minimum payment which is x% of their credit limit.

CGL 3 ➞ Simulations should show a clear connection between gameful design and real-world actions/impacts [21, 80, 93, 95, 68, 41]

- Practical example: Demonstrate a clear relationship between gamified EasyWeb and the user's money. Something similar to the example from CGL2, where making a purchase would be shown to have rippling effects on posted/pending transactions, available credit, etc. Potentially using predictions like "If you keep your current spending habits of this [month/week] you will spend XY more money than you have/fail to reach your spending goal/..." Or: Overlaying the spending behaviour of last [week/month] (in a beautiful chart) over the current spending behaviour

CGL 4 ➞ The design should take into account the serious nature of the financial content [5, 34, 41, 67, 90, 71, 84]

- Practical example: This would be a part of the design process. We need to find a gameful solution that's not too "gamey" and matches the tone of EasyWeb.

CGL 5 ➞ Gameful design elements should utilize visual metaphors to increase effectiveness [68, 41, 5, 66, 47, 54, 21, 65, 82]

- Practical example: Currently on EasyWeb, the question mark (?) hover tooltips would be considered to be icons. Something we could implement is to show available credit, we could have a representation of a loonie that fills up as spending reaches the credit limit, that would be a visual metaphor.

CGL 6 ➞ Adapt the visualization to the target audience through user feedback [25, 86, 44, 89, 77, 75, 33, 85, 84, 45, 5, 34, 41, 67]

- Practical example: Participatory design when prototyping.

CGL 7 ➞ Aesthetics and layout are important [44, 89, 78, 92, 45, 77, 58, 75, 19]

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- Practical example: EasyWeb currently uses TD colour scheme/layout. I don't think we would have too much freedom over this since it would have to fit seamlessly into EasyWeb as is, but the design elements could be clean and focus on visibility.

Chapter 4: Study Methodology

4.1 Objectives

The objectives of our first study is to examine how visually accommodated rhetoric and gameful design can affect financial behaviour, more specifically credit card spending habits. Participants are invited to participate in a 30 minute study. This work also aims to answer the research questions as outlined in chapter 1 and below:

RQ1 ➡ Do **gameful design elements** have an effect on controlling credit card spending?

RQ2 ➡ Which effect does **visual accommodation** have on the perception of gameful applications aiming at controlling credit card spending?

RQ3 ➡ Does **personalization of visual metaphors** help to increase their relevance and thus make credit card spending more concrete?

4.1.1 Context of Research

Exploration of research questions within the context of Easyweb as shown below in fig 4.1. Easyweb is an online digital web banking service for TD bank customers. Our goal was to explore how we could propose potential guidelines for designing digital experiences for online banking. Through this we designed and mocked up potential elements, elements being visual design cues and web elements(ie. text boxes, graph bars, etc.), to explore our research questions above. The current Easyweb, which we will call vanilla Easyweb from hereon, and the redesigned version, featuring our elements, will be used for a comparison study to answer the research questions and pursue the objectives.

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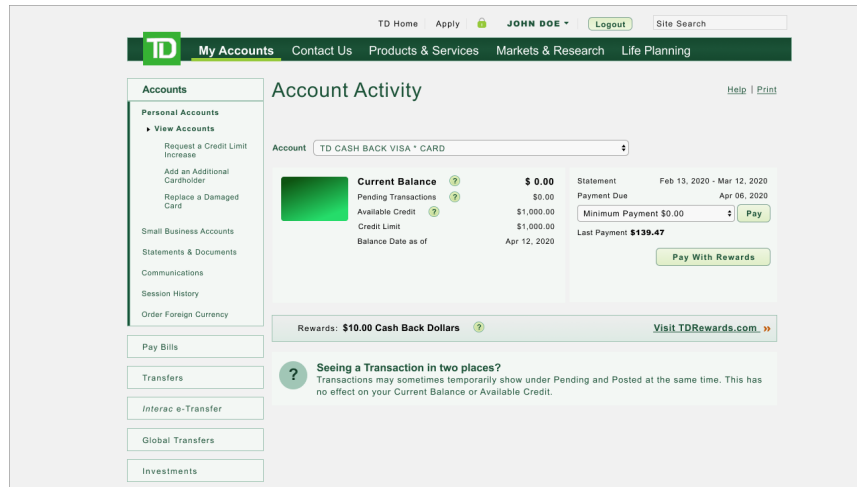
Figure 4.1: Replica of TD Easyweb with sensitive financial information removed

4.1.2 Objectives in Context

Our objectives are to validate and explore our hypothesis of whether rhetorically accommodated gamification can assist and help user's in debt management.

🏛 **Hypothesis** *EasyWeb* redesigned following the guidelines should be more effective at controlling credit card spending than vanilla *EasyWeb*. This can be examined through self reported measures of:

1. User reported experience with financial understanding and literacy is greater; greater financial understanding and literacy has been shown to be correlated with debt management [83]

2. User reports higher understanding of financial status/standing

In more detail, our proposed guidelines for visual rhetoric and gameful design in financial situations hypothesizes a simpler method of digesting information and aid in the decision-making of consumers, resulting in controlling credit card spending (which can be viewed also as savings).

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4.2 Research Design

I conducted a study that examined user experiences with gamification and visual rhetorical accommodation within TD Bank's EasyWeb credit card services, more specifically how these elements affected a user's behaviour and if we could motivate positive behavioural changes (reduce spending/debt incurment). This study was executed through a semi-structured interview where participants were invited to participate through UserInterviews, an online web-based user study service used to recruit participants. The interview followed a script with using questions from C, these questions probe the user for their initial thoughts and impressions with the condition they were given. This process was then followed by a structured scenario where the user is prompted to make choices based on information seen on the screen, for example: based on the following screenshot as this person with this bank account would you make the following purchase. This study featured 2 dependent variables and 4 independent variables in a between subjects user study. Participants were given one of 4 conditions randomly with and without gamification, also with and without visual rhetorical accommodation. A control group with no gamification and visual rhetorical accommodation was also tested. Interviews were recorded and then transcribed for the analysis process.

4.2.1 Design

The study was designed featuring 5 conditions; a control group, a gameful but not personalized or visually accommodated group, a personalized but not visually accommodated group, a visually accommodated but not personalized group, and a personalized and visually accommodated group. Our 5 conditions were randomly chosen and distributed to the participants during the start of each interview. Each condition was bound to a limit of 11 participants each. Our expectations were to recruit for 10 participants per condition expecting a few participants would not show.

In the beginning, we are recruiting 55 participants via the use of the online user study platform www.UserInterviews.com, for the sake of this work this shall be just called User-Interviews. During the duration of the study technical errors rendered a few recordings inaudible. We compensated for the loss of participants in each condition by recruiting 5

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extra participants to join the pool, randomizing the missing conditions into the pool to be redistributed again. The total number of participants at the end of the study was 60 participants. Our participants were recruited under the following criteria:

1. Participants must be over the age of 18 and under the age of 65

2. Participants were located/reside in Canada

3. Participants must be comfortable with speaking about their finances for the duration of this study

4. Participants must be online credit card banking users with any bank

5. Participant must have an internet connection and a personal computer

Our renumeration for participation in the study was a 7.50$ USD Amazon gift card.

4.2.2 Development of Study Platform

The study scenarios and static screens were developed as a collaborative process between the three researchers. These screens were developed using the proposed combined guidelines from Chapter 2 of this work. Using the combined guidelines, the live version of EasyWeb was studied and potential implementation of the guideline's suggestions were proposed.

To implement the combined guideline, four elements which addressed all seven aspects were created:

- A monthly current spending and goal indicator (CS)

- A total balance ratio indicator (CTB)

- A long term goal and reward system (LTR)

- A visual theme customization option (Theme)

Don't let the piggy leak out!

This month you are trying to save **5%**
which is **$50** of your credit limit
That's an average of 2 x ☕ Coffees

Figure 4.2: Current spending and goal indicator

The monthly spending and goal setting element shows the credit card's limit, typical spending, and the month's reduction goal. This element utilizes the goal setting gameful element while addressing combined guideline 1 and 2.

The ratio of credit card balance against the user's chequing account is shown. This element addressed combined guideline 3 and 4.

A monthly tracker of savings goals towards the incentive. The amount by which the user stayed under the goal limit is also represented as a purchasable item. It also gives a total sum of money not spent. This element utilizes the gameful elements of goal setting and reward while addressing combined guideline 5.

A drop down menu for theme selection or customization. It would allow the user to switch between food, shopping, utilities, etc. This element utilizes the gameful element of personalization while addressing combined guidelines 1 and 6.

In addition, all elements were designed to embody guidelines 4 and 7 to maintain a pleasing but professional aesthetic.

Current goal limit
$665.00

Credit card limit
$1000.00

Current spending
$378.00

Typical monthly spending
$700.00

This month you are trying to save **5%**
which is **$45** of your credit limit
That's one fitted cap!
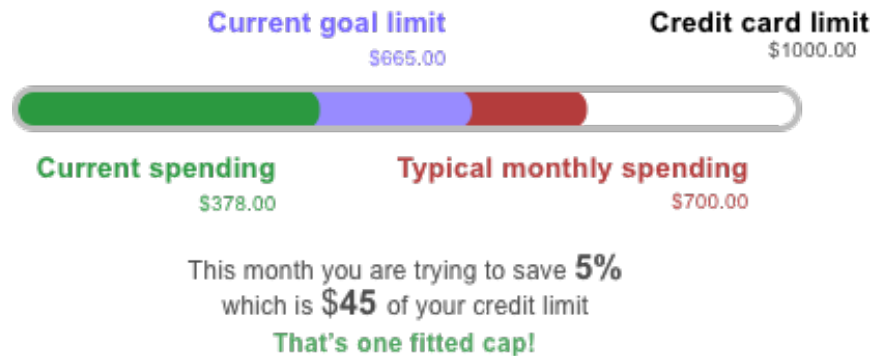
Figure 4.3: Current Spending and Goal Indicator - Neutral

Combined, the elements were introduced to EasyWeb in this format:

These four elements comprise a holistic system which aims to better inform and encourage better spending behaviour in users. This system tries to motivate users in both the short- and long-term through monthly spending reduction goals and yearly incentive rewards. It also shows the amount of credit card debt as a percentage of the user's chequing account. The system presents the user's financial status and progression towards the goals through the use of icons and other visuals to concretize abstract sums and rates, making decisions easier to make, thus making it simpler for users to control their spending. Rather than merely giving out a target, the system "translates" the information into visual cues which help users understand better and in more concrete terms. For example, if the user saved $5, that sum would be represented visually as a coffee and a snack to help translate it into more easily graspable and visceral terms. The system combines the goal setting and progression of gamification with the visual knowledge translation of rhetorical accommodation to help users make smarter choices. To help achieve a better idea of how these elements were put together, I have listed the conditions and their respective screenshots in Figures 4.8, 4.9, 4.10, 4.11, 4.12.

