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Simulations For Financial Literacy

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SIMULATIONS FOR FINANCIAL LITERACY

by

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ABSTRACT

Financially literate consumers are empowered with the knowledge and skills necessary to make sound financial decisions that ensure their long-term economic well-being. Within the context of the range of cognitive, psychological, and social factors that influence consumer behavior, simulations enhance financial literacy by developing consumers' mental models for decision-making. Technical communicators leverage plain language and visual language techniques to communicate complex financial concepts in ways that consumers can relate to and understand.

Simulations for financial education and decision support illustrate abstract financial concepts, provide a means of safe experimentation, and allow consumers to make informed choices based on a longitudinal comparison of decision outcomes. Technical communicators develop content based on best practices and conduct evaluations to ensure that simulations present information that is accessible, usable, and focused on the end-user. Potential simulation formats range from low- to high-fidelity. Low-fidelity simulations present static data in print or digital formats. Mid-fidelity simulations provide digital interactive decision support tools with dynamic user inputs. More complex high-fidelity simulations use narrative and dramatic elements to situate learning in applied contexts.

ACKNOWLEDGMENTS

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LIST OF ACRONYMS/ABBREVIATIONS

AFS   Alternative financial services

APR   Annual percentage rate

ARM   Adjustable rate mortgage

CD   Certificate of deposit

CFC   Consideration of future consequences

DSS   Decision support system

FDIC   Federal Deposit Insurance Corporation

GAO   Government Accountability Office

IRA   Individual retirement account

LOC   Locus of control

NFL   National Football League

NPC   Non-player character

PDF   Portable Document Format

PMI   Private mortgage insurance

PRN   Personal Retirement Number

CHAPTER ONE: INTRODUCTION

An individual's financial literacy has a demonstrable effect on his or her ability to function in society. Financially literate consumers are empowered with the knowledge and skills necessary to make sound financial decisions that ensure their long-term economic well-being. Simulations provide a method of enhancing financial literacy – by developing consumers' financial understanding and abilities and also informing consumer decision-making. Simulations for financial education and decision support illustrate abstract financial concepts, provide a means of safe experimentation, and allow consumers to make informed choices based on a longitudinal comparison of decision outcomes.

Scope

My thesis examines simulation as a method to improve understanding of financial concepts and support consumers in making decisions. Consumers face a wide range of financial choices on a daily basis and are subject to a host of cognitive, psychological, and social pressures and constraints that affect decision-making. These factors often lead to common financial mistakes, such as prematurely cashing out a tax-sheltered retirement account, carrying high balances on credit cards, or not diverting savings to a "rainy day" fund.

My research specifically focuses on the abilities of simulation to create data projections and contextual narratives, as well as techniques technical communicators can leverage to communicate complex financial concepts in ways consumers can relate to and understand. Potential simulation formats range from low- to high-fidelity (from simple print-based data projection tables to immersive and interactive virtual environments). I summarize the foundational theory of simulation design features and align specific consumer financial decision

contexts to example simulation interventions that provide financial education or decision support.

Chapter 1 introduces the dynamics of financial literacy and elaborates on the various influences on consumer behavior as well as types of financial decisions and common mistakes. Chapter 2 summarizes foundational theory and classifications for simulations for education and decision support and also articulates simulation's advantages for financial literacy. Chapter 3 elaborates on theories of visual language for technical communication and the classification of low- and mid-fidelity simulations, while Chapter 4 focuses on dramatic elements and interactive narratives for high-fidelity experiential simulations. Chapter 5 proposes best practices and design guidelines in addition to areas of future research.

Purpose

Americans' general lack of financial literacy has been well-documented. While the body of literature on financial literacy continues to grow, very little empirical evidence exists on effective instructional design techniques for financial literacy. Educational developers create content with little guidance on what techniques will have the best chance of improving cognition and leading to sustainable financial behaviors. Based on my extensive literature review within the fields of consumer finance and economics, psychology, sociology, communications, instructional technology, computer science, and game design, little or no research has been conducted that analyzes the use of simulations to improve consumer financial literacy.

To provide a foundation for future empirical research, I have developed a classification schema for consumer finance simulation formats based on fidelity and purpose. In addition to articulating simulation's specific affordances for providing financial education and decision

support, I have also classified the types of financial decisions that consumers face and aligned them with potential simulation interventions. Simulations offer opportunities for technical communicators to create content that addresses systemic communication challenges within the financial industry. Presenting financial information in terms that consumers can understand and act upon empowers them to make decisions that improve their financial security.

Significance and Rationale

In the last decade, as high consumer debt and low savings rates have persisted, a large portion of U.S. consumers have consistently demonstrated a lack of understanding of basic financial concepts and an inability to manage finances to ensure long-term well-being. Educators, financial institutions, and policymakers have increasingly focused on efforts to understand and improve financial literacy. The recent global economic crisis has only heightened the sense of urgency and brought national attention to the issues.