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Current total balance: $4,309.00

What is my total amount of money in the bank? (All accounts minus credit accounts)

$1,077.25 $4,309.00

How much of my current total balance spent: 20%

Figure 4.4: Current total balance

Total saved to date: **$216.00** =
reflects year to date

two average dinner dates
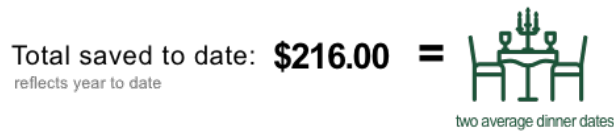
Figure 4.5: Total Saved to Date Element

Typical Sushi a la Carte

$56

$34

$12

$77

$23

Cost of average dinner

Reward
1% rebate bonus
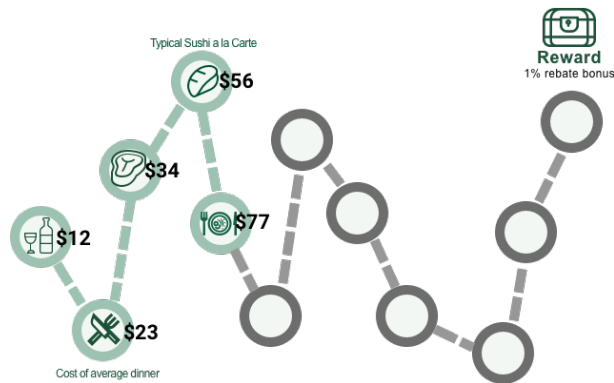
Figure 4.6: Long Term Reward Tracker

Figure 4.7: Theme Picker
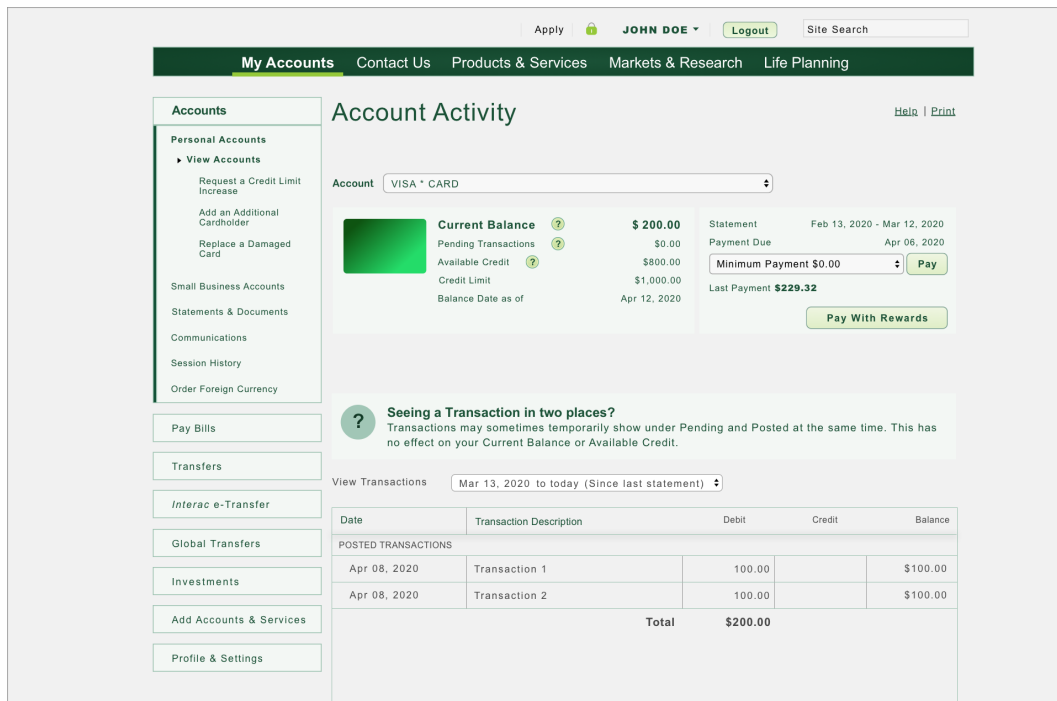
Figure 4.8: Vanilla EasyWeb condition mock up

4.2.3 Procedure

Pre-study steps

Participants are invited to a 45 minute remote un-moderated online interview study via UserInterviews. Participant are sent information through the online platform UserInterviews, at which point they select a time slot for a researcher to connect with them. The researcher is instructed to send a Webex invite to the participant 24 hours, or more, before the study takes place. Qualtric links to the consent letter was also set up to collect participant consent via check boxes and date they took the study. Each participant was randomly
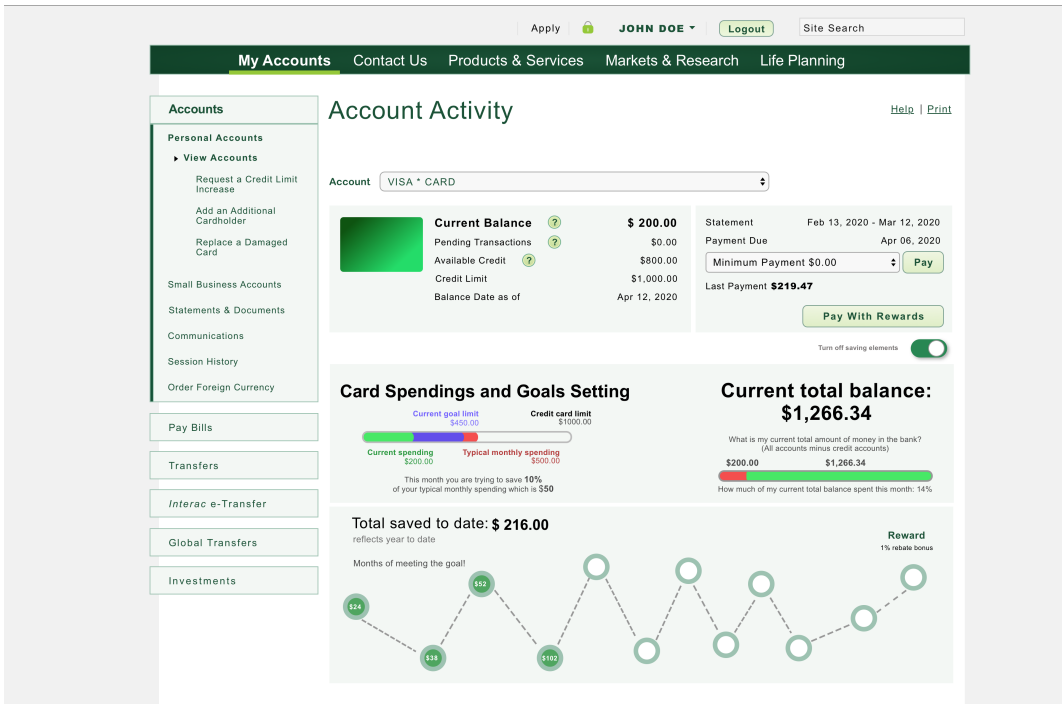
Figure 4.9: Neutral EasyWeb condition mock up
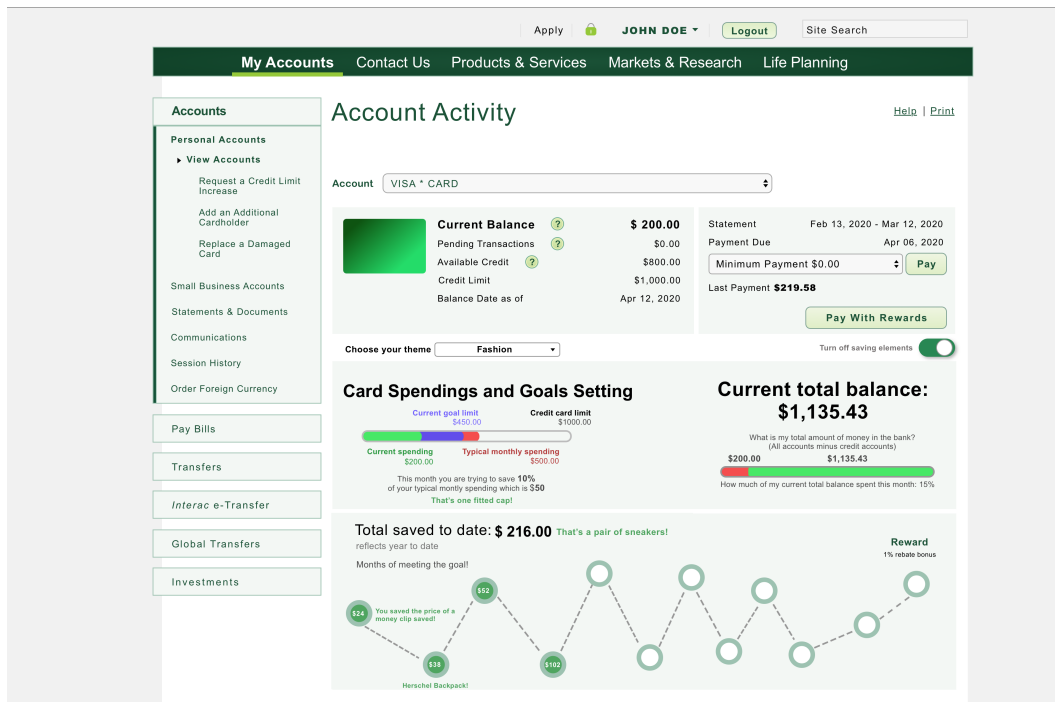
Figure 4.10: Personalization without visualized rhetorical elements applied on EasyWeb mock up
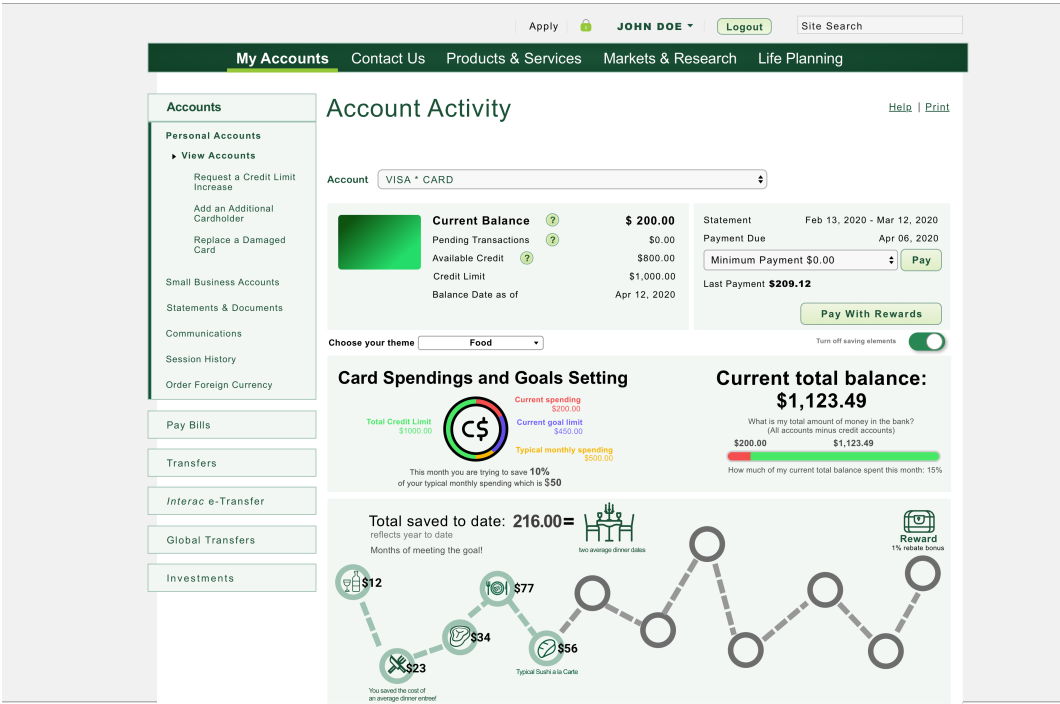
Figure 4.11: Visual rhetorically accommodated elements applied on EasyWeb mock up

Figure 4.12: Visual rhetorically accommodated and personalized elements applied on Easy-Web mock up

assigned a condition to test, this ensures an unbiased representation of the population.

Running the study

1. The participant connects to the researcher, via Webex or Jitsi, during the agreed upon time and is provided with a digital consent letter and information letter, see A, these forms were hosted on Qualtrics.

2. Verbal consent was collected from participants via Webex, or Jitsi. These participants were walked through the contents and described the task they would perform for the study.

3. They were also asked to consent to an audio recording of the study.

4. The researcher begins recording the participant and begins the interview stage of the study.

5. The first portion of the interview study asked them a series of 7 questions. These questions can be found attached to appendix B.

6. The participant is first presented with a screenshot representing a condition.

7. They are required to answer initial impression questions in regards to the screenshot.

8. The participant is then walked through a scenario where they will be tasked to purchasing an expensive item based on their screenshot and scenario.

9. After the participant has mentally walked through using the elements on the screenshot, they will be asked a series of questions, through an online verbal interview, in regards to their experience and driving factors that impacted their decision making process.

10. Lastly the participants are tasked with completing a 15 minute digital questionnaire, hosted on Qualtrics, about their financial risk and confidence attitudes. These questionnaires featured 8-15 items asking participants about their salaries, credit card spendings, their financial behaviours. The participants were to respond with short

answers, yes or no, or with a selection on a 1-9 likert scale. For example: Rather than purchasing a home in a good and established neighborhood, I am willing to buy one in a new neighborhood where home prices are 10% lower but I'm not sure how the neighborhood would turn out eventually (good or bad). Full list of questions can be found attached to B.

11. Participants are thanked for their time and provided a feedback letter debriefing their participation in the study, as the researcher concludes the study and ends the online call.

Chapter 5: Results and Analysis

In this chapter we report our study results and breakdown the data into digestible chunks in preparation for drawing insights into how this work could inform our current situations within financial settings. We will begin by reporting about the data collected, and continue into how we performed the thematic analysis and codifying of the data.

5.1 Results

To keep our results clear, concise, and maintain brevity for the sake of clarity, we have chosen to present our results through a series excerpts and snippets organized in each condition. These results will be reported in tables featuring number of comments we have identified in resulting tags.

During data collection, 3 researchers conducted a total of 60 interviews. Each interview ranged from 25-35 minutes, followed by a 10-15 minute questionnaire portion asking for demographics data. Our final distribution of participants is as follows:

5.1.1 Demographic data

Our study collected demographic data, for demographic survey questions they are attached with appendix B.

Study Participant Distribution						
Condition	Van	N	V	P	VP	Total
Number of participants	12	12	11	13	12	60

Table 5.1: Participant distribution across conditions
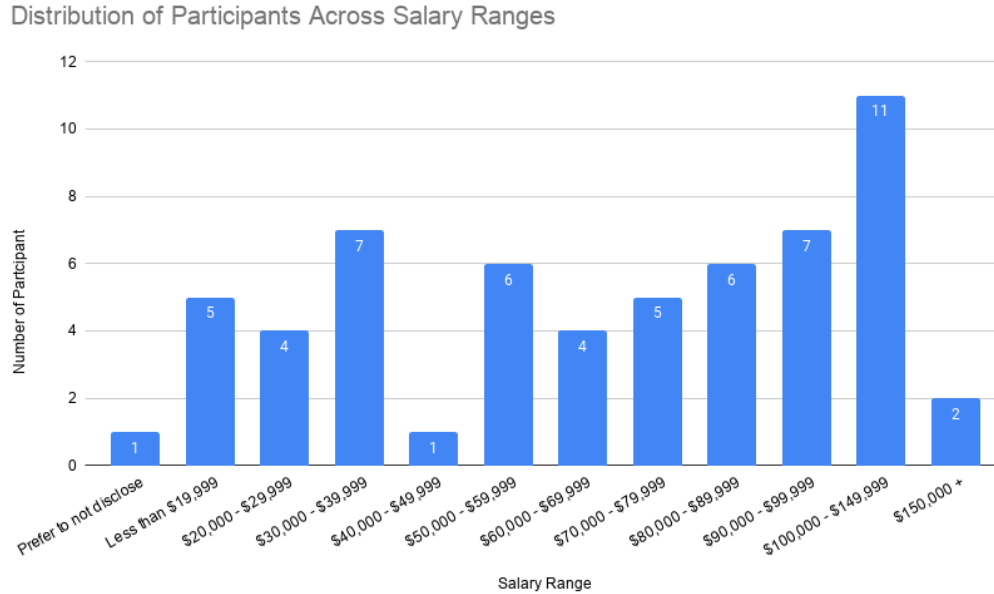
Figure 5.1: Participants distribution across salary ranges in ascending order

We surveyed a total of 28 participants who identified as male, 31 as female, and 1 as non-binary. Our youngest participant was 20 years old, and our oldest participant was 60. Our median age of participants was 34, and the average age of participants was 35. The pool of participants had a median income of $70,000 - $79,999. Two users did not disclose their income. 59 users reported having a credit card, 1 user reported not owning a credit card.

5.1.2 Interview Data

Through 60 interviews and a total range of about 1800 minutes worth of interview data, we established a total of 976 highlights. To create these interview highlights we established a set of ground rules while analyzing the transcript data for the first time. Two researchers would complete codifying 5 interviews together, using these interviews as a baseline we established similarities in coding approaches agreed upon some basic approaches to our initial pass of the data. Our first pass was to group the data within the area of design and

Condition Tags	
Code	**Condition**
N	Neutral
V	Visualization with no personalization
P	Personalization with no visualization
VP	Visualization and Personalization
Vanilla	Control Group

Table 5.2: Conditions and their respective shortform tags

Elements Tags	
Code	**Element represented**
CS	Current spending
LTR	Long term rewards
CTB	Current total balance
Theme	Theme picker
STD	Save to date

Table 5.3: Elements and their shortform tags

condition. We created tags above in Table 5.2 to organize the data into their respective conditions, for simplicity sake each of the conditions names were simplified from their original names (Visualization = Visual rhetorical accommodation, and Personalization = gamification). Alongside the condition tags we generated tags to also highlight which element the participant referred to or which general comment area the comment fell under. Comments that addressed the system and design of the study or the UI interfaces we designed, or if the comment was in relation to the scenario situation they were tasked with, etc. These tags are illustrated in the table 5.3 and 5.4 below:

5.2 Analysis Process

Within this section, we begin to explore the thematic analysis methodologies and document our process.

General Comment Areas Tags
Participant Behaviour/Personality
System and Design
Scenario

Table 5.4: Other tag groups for thematic analysis

5.2.1 Preliminary coding and coding process

Our work begins with an initial pass through of 5 interviews done asynchronously between two main coders (John Yoon, Andrew Cen). The coders then reviewed these 5 interviews and their transcripts and coded them separately. These interviews are then reviewed and a common approach to coding is generated for the initial pass through of all 60 interviews. The goal of the initial pass through was to be able to sort the comments into their respective condition and elements of discussion. General comment tags were created as a way to address grey space comments that didn't fall under a specific element of discussion, or be used in conjunction with elements to target specific comments made discussion and overlap in areas. Such is illustrated in the comment below:

[P002][Tags: N, System and Design, TD Brand Recognition] " Well, I didn't, I didn't check that lower part before, so, you know, I was going to be checking the upper parts of it. Yeah, yeah. But I could figure it out, but you guys are like building this thing for TD bank. Cause I, cause I used TD credit card and I didn't see things before, but I, I have seen, I had seen similar thing in, in, in PC"

The initial pass through of the interviews revealed 1400+ tagged comments across 60 interviews. To reduce the number of data points, we conducted a second pass through reorganizing comments and cross checking the other researchers work. We reduced the highlights to 976 after the second pass through and clean up. This allowed the team to be able to begin sorting and clustering highlights into similar areas.

Looking into the trends we could see in the respective tables below that user's felt certain emotions and inclination towards specific designs. Along with the highlight clusters, key findings were formulated as follows:

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1. Most positively received elements were the short-term goals and the real-world consequences

2. Short term goals, long term goals, and the system as a whole were seen as being most conducive to creating spending/saving goals

3. Short-term goals and real-world consequences were the most impactful on providing financial awareness

4. The scenario's purchase decision was slightly in favour of not buying

5. Short- and long-term goals were the most impactful on purchase decisions

6. Customization of experience was a key factor and frequently requested

7. The ability to categorize spending was heavily requested

8. The use of accommodated visualization was found to be helpful and motivating

5.2.2 Tables and counts of user comments

A count of the 976 comments that were selected by the two main coders into relevant themes that emerged or could explore our research questions are assembled into tables below. Each heading representing a potential related area of discussion, we dive deeper and discuss insights that we gleam from each chunk of positive, neutral, and negative statements in the next chapter of this work.

5.3 Qualitative research findings

5.3.1 Personalization

We are looking at gamification within financial settings. Our research question aimed to answer: How does personalization of information, goal setting, and incentive structures within financial credit card applications affect a user experience? Upon designing the study our initial hypothesis determined that user's would have a preference of how they would like the ability to personalize their experience within their financial application.

Insight: Personalization		Tags used: Condition Tags + Budget/Spending/Tracking OR Personalization/Customization				
Condition	Van	N	V	P	VP	Total
# of Participants mentioning	3	7	9	13	8	40
Total number of comments made	5	9	17	37	23	91
# Positive Comments	0	3	4	11	5	23
# Neutral Comments	5	5	11	20	18	59
# Negative Comments	0	1	2	6	0	9
# Irrelevant Comments	0	0	0	0	0	0

Table 5.5: This table explores positive, neutral, and negative comments on personalization

In combination, in some conditions, with visualizations, we designed the study platform to provided users with the ability to change "themes" of how the data is presented in relationship to real world objects of similar cost. Looking across all conditions we can see some interesting areas/themes arise.

Participants suggest having categorization/budget tracking is a useful feature for them

Participants expressed that being able to categorize and distribute their budget to their needs would allow them to better see the bigger picture. These personalized experiences were reflected in within commentary regarding the current spending element.