Sandra Braunstein and Carolyn Welch echo other researchers in the field by highlighting the increasing complexity of the financial services marketplace and consumers' increased responsibility for micro-managing their financial affairs – often without adequate information or understanding necessary to make sound decisions (448). According to Annamaria Lusardi, "individuals have to collect information and make forecasts about many variables, from Social Security and pensions to interest rates and projected inflation .... Moreover, they have to perform calculations that require, at minimum, an understanding of compound interest and the time value of money" (3).

With the rise of online banking and the selling of consumer loans and contracts to third-parties, consumers and financial service providers are fast losing opportunities for personal

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interaction and face-to-face communication. Financial transactions and agreements are often conducted in an impersonal vacuum, without adequate information or confidence.

Individual financial decisions have larger impacts on society and economies. Well-informed and financially secure consumers contribute to sustainable economic development – within communities and on a global scale. According to Marianne Hilgert, Jeanne Hogarth, and Sondra Beverly, "informed consumers provide the checks and balances that keep unscrupulous sellers out of the market" (309). Vanessa Perry and Marlene Morris point to the negative impacts of poor decisions that may result in loan defaults – which lead to increased rates for other consumers and potential losses for private investors and the federal government (310).

The ongoing economic crisis demonstrates the collective power of individual consumer decisions to produce ripple effects that impact global markets and socialize negative consequences. Although the causes of the recent sub-prime mortgage crisis are varied and complex, millions of Americans demonstrated a lack of financial knowledge or consideration of future consequences by taking out massive and complex loans that they could neither understand nor afford. When the sub-prime mortgage bubble burst, the U.S. economy nearly collapsed – plunging world markets into a deep and ongoing recession.

Poor financial decisions may be the result of either a lack of understanding of financial concepts or a failure to balance short- versus long-term risks and rewards. Within certain contexts, simulations may be capable of addressing both issues – as a method for illustrating financial concepts (such as compounding interest or the time value of money) or enabling consumers to evaluate and compare the short- and long-term outcomes of decisions.

Ultimately, simulations that aid in the development of mental schemas for long-term thinking may lead consumers to consider broader issues of sustainability. A focus on future

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consequences may transfer to domains other than finance, such as the environment or personal health and wellness – domains in which consumers must similarly balance the short- versus long-term consequences of behaviors.

<u>Dynamics of Financial Literacy</u>

Financial literacy is a complex domain. Researchers have produced a growing body of literature as they seek to identify and aid development of the knowledge, skills, and resources necessary for individuals to successfully manage their finances over the course of a lifetime. To establish consistent evaluation criteria for topics such as the effectiveness of consumer education or information standards, researchers seek to establish common conceptual and operational definitions of financial literacy.

David Remund proposes conceiving of financial literacy as an individual's understanding of key financial concepts coupled with "the ability and confidence to manage personal finances through appropriate, short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions" (284). For an operational definition (necessary for assessment), he suggests measuring understanding and behaviors related to budgeting, saving, borrowing, and investing (290).

Influences on Financial Behavior

Researchers have also examined the various mechanisms that influence consumer behavior. Complex cognitive, psychological, and social factors work together to guide individuals' financial choices – often in ways that do not ensure long-term well-being.

Cognitive Factors

Several cognitive factors shape consumers' ability to make sound financial decisions. Individuals' level of financial knowledge, ability to understand and act upon financial information, and mathematical ability affect their financial literacy. Individuals acquire financial knowledge from a variety of sources. However, a survey of American households in 2001 reported that personal experience, friends and family, and the media were the most common methods – more so than formal and informal education, seminars, employers, or the Internet – for learning about financial management (Hilgert, Hogarth, and Beverly 318).

Hilgert, Hogarth, and Beverly discovered significant correlations between levels of financial knowledge and financial behaviors in the areas of cash-flow management, credit, saving, and investing. Consumers with higher levels of knowledge around certain concepts generally reported more positive financial behaviors in those areas. However, a complex causality may exist in which 1) knowledge and education lead individuals to make better decisions, 2) positive behaviors actually lead individuals to seek out knowledge, or 3) both (320-321).

Lack of knowledge of financial concepts such as compounding interest can lead consumers to incur high levels of debt which they have difficulty repaying (Stango and Zinman 506). In addition to knowledge, however, individuals must also be able to perform simple mathematical calculations in order to apply the concept of interest to decisions on saving or borrowing.

Gerardi, Goette, and Meier examine the cognitive aspects of financial decision-making that led millions of American consumers to become delinquent or default on mortgages. The authors found that low numerical ability, or an inability to "perform simple mathematical

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calculations" (3), was prevalent among consumers who were frequently late or had defaulted on mortgage payments. Consumers with a demonstrated lack of numerical ability were also more likely to have adjustable-rate mortgages, which have a higher rate of default than fixed-rate home loans (21).

One cause of confusion is difficulty deciphering financial communications. Despite government attempts to regulate financial communications (focused on plain language initiatives and mandatory information disclosures), the financial services industry often relies on jargon, legalese, and overly complex financial instruments to obscure costs and risks to consumers. For example, in 2006 the United States Government Accountability Office (GAO) reported that credit card information disclosures are written beyond the eighth-grade level at which half of U.S. adults read. In addition, the documents are extremely complex and inaccessible – with poorly organized and displayed information that leads consumers to have difficulty locating or comprehending important details (6).