[P005]: *"but if I have what you show me, it will be easier for me to plan, to like, to distribute, to plan different portion for different spendings. Like, like say like food, internet communication kids expenses and stuff. And this app will give me like easy using like beneficial picture for spending and for planning my planning, my finances, of course I have situation let's say for the last five month."*

Insight: Visualization	Tags Used: Condition Tags + Simplify OR Different visual/colours/representation suggested OR Visualization useful OR Visually Busy OR Visualization Requested					
Condition	**Van**	**N**	**V**	**P**	**VP**	**Total**
# of Participants mentioning	4	11	10	8	12	45
Total number of comments made	7	37	22	33	43	142
# Positive Comments	1	18	13	15	27	74
# Neutral Comments	3	10	4	14	9	40
# Negative Comments	1	9	5	4	7	26
# Irrelevant Comments	2	0	0	0	0	2

Table 5.6: This table explores positive, neutral, and negative comments on visualization

Additionally, some participants expressed that the categorization of spending, which would separately track money spent on different types of purchases such as bills, food, entertainment, etc, would be an useful feature which would aid in budget-based spending.

[P030]: *"And then it should give me options as to why there's a breakdown. There should be correspond. Like let's say I'm spending way too much on gas or show me things that I'm spending on them spending a lot on and give me suggestions or at least point out where I'm most of my money on it a month."*

Some participants in the vanilla condition expressed that this would a useful feature that they would like to see implemented.

Across conditions, participants have claimed or commented on a potential need to be able to personalize/customize their banking experience.

[P014]: *"Yeah, it's, it's good to see something like, you know, relatable to say, well, you know, as I said, the whole fashion thing, it's not me. I mean, I do love clothes, but not, but yeah. So, you know, just make it relate something, you know, something relatable, stay almost there, you know?"*

[P013]: *"I think it makes sense because you're just trying to resonate with the person who's who has it set. Right. So something like that for like sneakers or a cap doesn't make sense to me, but maybe going out for dinner might make more sense to me or, or doing renovations, like, you know, you're closer to, you know, putting money towards your renovations or, you know, or, you know, (inaudible) yeah, yeah, yeah, exactly. But yeah, somebody who's maybe, you know, a little bit, you know, I don't know, younger, that's more into fashion might be like, Oh, I can get a new pair of shoes or, or some more clothing for that. And it makes sense it's gonna resonate to them than doing house renovations or something. So yeah, I think that makes sense."*

In another set of participants, they expressed the need to for more control and in-depth personalization to better match their real world needs with their banking expectations.

[P038]: *"Maybe if there's a way like that to average dinner dates, maybe like the user could customize it to a way where it's like, they're saving towards a goal and let's say they're want to get a car. And I feel like the car is like 10 grand and we'll say, okay, you are this much percent towards your car goal."*

[P056]: *"could be more personalized and things that you might want specifically. Like to me, maybe a money clip might be like, whatever"*

Our study found that users have a preference to customize their experiences within their financial applications. User's expressed the need to have control over their visuals, being able to categorize their purchases (automatic and manually).etc. This opens up the potential to explore visual rhetoric accommodation.

Some participants expect this to be naturally included, or expect these elements to function as so when asked how they believe this would work. As per their commentary on how they expect to be able to set their own goals and customize their own settings

[P011]: *"So this, I would like for the, like for the user to be able to add things or remove things based on their preferences. So some people that they might not be into fashion or they might not have any passion expenditure. Right. So in that is they should be able to deli in stuff like having some default options for everybody. They should be able to customize it on their own, like this from their usage. The drop down is, is actually great. It's a great idea. So you're can actually add like maybe after 10 or 15 items"*

[P023]: *"That's my first impression yeah. Okay, cool. So going back to that thought I have, would you like the ability to customize what you see? Like which ones you want to use at the time? If you can create your own little dashboard great, why not."*

5.3.2 Visualization

Our goal and research question for this study was to research how visual rhetoric affects an individual's experience within banking environments, specifically how we could improve

a user's understanding of their financial debt and credit within their credit card products. The goal here was to potentially create a potential guideline to assist a user in creating savings goals and reduce their credit card spending to decrease user debt.

In all conditions, participants reported that the models increased their financial awareness by bringing to attention their current goals, spending, progress, and other pertinent information. However, it should be noted that visualizations talked about here is referring to the graphical representation of information through the elements and not necessarily the thematically personalized use of icons only used in condition 4.

> [P009]: *"But if I had this visual tool, then I would have been able to do that a lot easier with taking a glance in real time as to how it's going. Instead of like, if I wanted to know how I'm doing in the middle of the month, what I had to do before is like total everything so far from my emails. So anyways, it was a really inefficient way of doing it, but I just did it and yeah, this would have made it a lot easier cause I had a goal, a spending goal, and this would have made it easier to track how I'm doing at any point in time during the month. These participants expressed that element CS made it easy and quick to ascertain their financial situation."*

> [P028]: *"I think that one, I like more, it's just, it's very simple. It's very simple, very clear. Look at it shows you essentially just takes your current balance credit limit, available credit and just combines it all together, which would actually be helpful. I haven't seen that on any of my credit cards, actually. It's usually what I see at the top where it says current balance pending, available credit credit limit. But, but, but this I like okay."*

Participants found that element CTB quickly showed them an overview of how much money was being spent on their credit card against their bank balance, which helped to discourage potential overspending.

> [P055]: *"So it's overall, it's telling me how much that I spend and how much that I say and how my current, debt versus overall assets that I do I'm standing*

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at. And it just gives me a bigger picture of my, how my spending, will affect my go towards saving or paying off my card. So instead of like seeing all those transactions each by each, this one will give me like a full picture and I guess it just helps me better in understanding my overall financial situation."

Participants found that element LTR informed them on past successes in spending reduction and thus motivated them to continue their saving habits.

[P009]: *"And I'd keep this a total saved to date section in, cause it's also good to good a visualization to know how successful you've been in how close you are to getting rewards and also just an incentive to not screw up a month because then you wouldn't have a nice green circle with on the mountain saved that is meeting your goal."*

Chapter 6: Discussion

In this chapter we reflect on the results and analysis from the previous section. We aim to offer offer insights, as observers, as to why certain effects within the data happen and dive deeper into participant motivations and related literature. Structured below you will find key findings and a statement identifying clusters of participant collective/similar thoughts followed by select excerpts of participant quotes, along side other related works that offer potential explanations to the effects we witness.

6.1 Key Findings

Through our qualitative results alongside our quantitative counts of positive/negative comment ratios we offer 8 key findings, and explore in relation to our hypothesis what these human behaviours could reflect.

Positive Comments					
	Neutral	**Visualization**	**Personalization**	**Combined**	**Total**
Short term goal	9	5	13	14	41
Real world consequences	13	10	9	10	42
Long term goal	9	8	7	7	31
Theme	0	0	5	3	8

Table 6.1: Table of positive comments within each testing group

6.1.1 Most positively received elements were the short-term goals and the real-world consequences.

Referring to table 6.1, we can see that across all variable conditions, the gameful elements employing short-term goal setting and showing the real impact of credit card spending garnered the highest number of positive comments. The results propose further inquiry, in future works, into **CGL3: Simulations should show a clear connection between gameful design and real-world actions/impacts**. This could potentially be explored in a future study design specifically targeting whether participants enjoy simulations without real world impacts vs. simulations that do demonstrate real world impact. Such as study could examine a purchase simulator of arbitrary items impacting a random dollar amount vs. items for purchases simulated against the participants account. Particularly interesting when we look into elements within these areas that affected the participants we can see that:

Participants found the monthly goal target to be motivating in reducing spending when given the chance. These positive reactions to the design elements posit that there exist some degree of relationship between gameful design elements and it's effects on credit card spending. We can see that **CGL3** is positively received in situations below positing that gameful designs do indeed have a degree of effect towards controlling these behaviours, credit card spending. To what degree the of effect and influence these gameful elements have is a suggestion for future work to determine.

> [P056]: *"I think that this would be like probably one of the most commonly looked at parts for me, because I think this is very, very valuable information that I know from some of my other banks[...] I think it's good to be able to see what your limits are for the month and whether you can stay under them [...]"*

Participants also found that being shown how much their credit card spending was in contrast to their bank account balance provided key information not found on similar platforms, as with P056 and P052.

> [P052]: *"Okay. I think that is interesting that the, what is my total amount of money in the bank? Because I think with my current bank, like the app that I*

use, it doesn't show that because it wants me to use my credit card more. Does that make sense?"

[P026]: *Overall. I think this approach is very interesting. It gives us a visual representation of how like to, to encourage people, to either save more or give them a very graphical idea of how they're spending these compared to their real life. Oh, sorry. How their savings compared to their real life spending and when they can use with those extra dollars I've backseat by the, yeah. Just, I like to have some questions regarding how this graph is some of the reasons behind the graph.*

Both examples suggest that participants experience positive effects of knowledge transfer when interacting with visual elements that demonstrate a clear connection between the element and the effects in the real world, in the above examples participants stated their understanding of how each element and its' visualization translated to their dollar amount spent, balance remaining, and translations of real-world examples representing dollars saved. Utilizing colour norms, these elements help make abstract ideas more concrete demonstrating spent money with the red and remaining balance in green. Examining table 6.2 in detail, we can see the combination of both personalization and visualization yielded the most positive comments within short-term goals. Drawing from the work of Teston, and Zimmerman et al. we can see how visualizations can make "present" the relationships of abstract concepts and allow users to create a connection to what they see and how they are affected through a simulation, or digital interaction[80, 95]. Alternatively looking at the other latter results in table 6.2 we can see that participants were not as receptive to the long term goal visual element, this could be due in part to how I specifically designed this element and would warrant further research within a future study. What the results could suggest is that participants prefer instant gratification over long term consequences. Potentially offering an explanation business technology news website ZDNET, and Boston Globe columnist both write that studies suggest that instant gratification[60] and technology[52] are the cause of increasingly impatient users. Corroborating with these results, a few participants are quoted below discussing what information is important to

them when banking, suggesting that although the element is useful it is not visually required to be seen, in the sense that although they believe the long term reward tracker element to be useful, it is not an element they need to visually see. The below are selected excerpt of this idea:

> [P015]: *"Simply because in the middle card spending's in goal setting is already there. I don't need another visual, like just, I want more simple simplified."*

> [P038]: *So also to date, maybe I feel like personally I would prefer if there was like an option to see how much did I save past six months, one month, one week. So like, I, I, that would be something I would use. And also the save to date is helpful.*

> [P037]: *Hey, you know, I can get an extra entree at dinner. Like I don't care for those things. Like just seeing, I have that connection to see that like, if the money is there, like I say, $77 this month, that's important enough to me and I can, I can make that connection. So like that, like just having maybe a chart or whatever, some of it simple way to present the information is good enough*

The impact of these findings suggest that when gamification is employed in financial settings that designers should create experiences that encapsulate the immediate future demonstrating real world effects. Further, they should do so while ensuring that the feature is quick and easy to convey information fast. This is important to ensure that participants can still complete the task of banking without confusion and quickly.

6.1.2 Short-term goals, long-term goals, and the system as a whole were seen as being most conducive to creating spending/saving goals.

In all variable conditions, either when asked or unprompted, participants reported that the monthly target, the long-term incentive (LTR), or the combination of all elements (CS, LTR, CTB, Theme) shown were the most amenable to creating new spending goals, as opposed to the theme picker. This potentially could be the fact that the theme picker does

Conducive to Goals					
	Neutral	**Visualization**	**Personalization**	**Combined**	**Total**
Short term goal	8	0	6	4	18
Real world consequences	0	2	4	0	6
Long term goal	2	4	2	6	14
Theme	0	0	0	4	4
Whole system	4	2	6	2	14

Table 6.2: Table count of comments of within each condition that was conducive to goals and decision making

not explicitly translate to money, but as a tool to create personalization for their tools. Exploring comments by participants below we discovered that:

Participants reported that having a monthly target for spending would be beneficial in keeping to a budget.