Braunstein and Welch assert financial markets become more competitive and efficient when consumers are adequately informed, allowing them to make sound decisions (445). As the sub-prime mortgage crisis (brought on by bad loans and mortgage-backed securities) demonstrated, financial institutions suffered the consequences of ill-informed consumers. Rather than engage in predatory lending practices, financial institutions would actually face less risk and be more competitive if they provided clear and accurate information to allow consumers to meet short- and long-term needs.

Psychological Factors

      An individual's decisions and behaviors are the result of complex psychological processes and aspects of their personality. Within the context of decisions on consumption and managing finances, individuals are especially influenced by self-regulation, future orientation, and locus of control (LOC). Elizabeth Howlett, Jeremy Kees, and Elyria Kemp elaborate on the role of self-regulation when individuals are faced with intertemporal choice – a decision between an immediate benefit or one at some future date. They define "self-regulation" as a psychological process "through which people exert control over their thoughts, feelings, and behavioral impulses" (225). An individual's ability to self-regulate is a resource that goes through cycles of depletion and replenishment. Individuals deplete the resource each time they resist temptation or impulses (227). A study demonstrated that individuals with a depleted self-regulatory state were less likely to participate in a 401(k) retirement plan than those who were fully able to exercise self-control (235).

      Mental accounting serves as an example of a self-control device that consumers rely on to make decisions. Individuals assign expenses to various mental accounts in order to manage budgets and avoid overspending. However, when ambiguous expenses arise, consumers may find it easier to justify the expense – therefore bending the rules of their cognitive bookkeeping to rationalize an indulgence (Cheema and Soman 33).

      Alan Strathman et al. establish the consideration of future consequences (CFC) – or the "extent to which individuals consider the potential distant outcomes of their current behaviors and the extent to which they are influenced by these potential outcomes" – as a relatively stable personality characteristic that can be measured according to a defined scale. Individuals with low

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CFC focus on immediate gratification, while those with high CFC focus on the future and "use their distant goals as guides for their current actions" (743).

Jeff Joireman, David Sprott, and Eric Spangenberg identify an individual's level of CFC as a key determinant of sound financial decision-making and fiscal responsibility – or "financial behavior that maximizes a person's long-term well-being" (1160). They align low CFC with impulsive behavior and assert that such individuals are more likely to engage in temporal discounting – the tendency to devalue future outcomes compared to immediate outcomes (1161).

To evaluate the effect of CFC on financial decisions in which consumers face temporal dilemmas, the authors conducted a study in which participants received a hypothetical sudden windfall of money. Those who were low in CFC were less likely to direct a significant portion of the windfall to pay off credit card debt and were instead more likely to focus on choices that offered immediate rewards, such as a costly trip (1166).

Howlett, Kees, and Kemp establish that without basic financial knowledge, CFC will not ensure sound decision-making. Consumers who have high CFC coupled with adequate financial knowledge are more likely to make decisions that offer long-term financial benefits (240). Without financial knowledge and access to information, even the most future-oriented consumer lacks the necessary understanding to secure long-term well-being.

Individuals also differ in how they perceive their level of control over life events. Their locus of control (LOC) – or the way they perceive the causes of positive and negative outcomes – may be internal or external. Individuals with an internal LOC expect predictable outcomes based on their decisions, while those with an external LOC believe that outcomes are the result of "luck, chance, or powerful others" (Perry and Morris 300).

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Within the context of financial management, individuals with an internal LOC are more likely to be able and willing to take the actions necessary to make informed and beneficial decisions. Individuals with an external LOC tend to believe financial outcomes are beyond their direct control and are therefore less likely to behave in a financially responsible manner (307).

Social Factors

In addition to cognitive and psychological influences on consumers' understanding and behavior, social, demographic, and cultural barriers to financial literacy are also prevalent. Starr argues against a behavioral focus on consumption and spending. Rather, individuals and the decisions they make are largely products of capitalist consumer culture – in which conspicuous consumption signifies social status while the media and competitive tendencies fuel consumer demand (214-217). George Moschis and Gilbert Churchill elaborate on the agents and processes of consumer socialization and establish that family, the media, formal education, and peers shape consumer-related knowledge, skills, and attitudes from an early age (601-602).

Surveys have demonstrated generally lower levels of financial literacy among women, those with low levels of education, and certain minority groups such as African-Americans and Hispanics (Lusardi 11-12). Such barriers to financial literacy are not a matter of intelligence. Instead, traditional gender roles regarding accumulating and managing wealth, socio-economic factors such as income and access to education, cultural attitudes on consumption and financial services, and language barriers often affect the development of financial literacy within those demographics.

Language plays a particularly powerful role in financial decision-making. The Census Bureau reports that over twelve million adults living in the U.S. have limited or no proficiency in

the English language (qtd. in United States GAO 3). According to the GAO, "a lack of proficiency in English can create significant barriers to financial literacy and to conducting everyday financial affairs, particularly given the complexity of financial products and the language often used to describe them" (7). Individuals with limited English proficiency may have issues completing key documents, managing bank accounts, resolving problems, or accessing financial education (8). Written translations of financial documents or educational materials often do not use colloquial or culturally appropriate language, and in cases where immigrants rely on oral translation (especially by their minor children), the translator may not fully understand the subject matter (10-11).

Cultural norms and attitudes prevent many immigrants from using mainstream financial services. For example, many Asians are averse to being in debt, while Muslims may not believe in receiving or paying interest. Mistrust of mainstream financial institutions is especially prevalent among Hispanics – largely due to expectations of corruption and concerns over privacy. However, the GAO warns that those "with limited English language skills may be more susceptible to fraudulent and predatory practices" (17), especially when they do business with the alternative service providers that cater to immigrant communities. According to a report from the Lutheran Immigration and Refugee Service, many immigrants tend to trust individuals or service providers based solely on whether the communication occurs in their native language – regardless of whether they understand the terms of the agreement (qtd. in United States GAO 17).

Financial Decisions and Common Mistakes

Individuals face a constant stream of decisions in order to manage personal finances and secure their futures. Information and education empower consumers to make decisions that ensure their long-term well-being. Empowered consumers are also more likely to avoid common mistakes that place their financial stability as well as the larger global economy at risk.

Consumption and Spending

Individuals make decisions every day on consumption and spending – what to purchase, when and where to purchase it, and when to forego a purchase in favor of saving the money for future use. Ideally, consumers seek ways to meet their needs and wants without exceeding their income. They use budgets to guide decisions on spending, by allocating their income among certain categories of expenses. After basic needs such as housing, food, utilities, transportation, and other fixed expenses are subtracted, consumers allocate discretionary income as they see fit.

Empowered consumers spend their income efficiently by "comparison shopping" – evaluating all purchase options to ensure they receive the most value for their money. They also carefully evaluate needs versus wants, prioritize purchase items, and balance short-term expenses with long-term needs and goals.

Many consumers struggle to control their spending and save for the future. In the lead-up to the 2008 financial crisis, savings rates among U.S. households were negative – meaning that in aggregate, Americans spent more money than they earned (Howlett, Kees, and Kemp 223). When individuals fail to allocate a portion of their income to savings, they place themselves in a vulnerable position of exponentially increasing their debt and living "paycheck to paycheck" – an unsustainable path for long-term quality of life.

Credit

Consumer credit allows individuals to make purchases in the short-term and pay over time. Empowered consumers use credit to make major purchases such as vehicles or homes while still retaining access to cash assets in the present. However, the misuse of consumer credit is a prime indicator of a lack of financial literacy. Annamaria Lusardi and Peter Tufano argue that "people who make financial choices that incur avoidable fees and charges ... are those with a weaker understanding of the implications of debt" (24).

Lenders make decisions based on an individual's risk profile – drawn from their credit history and quantified as a credit score. Consumers build their credit history over time and establish whether they pose a low- or high-risk to the lender. Consumers with high credit scores are typically eligible to receive larger loans, lower interest rates, and generally more favorable terms. Unfortunately, credit scores are based on a complex variety of factors, and consumers may fail to comprehend the effect of every decision on their perceived suitability as a borrower. Individuals who maintain high debt levels, are frequently late or default on payments, have declared bankruptcy, or have otherwise made poor financial decisions will have difficulty gaining access to affordable credit. They may also encounter problems securing housing and employment.

For empowered consumers, credit cards offer a convenient means of making and tracking purchase transactions as well as a means to earn reward incentives such as frequent flyer miles or cash back. Consumers who pay off the full balance on their credit cards every month also benefit from essentially free financing. During the "grace period" – or the period of time between the beginning of the billing cycle and when payment is due – consumers can leave their money to earn interest in a checking or savings account until the payment due date.

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Less financially literate consumers use credit cards as a means of financing expenses that exceed their income. In 2007 the Federal Reserve Board reported that nearly half of U.S. households carry a credit card balance, meaning they do not pay off the full balance every month and therefore incur debt and accrue interest (Bucks et al. A40). High levels of credit card debt are often the result of gaps in cognition. In a sample representative of the U.S. population, merely one-third of those surveyed were familiar with compounding interest or how credit cards work (Lusardi and Tufano 1).

Long-term credit card debt can prove devastating to consumers' finances and can be difficult to pay off, especially for those consumers who make only the required minimum monthly payment. They suffer the worst effects of compounding interest – in which their debt increases exponentially as they pay interest not only on the original balance but on previously accrued interest. When already high debt levels are made worse by the effects of variable interest rates, late payment or over-the-limit fees, or the use of high-interest cash advances or convenience checks, consumers can easily find themselves in a credit quagmire from which bankruptcy may provide the only escape.

Consumers commonly rely on credit financing to purchase automobiles and homes. The purchase of an automobile raises a number of financial considerations, including the price of the vehicle, financing, fuel economy, insurance, and maintenance. While some consumers are able to purchase vehicles using cash assets, most choose to finance at least some portion of the purchase price. Empowered consumers carefully consider terms such as the interest rate, contract length, and monthly payment amount. They may also decide to pay extra every month in order to pay down the balance and reduce overall finance charges.