> [P020]: *"Yeah. I mean, hopefully you definitely have some budget in terms of, yeah, definitely. It helps me just budget a lot better in terms of, you know, what I need to, if I have these, these goals and I want to, and want to get rewards for meeting these goals, it definitely encourages me to, you know, have a, you know, a plan in terms of how I'm going to achieve the goal and, and really to budget in terms of what I need this month. And, you know, how, you know, do I really need this item this month?"*

Participants reported that working towards an incentive, even if over a 12-month period, would motivate them to adhere to spending or saving goals.

> [P053]: *"I would use this as a way for me to visualize my goals, especially since I can see that six, seven around the seventh circle is halfway through to the first reward. ABC me closer to the end circles could inspire me to, you know, go through that extra step to save a little bit more, to get that 1% rebate bonus. I think that's a pretty strong method to get people to save pretty enticing"*

Participants either could not attribute to a single element or reported that the whole model was amenable to creating spending or saving goals.

[P025]: *"Most definitely. I mean, the information is very well laid out and I will use all of them, but I would probably change, just change a bit about how the current spendings and goals settings are laid out just that portion, but everything is, it will be very useful for me. I would definitely use it."*

The study results demonstrates a potential impact in creating/changing user behaviour. Some participants stated that having a visualization could help them break down their goals into attainable measures.

[P007]: *"So I guess that's kind of cool that you can see how much you've been saving per month and that you can set a goal for yourself. I'm assuming that you set it for yourself and that someone's instead of for you. So it's like interesting to see kind of the, the tracking of that. And also since it's not just per year, it's like per month, so it's like a better, I guess, like interval."*

Examining these effects in relation to our earlier literature review findings points us to **CGL 2: Make abstract finances more visually concrete by establishing presence through simulations** and **CGL 3: Simulations should show clear connection between gameful design and real world actions/impacts** that rooted within gamification guideline **G4: Help users gain financial knowledge through feedback and discussion using tips, avatars giving feedback, quizzes, and social platforms for communication and knowledge sharing.** Observing similar effects in a study by Albrecht et al. [2] we can see that providing an interconnected tool, a system where all elements work in conjunction with each other, will guide/push users to make diligent choices and assess the impacts of their choices. In the case of the study, the elements are designed to assist users in creating both short and long term saving goals and provide feedback with the use of visualizations. According to Rodrigues et al. [67] humans process information better visually with patterns and systems, in which we observe the effects from the statements above. Also building on Tibco's work on the four principles of good user

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Financial Awareness					
	Neutral	**Visualization**	**Personalization**	**Combined**	**Total**
Short term goal	9	7	6	9	31
Real world consequences	9	9	3	10	31
Long term goal	4	3	4	1	12
Theme	0	0	0	2	2
Whole system	6	0	4	6	16

Table 6.3: Table count of comments made by participants claiming positive effects to financial awareness within each condition

experience design we can observe the effects on good user experience as outlined: visuals, interactive, immediate, contextual [38]. In this article we gather that good user experience must have visuals that are interactive, featuring immediate response in a cause and effect manner, and being able to properly contextualize the information in a digestible manner for the user. Showcasing such behaviour in our system we can also similarly examine atomic habits effects [17], a framework for developing good habits through implementing small behavioural changes, in such that our system visually creates a reoccurring stimuli to reward the user with images of items, dollar amounts, and chart elements, visualizing what they have saved and logged on the long term tracker tool to see the meaningful steps they have taken towards a bigger goal.

6.1.3 Short-term goals and real-world consequences were the most impactful on providing financial awareness.

In all variable conditions, participants expressed that these two elements, short-term goals and real-world consequences, were the most effective in giving them key information about their financial status and keeping them aware of progress towards their targets. Referring to 6.3.

The monthly target was important in giving participants a sense of what their immediate goals were and how close they are to overspending.

[P009]: *"But if I had this visual tool, then I would have been able to do that a*

lot easier with taking a glance in real time as to how it's going. Instead of like, if I wanted to know how I'm doing in the middle of the month, what I had to do before is like total everything so far from my emails. So anyways, it was a really inefficient way of doing it, but I just did it and yeah, this would have made it a lot easier cause I had a goal, a spending goal, and this would have made it easier to track how I'm doing at any point in time during the month."

The ratio of credit card spending to bank account balance gave participants a quick but informative overview of gauging how much they were spending.

[P055]: *"So it's overall, it's telling me how much that I spend and how much that I say and how my current, debt versus overall assets that I do I'm standing at. And it just gives me a bigger picture of my, how my spending, will affect my go towards saving or paying off my card. So instead of like seeing all those transactions each by each, this one will give me like a full picture and I guess it just helps me better in understanding my overall financial situation."*

In both situations we can see that participants exhibit positive reactions towards the relationship between short and long term goals in relation to financial awareness, more specifically they demonstrate an understanding of these specific visuals and describe how simplification and knowledge translation of visual elements conveyed their banking information to them in a clear and fast manner. Visuals that illustrate in metaphors and openness are more easily perceived and appreciated [47] by users, and in this sense our elements portray such simpleness/openness through it's design such as debt and available balance being represented by traditional colour norms, red and green respectively, user's can expect when they see red larger than green that they have more debt than available balance. Furthermore, exploring work by [68] we can surmise the the impact that this finding proposes is that by visually maintaining the simplicity we can ensure and maintain user attention, motivation, and use.

6.1.4 The scenario's purchase decision was slightly in favour of not buying.

Referring to information on 6.4. Across all conditions, there were slightly more participants who chose not to purchase the shoes in the given scenario.

Purchase Decision						
Condition	Control	Neutral	Visualization	Personalization	Combined	Total
Would Buy	7	6	4	6	5	28
Would Not Buy	5	6	7	7	7	32

Table 6.4: Table displaying count of comments within each condition participants made of purchase decisions pertaining to the study scenario

Element behind Purchase					
	Neutral	Visualization	Personalization	Combined	Total
Short term goal	7	10	3	11	31
Real world consequences	2	0	1	1	4
Long term goal	5	7	6	8	24
Theme	0	0	0	0	0
Whole system	0	1	2	0	3
None	0	1	2	0	3

Table 6.5: Table count of comments made by participants on which element was pertinent to their decision making process

6.1.5 Short- and long-term goals were the most impactful on purchase decisions.

Referring to table 6.5. In the variable conditions, when asked about their purchase decisions, participants reported that the monthly spending target and the incentive structure had the most influence on their decisions.Participants expressed not wanting to leave too little for necessities or overspend and go over the monthly limits, if possible.

> [P058]: *"I would have about $70 left to spend for the rest of the month on like food and eating out and stuff, which I don't think would be enough"*

Participants reported a few different reasons as to how the incentive influenced them. Some did not want to miss the extrinsic reward.

> [P010]: *"I think that it is pertinent though, but those that struggle with that, that struggle with their spending habits and it could be motivating for them to see,*

> *Oh, well, there's a way I can gain more perks through my banking institution, by being more mindful of my spending habits."*

Some felt already too invested in the past months of success and did not want to ruin their streak.

> [P038]: *"And then I would look and I said that, Oh, another thing that intrigued me was that the plus 1% cashback, I wouldn't want to like ruin my streak. So that is all something that benefited. Like I just feel like officials are really that worth it. I don't want to like mess up that streak since I'm already like five months in."*

Some decided to make the purchase because they had saved money in past months.

> [P019]: *"Like I saved this much already, so it's kind of like I can afford to lower myself or afford to splurge a little bit here and there."*

As per the proposed framework of gamification for financial literacy by Inchamnan et al. The use of gamification through unlockable extrinsic rewards, short-term intrinsic reward, alongside feedback leading back to an overall master task leads to persuasive behaviour[41]. With evidence from the excerpt from P038 above, we observe that feedback in the form of the long term reward tracker allowed the user to be more financially aware and could then have contributed to the decision of ultimately not purchasing the shoes in the given scenario.

6.1.6 Customization of experience was a key factor and frequently requested.

In all conditions, participants either assumed or asked that many parts of the model were customizable/personalizable, including targets, visuals, and rewards. Participants wanted the ability to personalize their spending targets.

> [P007]: *"Like if the goal is set by the credit card company? Well, like I want to set my own goals, you know, like I might not be trying to say 10%. It might be trying to say like 5% or something. I dunno"*

Participants in the thematically variable conditions expressed that how their goals and past savings are represented should be personalizable.

> [P011]: *"So this, I would like for the, like for the user to be able to add things or remove things based on their preferences. So some people that they might not be into fashion or they might not have any fashion expenditures. Right. So in that is they should be able to stuff like having some default options for everybody. They should be able to customize it on their own, like this from their usage. The dropdown is, is actually great. It's a great idea. So you're can actually add like maybe after 10 or 15 items"*

Visualization						
Condition	**Control**	**Neutral**	**Visuali-zation**	**Personali-zation**	**Combined**	**Total**
# of Participants mentioning	4	11	10	8	12	45
Total number of comments made	7	37	22	33	43	142
# Positive Comments	1	18	13	15	27	74
# Neutral Comments	3	10	4	14	9	40
# Negative Comments	1	9	5	4	7	26
# Irrelevant Comments	2	0	0	0	0	2

Table 6.6: Complete table count of participant comments towards visualization and it's effects in each condition

6.1.7 The ability to categorize spending was heavily requested.

In all conditions, participants wanted to categorize how their spending was shown. Some wanted to group spending based on larger categories such as groceries, entertainment, etc., as is done in other tracking applications.

> [P042]: *"So I mean, knowing what I spend my money on, I guess, would be a way to budget that. So knowing that say if transaction one was labelled as*

like food and transaction two was labelled as like entertainment, I would know where I spend my money most, I guess"

Some wanted to introduce separate spending goals for different categories of purchases to better see where non-essential spending could be reduced.

[P030]: *"And then it should give me options as to why there's a breakdown. There should be correspond. Like let's say I'm spending way too much on gas or show me things that I'm spending on them spending a lot on and give me suggestions or at least point out where I'm most of my money on it a month."*

In an effort to bridge into visualizations, we can observe the effects of *RA1*. The design should accommodate the audience by using information suitable to the audience[25], translating and adapting the information if necessary[86, 44, 89, 77, 75, 33]. Observing that visual images are power tools for communicating messages, we must consider that different user's will have different expectations of the system and will have a different set of needs from another user, such as the Brazilians outlined in the work done by Baptista et al[3].

6.1.8 The use of accommodated visualization was found to be helpful and motivating.

In variable conditions utilizing rhetorical accommodation, participants found that the practice of accommodation made tracking spending and saving easier to understand and more motivating. In the two visually accommodated conditions, participants found that the use of icons made their spending goals easier to understand and engaging, and thus more motivated to save.