For most consumers, the purchase of a home will be the biggest financial decision they make in their lifetime. It may also be the most complex. Prospective homeowners must decide how much money to put down, the type and structure of their mortgage, the length of the loan, interest rate, and many other factors. After the initial purchase, homeowners may also have additional options such as refinancing or using the property as collateral for another loan.

One of the first decisions prospective homeowners face (and one that typically requires advance planning) relates to the size of a downpayment. Under a standard mortgage contract, consumers make a downpayment of at least twenty percent of the price of the home. While future-oriented consumers may spend several years saving toward a downpayment, others are either unable or unwilling to place such a significant amount of money down upfront and instead choose to finance nearly the entire cost of the home. Lenders consider such consumers to be high-risk and typically require them to pay for private mortgage insurance (PMI) – which insures the lender against consumer default. Contrary to common misperceptions, consumers pay PMI to protect the lender – not themselves. While a low downpayment may provide a consumer with more cash liquidity in the short-term, PMI premiums can add a significant amount to the monthly payment on a mortgage and have no effect on paying down the principal or interest of the loan itself.

Consumers must also decide on the type or structure of their loan. During the housing boom of the late 1990s and early 2000s when housing prices were steadily rising, mortgage service providers began relying on increasingly complex loan instruments to attract customers who otherwise could not afford to purchase a home. While standard fifteen- or thirty-year fixed rate mortgages may not be an option for many low-income or otherwise high-risk ("sub-prime")

borrowers, many of the alternative loan instruments are often inappropriate in the context of the consumers' financial situations.

Balloon structures place consumers at particularly high-risk. Operating under the assumption that their income will increase over time or that they will simply refinance the loan, a balloon structure allows consumers to make smaller payments during the beginning of the loan term but requires a much larger "balloon payment" at the end. If the borrower's income stagnates over time, or if they do not have access to enough cash at the end of the loan term (whether due to lack of saving or incurring emergency expenses), they become vulnerable to default and foreclosure (Braunstein and Welch 446).

Adjustable rate mortgages (ARMs) are complex financial instruments in which consumers often do not understand the inherent risks. Although lenders offer ARMs in a variety of formats, the key differentiator of ARMs is that rather than being "fixed" or "locked in," the interest rate can fluctuate over time. Low numerical ability represents a key indicator of some consumers' decisions to select ARMs, placing them at a greater risk of default than those with fixed-rate mortgages (Gerardi, Goette, and Meier 21). Consumers with low levels of financial literacy and numerical ability either underestimate or fail to understand the effect of interest rate changes on monthly payments. In the lead-up to the financial crisis, financially literate consumers were more likely to select fixed-rate loans (Bergstresser and Beshears 15). Even when consumers make a sufficient downpayment and select an appropriate loan instrument and terms, they may simply find that they paid too much for their home. In the midst of the recent housing bubble and its immediate aftermath, phrases such as "buying too much house" or being "house rich and cash poor" became common vernacular for consumers who realized they had tied up the majority of their income and net worth in their mortgages. Those consumers were

especially vulnerable to sudden shocks such as unemployment or major health expenses. While they may have been counting on being able to sell their home for a profit in the event of financial emergency, in reality many found themselves "underwater" – meaning they owed more on their home than it was worth – due to rapidly falling home prices and the decline of the housing market.

Financial Services

Banks and other mainstream financial institutions provide consumers with basic structures for conducting everyday financial affairs. They offer a variety of federally-insured instruments for saving (savings accounts, money markets, and certificates of deposit) and conducting transactions (checking accounts and debit cards). Additionally, they offer credit services in the form of credit cards and loans (small business, personal, auto, and mortgages).

While mainstream financial institutions cater to middle- to upper-income households, low- and moderate-income consumers often rely on alternative financial service (AFS) providers (Barr 121). Nearly ten percent of U.S. households do not have a bank account (qtd. in Hogarth and O'Donnell 409). "Unbanked" consumers lack mechanisms for saving as well as access to traditional credit. Instead, they conduct high-cost transactions with check cashers, money wirers, pawn brokers, rent-to-own stores, payday and title lenders, and tax preparers that offer loans based on expected tax refunds (Barr 124; Hogarth and O'Donnell 409).

Establishing a bank account allows consumers to manage finances without unnecessary fees, build a credit history, and save for the future. Banked households are much more likely to save than those who rely entirely on AFS providers (Braunstein and Welch 448).

Retirement Planning and Investing

Although not always for the purpose of planning for retirement, participation in the stock market and other investment vehicles are becoming a vital component of an individual's retirement portfolio. Lusardi asserts that as employers are increasingly shifting from defined benefit plans (for example, pensions) to defined contribution plans (for example, mutual funds and IRAs), individuals bear more responsibility for allocating and directing investments (2). Between the trend toward defined contribution plans and the real possibility of future reform of the federal Social Security system – a safety net that senior citizens have relied upon since the 1940s – individuals must take an active role in securing their financial future long before they leave the workforce.