[P052]: *"I like the visual picture of all of the things you saved, the cost of an average dinner entree. That's I think a really good way of motivating people... I think it's cute. I think it's a really great way of, I think a lot of times it's very difficult to conceptualize. You're like people I like saved money and you're like, well, what am I saving for? Like when you set saving goals, it's very hard to stick to the goals. So having something that's like, like an example, like the two average to engage with the cute little picture."*

Even in the textually accommodated condition, participants found that even text-based descriptions of real-world items have similar effects.

> [P017]: *"so it gives a like a more, I can't think of the word, like a value that maybe someone could understand better than just $216. That's a fancy pair of sneakers. That's a, I like AirPod something like that to put a monetary value to like a 10."*

As such before we move into the limitations and potential future work for our research, we believe it is important to highlight our research in context of our research questions. In terms of our first research question RQ1) Do gameful design elements have an effect on controlling credit card spending? Demonstrating viability of our proposed guidelines featuring intersection of visual rhetorical accommodation and gamification, we can observe from a small effect from a users that would buy over would not buy vs. the rest of the gamified conditions beating out would buy by 1-3 participants, with the exception of the neutral condition that is tied. That is not to say it didn't work, but the effect was not to the extent we could definitively claim that gameful elements did solely affect the decision making process. We can however state that, with some qualitative data, that gameful design elements did play a part in the decision making process vs. the control group which did not. Exploring work by other reveal that we potentially did not incorporate enough activities alongside rewards in an interactive methodology[41], or perhaps our platform design was not visually appealing, polished, simple, and functional[68], which resulted in poor user experience.

In terms of our second research question RQ2 Which effect does visual accommodation have on the perception of gameful applications aiming at controlling credit card spending? In this situation we can assert that user's had a generally positive trend towards visualizations within the study platform across all gamified conditions. Work in similar areas have driving observably similar effects such the study by Gunaratne and Nov, observing 400+ participants and 3 random user interfaces and it's effects on loss aversion and control, quoting:

"institutions who regulate and manage retirement saving can help the public

by utilizing design. In particular, displaying information that emphasizes goals, deviation from goals, and long-term scenarios can be highly effective."[34]

Lastly our RQ3) Does personalization of visual metaphors help to increase their relevance and thus make credit card spending more concrete? To this effect we can refer to the lower section of study designs and limitations. As of now this remains to be answered with our limited view into this component. We originally set out to allow users to chose themes and create relevance to visual objects they see in relationship to their savings/spendings goals. As we discovered through the process of the study user's did not find that feature useful, however they did request personalization in the form being able to adjust the information they see and how they view it.

6.2 Study Design Limitations and Future Work

6.2.1 Potential sample limitations

Our pool of participants were limited in those users who had a stable internet connection and were available to speak via online interviews, as we conducted the study via online interviews. There is potential data to explore in credit card user's not represented within the online community, or the pool within UserInterviews.

The study platform that we employed also seemed to demonstrate some limitations in participant pool and knowledge. Participants on this platform represent a group of online user testers as they use UserInterviews as a source of revenue. The data generated through these interviews only explore the our work through the lens of a user tester deliberately looking for faults within the system.

Our study, due to the effects of COVID-19, had went from an in person study to an online interview. Our goal was to provide participants conditions randomly, but also ensure equal distribution of each condition. We aimed to recruit 55 participants, 11 per condition, with the expectation of 10% of recruitment being no shows. During the process of conducting the study, due to technical difficulties, we temporarily lost audio and data from 5 participants. To remedy the situation we recruited 5 more participants to fill in the missing conditions. With the help of technical support we recovered the lost recordings and ended up with uneven amount of distribution in participants for our study.

6.2.2 Participant behaviours and attitudes

Participants who are already financially organized find these features redundant or not of use. A few participants expressed that they could see the benefit but is currently not useful for them. These same participants also expressed that during their student years that they would have appreciated these features. Currently it seems that they are content with the way they organize money and have systems in place, which would conflict cause a clutter if they integrated any of our works designs.

Alongside the above participant behaviours, participants also reported their lack of connection with the scenario and elements set up. Some reporting their card spending would never be in this situation, or they would rather spend money on groceries or items of more value to their situation.

☰ Participant already performs task/redundant features	
P007	So I kind of do similar things for myself already. So in a way, yes, but also because I'm doing it for myself already. I don't need it in a bank account, I guess also because I like doing it for myself because I can personalize it more. I don't know how the personalization for this would work online
P008	Honestly, I probably wouldn't. Okay. Any reason why? I just feel like it's not so necessary
P010	The 1% rebate bonus is not as motivating for me personally because I don't, I'm already very mindful of my spending habits
P010	And I also have a tool that I use a tracker or an expense sheet. So that right by, I guess I use a budget sheet. So I think this graph does not speak out to me personally
P018	I mean, I don't think the current total balance section is exactly necessary. I think that's something that maybe a person can kind of determine on their own by in terms I keep the,

P025	So, Hmm. Well, do I agree in interest? Well, personally, I, I'm not really interested in this, although it's very useful. It's probably because I have my own Excel sheet, <inaudible>and everything, but if I didn't have that. Yeah. And then, yeah, this is pretty useful. I really like the part, the part for current spending and credit limit. So those two items are what really attracts me for this.
P060	credit limit shown there as well to probably remove that limit from the there at the top and at then show it at the bottom.
P060	I mean, just to like, you know, not to have repetitive places where the same information that is displayed again and again, I would rather want everything to be more efficient on the screen.
P035	ell, the whole credit card balance thing, like I don't think that needs to be there
P035	So, you know, just, just a lot, a lot of redundancy that I probably don't need to see right away.

Table 6.7: Comments of participants who already perform this task and cannot connect with scenario or situation

6.2.3 Gamified elements design

The design of the study platform's elements were guided by our proposed elements. This does not take into account how many elements should be used with each point in the guidelines, and the extent of the gamification we need. In future works, we could possibly explore collaborative design with end users and answer the question how much gamification is enough gamification within financial settings, as per rhetorical accommodation guideline CGL6: Adapt the visualization to the target audience through user feedback.

⚑ Features are convoluted and visually confusing	
P001	Correct? Because the only reason I'm saving is so that I could get the cashback I've saved and I've met my goal. I don't need to know how I met that goal. I just need to know what I'm getting because I met the goal. It's just very convoluted. The whole program itself is very fun. Let's just give you cashback. You need a goal and 1% is enough. So to put a condition on it, fine, some people need motivation. I understand let's just make simpler, it's too complicated.
P001	Just very confusing. It's just all over the place. I have no idea what the card spending's in goal settings. I have never seen something like that. Okay. And don't really understand why my current total balance sheet 1,266 and 34 cents. If I have only kind of a balance of 200, let me see. Zero pending.
P010	I'm still, I think it's too much information again. And I leave that section out or it with something else, which I can not think about right now, but would be more pertinent, but that my eyes are not drawn visually to that kind of information. And I don't think it'd be okay. You said, this is, this section here is too much information. Do you mean it's just unnecessary information or not useful
P015	Simply because in the middle card spending's in goal setting is already there. I don't need another visual, like just, I want more simple simplified.
P035	So, you know, just, just a lot, a lot of redundancy that I probably don't need to see right away.
P023	I get it again, the information, there's a lot of information. Good information, but it's just a lot, like to me, it's I want to see three things, my total credit card limit. How many do I want to spend and where I'm at? that's all literally I'll care for, I don't care for if it's 10% of that or not. You know, for me, the bar on the right is probably sufficient enough.

P027	It looks like it's from what I can tell, let me see. One, two, three, four, five, six, seven, eight, nine, 10. Yeah. These are by months. So I would look at the end of the month to see what I've spent on there, but I wouldn't, I wouldn't look at it. I wouldn't pay a lot of attention to it. I would just look at it at the end of the month to balance my budget.
P007	It's pretty clear. One thing is the, the little like graph line thing at the bottom, it seems a little bit weird because the lines are a bit random.
P056	Okay. I think that when I first got on this site, it looked a little bit too busy for me. And I guess with like a bunch of other banks have like very clean layouts and stuff like that.
P058	Yeah. And I think the bottom session can definitely be simplified a little bit. Maybe not having so much emphasis on that section. I think all I need to do is to see like how much I've saved up to now and like maybe a very simplified map as to where I'm going.
P005	Okay. I would take off the zigzag in the middle. I didn't like it at the beginning when they open the page, when they thought about it and you're asking me like, to concentrate that yet, I still don't see how can I use it and how this can support me.

Table 6.8: Participants who find features visually convoluted and confusing

6.2.4 Personalization study design lacking

Instead of allowing the user's to actually customize their gamified experiences, we presented scenarios to put them into mindsets of character who would enjoy shopping, food, or sports. This kind of system also does not take into account of individual sub preferences, a liking for hockey is not an indication that the same individual would like baseball.

True personalization of the experience would explore other areas, as mentioned through

our discussion and results, Users believe they should be able to personalize how information is displayed to them and what choose what information they would most like to see.

📊 Different Visuals and Design	
P002	Take off the site, the lower portion, you know, where do you have shown the graph? Like the months, you know, I could have made that more more smaller and focus more on the middle portion.
P011	Definitely ever do use a pie, pie charts, or bar graphs, anything of those sorts, except for this one, I would go for pie charts or bar graphs. And we can give like, you know, the time of the meeting kind of like the, what is that call I'm now getting the word, Oh, the legend. Yes. We can give the lesson separately in of like adding to the numbers itself. We can just highlight the numbers. So say, for example, if you're going for a bar chat so we can just give the numbers, like whether it's going up or down, like in a certain time timescale and next to it, we can give a legend saying like, okay, this is what this means, this, this is what the vertical lines mean, stuff like that.
P011	I would like to see the vertical bar graph
P011	Yeah. The options in either percentages or dollar amounts.
P024	he money bag under the bottom section where it says total safety date, the 216, it makes the 260, a little bit difficult to use. So actually I might remove the money bag. You know, I get that. It's, it's trying to say that the section relates to spending, but it looks a little bit out of place given that there's no icons anywhere else on the page.
P026	I think I, I would prefer a different design for the spending and then goal setting, because I think I, I was very confused from the get go. So that's something that I like to be changed. And also it would be like, I don't see anywhere where I can change my goa

P022	Right. So like the ability to set in your own goals and personalized that's, you will want that to be more clear. Yeah. More clear, more apparent. And my only real other comment is that the yellow color for typical monthly spending I think is doesn't stand out enough.
P030	s. I do not like the color scheme. Like <inaudible>, you got the current spending and that's in red and while it is suppose to be obvious,
P035	Yeah. This, this feels like, like, like as you're progressing through like a game stage, right. And maybe that's what you're going going for, but, but it's hard to see the correlation for the different categories there. Maybe if it's presented in a different way, like this is, again, my personal opinion, it feels like they're all correlated in one way or the other. And then one is like a sequence of the other, but they're not, they're all kind of individual managed. So I, I don't agree with the dotted lines in that sense.
P055	It just the way of presenting the charts to make it easier. I know like for even like Excel sheet, it's boring, but it's easy to understand like those charts in Excel, Excel sheets or those bar charts or something. Okay.
P058	I think it would be very useful if I think graphically, it was more clear. By graphically clear, what exactly do you mean? Just to make sure I understand. So right now it looks like the $200 spent on your credit card. It's not within the $1,123$. So I feel like it would be like easier if it was like a sub category. Would you know what I mean? Yeah. So, so then it kind of detracts from your, the bar once you spend more money

Table 6.9: Comments of participants who requested different visuals or designs

6.2.5 Study Platform

Participants in the study were cognitively walked through a scenario featuring some pre-existing conditions of previously purchased goods, an existing balance, and a decision to make of whether to purchase the current goods or not. This does not represent true too life scenarios where user's would be able to interact with the design elements and possibly explore the system. In future work, we suggest a more connected HCI approach with a interactive prototype featuring touchable points and reactive elements. Exploring possible concepts as to how this financial gamification would be affected provided participants had an on-boarding process vs. not, etc.