Participation in employer-sponsored retirement plans such as 401(k)s represent one of the most common vehicles for saving for retirement. Many employers offer match funding based on a percentage of every dollar that the employee contributes to the plan. Based on employee preferences (including aversion to risk and years until anticipated retirement), a service provider then invests the money on behalf of the employee. When employees reach their sixties or seventies, they typically begin withdrawing funds.

Some employers offer retirement benefits in the form of company stock. However, consumers who rely too heavily on a single stock run the risk of losing their life savings in the event of a company downturn or collapse – as was the case with Enron in the 1990s and many other companies since. Diversified investment portfolios typically include a blend of stocks, bonds, mutual funds, real estate, and FDIC-insured savings accounts.

Planning for the future requires the discipline to first allocate money for savings and then to leave the money in the designated accounts to accumulate and appreciate over time. Many

consumers make the critical mistake of cashing out tax-sheltered retirement plans in order to make big ticket purchases such as houses or vehicles. When they do so, they pay steep penalties and taxes for early withdrawal and only salvage a fraction of the account's value. They must also begin saving for retirement all over again or risk an abrupt and drastic lifestyle change when they leave the workforce.

Risk Management

A recurring theme emerges in which empowered consumers plan for the future and protect themselves so that their finances can withstand sudden traumas or changes to their situation. Financially literate consumers equip themselves to deal with events such as sudden unemployment, major health problems or disability, property loss, major liability, or economic downturns. While they cannot predict the future, empowered consumers can at least prepare for the worst. They can manage risks by securing appropriate amounts of health, property, and liability insurance, allocating portions of their income to an emergency or "rainy day" fund, and diversifying investments and assets.

Chapter 2 elaborates on simulation and its affordances for improving consumers' financial literacy and decision-making.

CHAPTER TWO: SIMULATION

Chapter 2 introduces simulation and its affordances for learning and cognition, as well as its specific affordances for improving financial literacy and informing consumer decision-making. Simulation provides a method for illustrating financial concepts and enabling consumers to evaluate and compare the short- and long-term outcomes of their decisions.

Simulations attempt to imitate reality. They are a method of descriptive modeling, describing "things as they are, or as they are believed to be" (Turban, Aronson, and Liang 65). A simulation model describes the behavior of a system according to various input values and assumptions. The realism of a simulation is confined by the design of the underlying model (for example, problem sets, input and output variables, relationships and causal links). Users may experiment with differing input values and explore a system within the constraints of the model but will not discover new relationships or potential outcomes that are not already part of the structured assumptions in the model's design. Such boundaries lead to simplified representations of reality, as descriptive models cannot possibly account for any and all variables and external factors that influence real-world outcomes.

Theory and Classification

Classification schemas for simulations vary by discipline as well as the domain in which the simulations are applied. A simulation may also be classified by its component features or practical objectives. For example, instructional technologists tend to focus on immersive virtual learning environments, while economists or business managers use predictive simulation models to forecast market conditions or analyze the effects of an array of potential decisions. Technical communicators may label a certain class of data-driven info-graphics, tables, or contextual

calculators as simulations, based on the use of models and data projection to reflect or predict real conditions. Ultimately, classifications will overlap, as a given simulation may fall within the definition of several categories. Within the domain of financial literacy, simulations can serve as a medium for education or decision support.

Simulations for Education

Simulations are a flexible method for education, as they are capable of satisfying all four phases of instruction: presentation of information, guidance, practice, and assessment (Alessi and Trollip 230). They elaborate on complex systems and processes, allowing individuals to form mental models and "explore, practice, test, and improve those models safely and efficiently" (214). Simplified models can allow learners to interact with a system – experimenting with variables and exploring how the system behaves under different conditions and situations.

For educational purposes, a simplified form of reality is often necessary to facilitate understanding. According to the theory of bounded rationality, individuals have limited processing capacity and tend to "construct and analyze a simplified [mental] model of a real situation by considering fewer alternatives, criteria, and/or constraints" (Turban, Aronson, and Liang 66). Individuals may also reach a cognitive limit – a point at which the complexity and scope of the information and knowledge required to solve a problem overwhelms the ability to make a sound decision (11). Simplified models of reality help individuals avoid information overload and therefore make complex systems and concepts more accessible.

Margaret Gredler distinguishes between symbolic and experiential simulations for education. Symbolic simulations provide a dynamic representation of a system, demonstrating the interaction of two or more variables over time and allowing learners to explore system

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behavior. Learners may interact with the system by manipulating variable values, but the users are not functional components of the system (523). Rather, they influence the system "from the outside" (533).

Within experiential simulations, learners take on an authentic role. They perform complex tasks and make decisions that guide their path through the simulation. According to Gredler:

> [Experiential] simulations [establish] a particular psychological reality and [place] the participants in defined roles within that reality. The participants, in the context of their roles, execute their responsibilities in an evolving situation. Experiential simulations, in other words, are dynamic case studies with the participants on the inside. (523)

Barry Harper, David Squires, and Anne McDougall propose a hybrid paradigm for educational simulations. They present a blended pedagogical approach in which auxiliary symbolic simulations are embedded within an experiential learning environment. The symbolic simulations allow the learners to explore system behavior (focusing on one concept at a time) and serve to scaffold the wide range of knowledge required to perform tasks within the experiential simulation's over-arching narrative (116-127). In essence, each symbolic simulation serves as a narrowly focused training module that informs a learner's role-based actions.