6.3 Conclusion

Our work here examined the implementation of how visual rhetorical accommodation alongside the use of gamification could affect human behaviour within financial settings.

We created an online study platform where we tested and interviewed 60 participants against 5 conditions featuring varying levels of gamification elements, with and without rhetorical accommodations, and personalization. Our work uncovered that user's did indeed have preferences towards gamification within financial settings, specifically the ability to control the visualizations and information that the user considers more pertinent to their situation and basis.

Our findings are as follows:

1. Most positively received elements were the short-term goals and the real-world consequences

2. Short term goals, long term goals, and the system as a whole were seen as being most conducive to creating spending/saving goals

3. Short-term goals and real-world consequences were the most impactful on providing financial awareness

4. The scenario's purchase decision was slightly in favour of not buying

5. Short- and long-term goals were the most impactful on purchase decisions

6. Customization of experience was a key factor and frequently requested

7. The ability to categorize spending was heavily requested

8. The use of accommodated visualization was found to be helpful and motivating

In relation to our research questions, we have seen that these findings corroborate with our hypothesis that gameful design elements do indeed introduce positive effects with users in financial settings. These findings also do answer my research questions to some degree. We can see that to RQ2) visually accommodated rhetoric do affect the perception of gameful design within controlling credit card spending through findings 8 and 6. RQ3) is explored through findings 6 and 7, as participants wanted to be personalization and customize their banking experience, also they requested the ability to categorize their spending in their own specific buckets/categories. This all contributes to the finding that RQ1) gameful design elements do indeed have some degree of effect on controlling credit card spending, through findings 1-6, and 8. Participants did demonstrate a strong initial positive reaction to the design such as the short-term goals and real-world consequences elements, exclaiming that it is interesting, that they would love to see this work for real, or interact with it for a longer time. To what degree and how much of an effect that these findings have on the user is a reservation for a longitudinal study in the future, along with the suggestion that an interactive prototype be created.

6.3.1 Impact

Our work begins to build a basis into how we can look at designing useful tools to assist user's within financial settings. We built a set of proposed guidelines through variety of sources within rhetorical accommodation and financial gamification. Our belief is that these guidelines can be used to:

1. Aid user experience designers creating a gamified approaches within financial settings

2. Help financial institutions disseminate critical information to their clients

3. Promote end user experiences in reducing spending and debt prevention

We believe that future work can improve on these suggested guidelines of design, and possibly validate this approach of gamification in financial settings. Our long term goal is to understand how we can improve user experiences through gamification and rhetorical accommodation.

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Appendix A: Recruitment/Supporting Material - Information, Consent, and Feedback Letter

Information and Consent Form

Date: April 5th, 2020

Title of Project: Mitacs - Knowledge translation and simulation: Viability of teaching financial literacy through gameful design and applied rhetorical accommodation

Faculty Supervisor:
Dr. Lennart Nacke,
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External Partners:

Study Overview

We are faculty and students at the University of Waterloo conducting research with the possibility of publication under the supervision of Dr. Lennart Nacke (Department of Drama and Speech Communication) in partnership with TD Bank under a Mitacs Accelerate internship. Credit card debt is a serious problem for many Canadians. To address this issue, the project partners up with TD Bank to investigates gameful ways to aid banking customers avoid credit card debt. You do not have to be a TD bank customer to participate in this research. Our primary research question and two sub-questions for this study is: RQ1: How can we change a consumer's spending habit, ideally toward debt reduction and debt avoidance? RQ2: Does gameful design affect the consumer experience and spending habits? RQ3: Does rhetorical accommodation affect the consumer experience and spending habits?

Participant Task Overview

You will be asked to participate in a 45 minute online interview study hosted on Webex, and complete a survey hosted on Qualtrics.

You, the participant, will be provided with a prototype shared via Webex by the researcher. The researcher will provide you time to look over the material and familiarize yourself with the prototype. When you are ready you will be asked to answer questions in regards to the

prototype you have just witnessed and your opinions regarding such. You will then be provided with a scenario and short descriptions of particular elements within the prototype. You will be asked to re-answer the questions provided by the researcher to understand how the situation has changed for you. At the end of the interview portion the study voice recording will stop. You will be asked to complete a 15 minute online survey hosted on Qualtrics. When this is complete the study is finished and you will be provided a feedback letter and a de-brief from the researcher.

Participation and Remuneration

Participants must meet the following criteria for inclusion in this study:

- Adults (age 18-64 years)
- Participants are required to have a steady internet connection
- A personal computer (PC) or laptop with a webcam and microphone
- Having used online credit card banking products(services)

Participation in this study is voluntary, and will take 45 minutes of your time. You may decline to answer any questions presented during the study if you so wish. Further, you may decide to withdraw from this study at any time by advising the researcher and UserInterviews.com, and may do so without any penalty. Your data will be linked to your online user handle, if you would wish to remove/withdraw your data from the study you can contact the researcher to do so.

Benefits of the Study

There is no personal benefit for the participant during this study. By investigating the use of rhetorically accommodated gameful design we can develop design guidelines that could lead to the development of better banking services.

Risks to Participation in the Study

There are no known physical risk to you during this study. You might experience psychological risk due to having to report your level of financial literacy. You are allowed to pause or leave the study at any point in time should they feel the need to or desire to.

Confidentiality and Security of Data

Your identity is considered completely confidential; your name will not be included or in any other way associated, with the data collected in the study. Furthermore, because the interest of this study is in the average responses of the entire group of participants, you will not be identified individually in any way in any written reports of this research.
Electronic data and audio recordings will be kept for a minimum of 7 years on a secure password protected computer to which only researchers associated with this study have

access. All identifying information will be removed from audio transcripts and stored separately.

All identifying information will be removed from the records prior to storage. Your results will be tied to a participant ID. Data without identifiers may be shared publicly. Your identity will be confidential. With permission, anonymous quotations may be used in publications/presentations resulting from this research.

You will be completing the study by an online survey operated by Qualtrics®. When information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). Qualtrics® temporarily collects your computer IP address to avoid duplicate responses in the dataset but will not collect information that could identify you personally

You will also be completing this study via Webex, and this study will be audio recorded for analysis purposes. Only the researchers who the participant willingly conducts the study for will have access to the video recording and data. These audio recordings will only be used for study purposes. The video will be shared between the researchers listed on the study, and the online transcription software (Dovetail). When there is no more need for the data the researcher will delete it. The data will also be deleted by the researcher upon the participant's request, if they no longer wish to continue with the study. UserInterview.com's data retention, and privacy policy for researchers and participants can be located on their site, link provided below, this information can be found under Privacy policy/How we handle your data/Retention and Participant Terms of Service.
(https://www.userinterviews.com/support-category/participant-resources)

Concerns or Questions about Participation
This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#42011). If you have questions for the Committee contact the Chief Ethics Officer, Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

For all other questions contact any of the researchers at jacen@uwaterloo.ca, j42yoon@uwaterloo.ca or Dr. Lennart Nacke at len@uwaterloo.ca.

UNIVERSITY OF WATERLOO

Oral Consent Letter

By providing your consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

Mitacs – Easy Finance through gameful design and rhetorical accommodation:

I have read the information presented in the information letter about a study conducted by Dr. Lennart Nacke **and** Andrew Cen (Systems Design), John Yoon (English), Ekaterina Durmanova (Stratford school of Interaction Design and Business); from the faculty of Systems Design Engineering, English, Stratford school of interaction design and business, and the University of Waterloo. I have had the opportunity to ask questions related to the study and have received satisfactory answers to my questions and any additional details.

You will be completing the study by an online interview via Webex along side an online survey hosted on Qualtrics. When information is transmitted over the internet privacy cannot be guaranteed. There is always a risk your responses may be intercepted by a third party (e.g., government agencies, hackers). Qualtrics® temporarily collects your computer IP address to avoid duplicate responses in the dataset but will not collect information that could identify you personally.

I was informed that participation in the study is voluntary and that I can withdraw this consent by informing the researcher.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#42011). If you have questions for the Committee contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

For all other questions contact Jacen@edu.uwaterloo.ca.

Audio recording for transcription/analysis purposes only:	☐ I agree to my session being audio recorded to ensure accurate transcription and analysis.
Video screen capture recording for transcription/analysis purposes only:	☐ I agree to my session being screen captured recorded to ensure accurate transcription and analysis.
Use of anonymous quotations:	☐I agree to the use of anonymous quotations in any thesis or publication that comes from this research.

I agree of my own free will to participate in the study.

☐ Yes

Date:

FEEDBACK LETTER

Project Title: Mitacs - Knowledge translation and simulation: Viability of teaching financial literacy through gameful design and applied rhetorical accommodation
Student Investigators: Andrew Cen, John Yoon, Ekaterina Durmanova
Faculty Advisor: Dr. Lennart Nacke, Stratford School of Interaction Design and Business
len@uwaterloo.ca, (519) 888-4567 ext. 38251

We appreciate your participation in our study, and thank you for spending the time helping us with our research!

In this study you were asked to participate in an online 45 minute Webex/Qualtrics study. You were instructed to interface with one of five dummy prototypes of a mock banking application. Following a fictional scenario we asked you to make purchase decisions and participate in a voice recorded interview hosted via Webex lasting about 30 minutes. Then you were asked to complete a 15 minute online survey hosted on Qualtrics.

The focus of the study was to understand how we can change consumer debt and spending habits. Our hypothesis posits that applied rhetorical accommodation and gameful design will assist in knowledge translation of financial products, which will promote healthier informed spending decisions and debt management.

Your identity is considered completely confidential; indeed, your name will not be included in any other way associated, with the data collected in the study. Furthermore, because the interest of this study is in the average responses of the entire group of participants, you will not be identified individually in any way in any written reports of this research. Once all the data are collected and analyzed for this project, I plan on sharing this information with the research community through seminars, conferences, presentations, and journal articles.

Electronic data and audio recordings will be retained for a minimum of 7 years on a secure password protected computer to which only researchers associated with this study have access. All identifying information will be removed from the records prior to storage. Data without identifiers may be shared publicly. Your identity will be confidential.

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE#42011). If you have questions for the Committee contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

For all other questions contact any of the researchers at Jacen@uwaterloo.ca, or j42yoon@uwaterloo.ca or Dr.Lennart Nacke at len@uwaterloo.ca. If you think of some other questions regarding this study, please do not hesitate to contact a member of the research team.

We really appreciate your participation, and hope that this has been an interesting experience for you.

Appendix B: Demographic and Scale Questionnaires

Demographics

Please ask your researcher for this number - Participant ID

_____

What is your age?

_____

What is your gender?

○ Male

○ Female

○ Gendered non binary

○ Prefer to not to answer

○ Prefer to self describe _____

What currency do you use?

○ CAD

○ USD

○ Other

What is your income level per year?

○ Less than $19,999

○ $20,000 - $29,999

○ $30,000 - $39,999

○ $40,000 - $49,999

○ $50,000 - $59,999

○ $60,000 - $69,999

○ $70,000 - $79,999

○ $80,000 - $89,999

○ $90,000 - $99,999

○ $100,000 - $149,999

○ More than $150,000

○ Prefer to not disclose

End of Block: Demographics

FedsReserve

Credit cards allow you to carry a balance from month to month.

Charge cards must be paid in full at the end of each billing cycle.

If you are married or living with a partner, please report all cards belonging to you and all cards jointly owned with your spouse or partner.
Do not include cards held only by your spouse or partner or for business purposes only.

Do you have any credit cards?

○ Yes

○ No

On your last bill(s), about how much were the new charges made to all of your credit cards?

Enter 0 (zero) if none.

_____

Last month, about how much was the unpaid balance on all of your credit cards that you carried over from the previous month?
Enter 0 (zero) if none.

_____

During the past 12 months, did you carry an unpaid balance on any credit card from one month to the next (that is, you did not pay the balance in full at the month due date)?

○ Yes

○ No

How would you compare your unpaid balance last month to your unpaid balance 12 months ago? Last month's balance is...

○ Much lower

○ Lower

○ About the same

○ Higher

○ Much higher

○ I did not have a balance 12 months ago

Today, how much is the total credit limit of all your credit cards?

_____

End of Block: FedsReserve

Financial Risk Tolerance

Rate how accurate the actions reflect you.

A month after I invested in a stock, its price has gone down 30% due to economic concerns. I would sell the stock to cut further losses.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

I am willing to give up job security for an **additional** 5% annual raise.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

- -

After purchasing a cruise ticket for $2,000, I would also buy a trip cancellation insurance (refund in case of illness) for $100.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

Rather than purchasing a home in a good and established neighborhood, I am willing to buy one in a new neighborhood where home prices are 10% lower but I'm not sure how the neighborhood would turn out eventually (good or bad).

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

You have just finished saving for a "once-in-a-lifetime" vacation. Three weeks before you plan to leave, you lose your job. You would go as scheduled.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

- -

When you think of the word "risk", opportunity comes to mind first.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

An oil exploratory venture has a 20% chance of success. If successful, it pays back 50 to 100 times the investment. If not, the entire thing is lost. If you had the money and working full-time, you would invest the equivalent of 5 months' salary.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

Pressed for time, *you lean toward taking a short cut* if the choice is between traveling the long way that you know and taking a shortcut you've never taken before.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

- -

Compared to others, I would rate myself as a high risk taker.

○ Extremely inaccurate (1)

○ Very inaccurate (2)

○ Moderately inaccurate (3)

○ Slightly inaccurate (4)

○ Neither accurate or inaccurate (5)

○ Slightly accurate (6)

○ Moderately Accurate (7)

○ Very Accurate (8)

○ Extremely Accurate (9)

Financial Confidence

How would you rate your level of financial knowledge?

○ Very unknowledgeable

○

○

○ Very knowledgeable

I enjoy dealing with financial matters.

○ Strongly disagree

○

○

○ Strongly agree

- -

I tend to trust professional financial advisers and accept what they recommend.

○ Strongly disagree

○

○

○ Strongly agree

- -

I frequently get financial advice from my friends and family.

○ Strongly disagree

○

○

○ Strongly agree

I've got a clear idea of the sorts of financial products that I need.

○ Strongly disagree

○

○

○ Strongly agree

I keep a close personal watch on my financial affairs.

○ Strongly disagree

○

○

○ Strongly agree

I know enough about investments to choose ones that are suitable for my circumstances.

○ Strongly disagree

○

○

○ Strongly agree

I always research my choices thoroughly before making any financial decisions.

○ Strongly disagree

○

○

○ Strongly agree

I always consult my family/spouse before making any important financial decisions.

○ Strongly disagree

○

○

○ Strongly agree

Page Break ————————————————————

How would you rate yourself on each of the following areas of financial management?

I am good at keeping track of money.

○ Strongly disagree

○

○

○ Strongly agree

I am good at making ends meet.

○ Strongly disagree

○

○

○ Strongly agree

I am good at shopping around to get the best financial products such as loans or insurance rates.

○ Strongly disagree

○

○

○ Strongly agree

I am good at staying informed on financial issues.

○ Strongly disagree

○

○

○ Strongly agree

Financial Attitudes (OECD)

Please read each of the following statements and indicate how much you agree or disagree that each statement applies to you personally. Please select the response that best describes you currently.

Before I buy something, I carefully consider whether I can afford it.

○ Completely disagree

○

○

○

○ Completely agree

I tend to live for today and let tomorrow take care of itself.

○ Completely disagree

○

○

○

○ Completely agree

I find it more satisfying to spend money than to save it for the long term.

○ Completely disagree

○

○

○

○ Completely agree

I pay my bills on time.

○ Completely disagree

○

○

○

○ Completely agree

I am prepared to risk some of my own money when saving or making an investment.

○ Completely disagree

○

○

○

○ Completely agree

I set long term financial goals and strive to achieve them.

○ Completely disagree

○

○

○

○ Completely agree

Money is there to be spent.

○ Completely disagree

○

○

○

○ Completely agree

End of Block: Financial Attitudes (OECD)

Appendix C: Interview Script and Questions

[Upon entering Webex call with a participant]

1. Greet participant and introduce yourself

   (a) Hi I'm [researcher name] it's nice to meet you. Today we're going to be conducting a study on a credit card spending tool. I've just sent you a link for a qualtrics survey in the chat if you could open it and we can go over the information and consent forms together that would be great. And please don't close the page until the end of the study. Refer to appendix A

2. Provide participant information about the study and go over the information consent form and explain how the study will be recorded and captured for analysis. Start screen share with WebEx, only share your browser (chrome and ask the participant if they are seeing the information on your screen to confirm).

   (a) I will now share my screen with you. Can you confirm that you see the information and consent form?

   (b) The goal of the study is to investigate a credit card spending tool. I'll briefly explain what your participation in the study will be like. You will be shown a model of a banking web platform and will be given 5 minutes of time to freely explore and familiarize yourself with the model. Following this, you will be asked for your first impressions about the web page.

   (c) Then each element of the model (a maximum of 5) will be discussed, and ask you a series of open-ended questions about each element. This portion will last

up to 10 minutes. Next, you will be asked to imagine yourself in a fictional scenario where you will be assigned a credit card, bank account, and an item to potentially purchase. You will be asked if you would or would not make a purchase in this imaginary scenario and be asked to explain why or why not. Then you will be asked to re-examine and re-evaluate the web platform you saw earlier in light of the scenario and asked a series of open-ended questions about your response. Finally, you will be asked to complete a series of questionnaires about your financial habits and attitudes, and that will be the end of the study. Your participation in the study will be recorded via the Webex platform and analyzed through Dovetail. Any data will be only used anonymously. All data will be stored on the WebEx cloud and the Dovetail cloud servers.

3. Obtain verbal consent and digital signatures for the study

   (a) Can I get verbal consent from you for participation in this study and also for the video recording? Thank you.

   (b) Please check off and date the consent form after reviewing all the information given to you.

[Beginning the study]

1. Begin the recording in WebEx! Inform the participant that actions now will be recorded.

   (a) Okay, I am just letting you know that I have now started recording our session.

2. Provide participant with one specific condition (conditions will be given to participants in a between study set up, each participant will go through one condition, each set of condition will cycle over when the set is complete)

3. Have the participant identify the page as a whole at their own pace, provide them 5 minutes and only prompt if they are being too quiet or have concrete questions. Let the participant walk you through what they are seeing and how they are understanding the screen.

(a) Please have a look at the screenshot being shared with you. Feel free to take some time to familiarize yourself with it. Here you're encouraged to think out loud and explore what you see. For example, you may say "I'm looking at this..." or "I am trying to understand this..." so that we know what you are looking at and what you are thinking. When you are comfortable please let me know you are ready to proceed.

4. Ask participants if they are ready when they are please ask them for their thoughts on:

   (a) If you're ready, I have a couple of initial questions about what you're looking at.

   (b) Please explain what you see on the screen.

   (c) What do you think this site is for?

      i. Probe: What do you think you can do on this site?

   (d) Please walk me through your thoughts and understanding of each of the elements I point out.

5. Have the participant look at elements and provide their thoughts on what they believe it is upon initial viewing. (Max amount of elements is 5, elements will be highlighted with a red box in 5 slides, annotate with webex)

   (a) How would you expect to use this element?

   (b) How would you expect these elements to inform your saving and spending decisions?

      i. Probe: How would you use these elements to create goals to reduce spending?

   (c) Can you think of a situation in the past where this would have been useful for you?

      i. Probe: How would you use a tool like this in your banking routine?

6. Read out this scenario for the participant

(a) Now, I'll present you with a scenario and I want you to imagine yourself in it. Try to pay attention to the details although I will send you the details of the scenario through the chat in WebEx. (Located underneath)

Typical monthly spending	$500
Current credit card balance	$200
Payment due date	Currently halfway until next date
Monthly goal	Reduce spending by 10%
Past goals	Succeeded for 5 months, total $216 saved
Reward	Unlock +1% cashback rebate on credit card, if successful 7 more times
Cost of potential purchase	$180

(b) You are a credit card customer with a bank and your income level lets you comfortably pay your bills on time. You are online shopping and see a pair of shoes you like for $180. So you check your credit card and bank balance online, and the screenshot you are being shown is reflective of your current bank account. Your current financial situation is summarized in the table given to you.

    i. **Do you buy shoes? Please explain your reasoning. Please think out loud as you make your decision.

7. Ask participants to re-examine and re-evaluate the elements after the scenario.

(a) Now that you have thought about using the web page, let's go back and re-examine the web page.

    i. What helped you make your decision?

      A. Probe: Tell me more

    ii. If no mention of elements: So just to confirm, from what I'm understanding, x,y,z are the reasons that helped make your decision, and none of the elements were helpful in making your decision?

    iii. What elements would you take off the website if you could? What elements would you leave in?

    iv. If you could change something what would you change?

[Study questionnaires]

1. Thank the participant for completing the interview portion and proceed to the next stage of the study.

   (a) Thank you for completing the interview portion of the study and if you return to the Qualtrics survey, you can now begin the questionnaires. Your participant id is: [Participant ID] (refer to google sheet to assign participant ID)

2. Provide the finance questionnaires

   (a) Financial Attitudes

   (b) Financial Risk

   (c) Credit card portion of the annual questionnaire by Fedsreserve

   (d) Financial Confidence

[Ending the study]

1. The participant has now completed the study. Send them the google doc for the feedback letter and thank them for their time. See appendix A for feedback letter.

   (a) Thank you for participating in this study! I have sent a feedback letter in the chat.

   (b) If you have any questions, you can contact the researchers at [emails]. This is the end of the study, thank you for your time.

   (c) Do you have any questions before we leave? Thank you, goodbye.