Stephen Alessi and Stanley Trollip present a classification model that distinguishes between educational simulations that teach about something (physical and iterative) versus how to do something (procedural and situational) (214). Within the first category, physical simulations allow learners to manipulate a physical object or phenomenon that is digitally represented onscreen. In contrast, iterative or process simulations allow learners to run a

simulation multiple times under different conditions (parameter values) in order to observe and interpret the effect that changing parameter values will have on the results of the simulation (215-217). Iterative simulations are especially useful for financial education, as they illustrate invisible mathematical processes and emphasize output values over time.

Within their second category – educational simulations that teach learners how to do something – Alessi and Trollip further distinguish between procedural and situational simulations. Procedural simulations guide learners through a "sequence of actions" or steps necessary to complete a process and accomplish a particular goal (221). In contrast, situational simulations allow learners to role play and explore the unpredictable nature and "great complexity of human and organizational behavior" in different situations (224-226). Both procedural and situational simulations are commonly used to teach financial and economic concepts. For example, a procedural simulation may guide a learner through the process of balancing a checkbook or buying a house. Situational simulations, however, are more commonly used in business education rather than personal finance, as they allow business students to make decisions and explore effects on markets as well as employee and consumer attitudes.

Simulations for Decision Support

In addition to education, the other primary function of simulations for financial literacy is to support decision-making. Decision-making is "a process of choosing among alternative courses of action for the purpose of attaining a goal or goals" (Aronson, Turban, and Liang 40). Simulations can support decision-making, as they are capable of elaborating on complex systems and provide a method of experimentation, allowing users to test a range of input values for decision variables and observe the results on output values (185).

An iterative simulation may serve as a decision support system (DSS) with structured inputs, processes, and outputs. Users analyze system feedback and may alter the simulation's inputs or processes for the next iteration in order to achieve desired outputs and reach specific goals (43). Within the realm of financial literacy, goals might include a specific target for retirement savings or simply selecting the best loan terms among several alternatives.

Although branching features are commonly present in educational simulations, they are especially important for interactive decision support tools. Branching is the design feature which allows users "at each decision point [to] face different issues, problems, or events that result in large measure from their prior decisions" (Gredler 523). Branching structures are effective in demonstrating cause and effect relationships within systems, increasing motivation by enhancing a user's locus of control (LOC), and creating an environment for safe experimentation and exploration. Branching simulations also lend themselves to the incorporation of interactive narratives common in experiential simulations. For example, a simulation may place the user in the role of an entrepreneur starting a small business, where each decision point on strategy or resource allocation affects future decisions and outcomes.

Simulations that support decision-making share many of the same characteristics of educational simulations, and some classifications may overlap. In fact, a single simulation may have design features that make it flexible enough to be used for both purposes. However, the primary objectives and user context for each use differ greatly. Simulations that support decision-making have several distinguishing objectives and features.

One purpose of education is to develop individuals' knowledge so that they can potentially apply what they have learned at an unspecified time in the future. In contrast, the defining characteristic of decision support tools – as well as the broader domain of performance

support tools – is that they provide users with the information or resources necessary to accomplish a specific real-world goal or task at or near the point of need.

Decision support tools offer just-in-time information that is accessible on-demand and immediately actionable. Therefore, the user profiles for the target audiences of decision support and educational simulations will often differ. As support tool users typically initiate the search for the resources and tools needed to address their specific and immediate need, they are less likely than educational audiences to be passive recipients of information.

Basis in Learning Theory

Educational simulation theory is based on a variety of cognitive psychology principles and approaches to learning. The theoretical foundation informs both the instructional design and validation of simulations so that simulation interventions produce the targeted outcomes in an efficient and engaging manner.

Although the primary purpose and user context differ from educational simulations, decision support simulations can also lead to learning outcomes for users. Despite the distinction between learning versus performance objectives, learning may still occur within a decision support context. While support tool users apply the insights and information gained from a simulation to support real-world decision-making, they simultaneously enhance or reinforce their knowledge and understanding of a system and its individual components. A simulation's decision support framework may also lead users to develop mental models that allow them to eventually make decisions without the aid of a support tool. Therefore, while the primary function may differ between educational and decision support simulations, the learning outcomes may be similar.

Transformative Learning

In addition to learning objectives, simulations for financial literacy are intended to produce behavioral outcomes. Transformative learning is the "process by which we recognize and alter our existing meaning schemes [or beliefs and attitudes] through experience, critical reflection, reflective discourse, and action" (Way and Wong 36). As simulations illustrate concepts, elaborate on systems, and demonstrate short- and long-term causes and effects, they may transform users' perceptions and eventually lead to changes in financial behavior.

Transfer of Learning

Simulations support the transfer of learning – in which learners can take the knowledge and skills they gain from one situation and apply them to another – ensuring that an instructional intervention provides a future benefit to the learner (Clark and Voogel 113). Interactive simulations allow users to explore multiple dimensions of a concept or system and to develop experience based on observation and practice within that system. Such opportunities for interaction often promote a deeper understanding than static text-based instruction. Alessi and Trollip assert that simulations can be designed to support both near and far transfer of learning (229-230). Near transfer occurs when the new situation or context is very similar to the one in which the knowledge and skills were originally developed, such as a procedural simulation intended to guide someone through the steps of applying for a credit card. In contrast, far transfer occurs when individuals are able to apply knowledge and skills to a distinctly new situation. For example, a simulation that elaborates on the concept of compounding interest will ideally support the learner in the future when they must manage credit cards, select a mortgage instrument, or invest for retirement.

Experiential Learning

Experiential learning is one approach to producing transformative experiences that transfer to multiple contexts. The approach aligns with the popular wisdom that people "learn by doing." Experiential simulations are framed around a continuous cycle of experimentation, experience, feedback, and reflection. Participants adopt a defined role, perform actions within the system, observe consequences, and adjust future decisions accordingly (Hermens and Clarke 479). David Kolb represents experiential learning as a four-state model based on a continuous cycle of observation and reflection, formulation of abstract concepts and generalizations, concrete experience, and testing implications of concepts in new situations (21).

Contextual Learning

Context often allows individuals to more easily relate complex concepts to real life. Grounding concepts in reality makes them more tangible and relevant and is therefore likely to engage and motivate learners. Simulations that embed concepts within multiple contexts lead users to develop a more flexible understanding of the underlying concepts, thereby supporting transfer of learning (Mayer et al. 66).

Simulation designers create context with subject domains, narratives, defined user roles and actions, problem sets, and other flexible design features that frame the content being presented. Some simulations may allow users to personalize context by allowing for inputs based on an individual's unique situation – such as input values for income, debts, and savings goals.

Affordances for Financial Literacy

The primary advantages of human-centric simulations are the ability to "enhance safety, provide experiences not readily available in reality, modify time frames, make rare events more

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common, control the complexity of the learning situation for instructional benefit, and save money" (Alessi and Trollip 226). Within the domain of financial literacy, simulations have specific affordances that make them especially appropriate for financial education and decision support.

Manipulation of Time

Perhaps the most important affordance of simulation for financial literacy is the ability to manipulate time. An individual's financial literacy centers on his or her ability to consider the future and weigh short- and long-term risks and rewards in order to maximize present and lifelong financial well-being. Two consistent objectives of financial literacy interventions are stimulating long-term thinking and future-orientation. Therefore, time emerges as a critical component in any supporting intervention.

Simplification of Reality

As previously stated in the discussion of bounded rationality and cognitive limits, a simplified model of a system is often necessary to facilitate understanding – especially within a domain as broad and convoluted as finance. Alessi and Trollip assert that the appropriate level of simplification varies by the prior knowledge and skill level of the target audience. Users with less prior knowledge and skill benefit from simpler models, while users with more advanced understanding benefit from more complex models (233).

Simulations can limit variables and events to only those with the greatest effect on the system in order to focus on key concepts. They may also include basic assumptions and standard values for certain variables, such as an average expected annual rate of return in a simulation demonstrating the time of value of money. The challenge for designers, however, becomes one

of simplifying reality without misrepresenting it. Oversimplification of financial concepts and systems may lead individuals to act confidently but not in their own best interest.

Demonstration of Complex Systems and Processes

Simulations have the ability to break down complexity into distinct modules or steps. Once the user demonstrates comprehension and proficiency with one concept, they are free to move on to the next. For example, a process simulation may guide users through step-by-step procedures for buying a house – from defining savings goals for a downpayment, to selecting a mortgage instrument and terms, to securing insurance, and finally making an offer and closing on the contract.

Visualization of Concepts and Data

Many financial concepts are too abstract to be easily understood without the use of visual aids. Simulations often use a visual medium to cater to visual learning styles – especially for complex math and systems. Visual elements include the ability to see all of the values within the system, maps of process flows, organizational charts, and other components that allow users to better conceptualize how the components of a system interact to produce outputs. Visual language can also help mitigate barriers for individuals with limited English proficiency.

Mathematical Calculations

For consumers with low numerical ability, low-fidelity simulations such as simple data projections and tables or utility calculators are capable of taking the mathematical burden away from individuals and providing accurate calculations within the context of their personal situation. For consumers who demonstrate a deeper lack of comprehension of financial concepts,

additional intervention may be necessary to fully communicate the practical meaning of the resulting calculations within a specific decision context.

Data Projections

The manipulation of time enables an equally vital component of simulations – the ability to project the future value of a variable. While projections are only as accurate as the simulation's underlying model, they frame realistic expectations about the performance of a system. Data projections emphasize realistic future consequences, allowing individuals to compare and evaluate the effects of decisions. Wendy Way and Nancy Wong suggest that financial simulations can be used to set outcome expectations – or "beliefs about the likelihood and value of consequences associated with the behavior" (96) – such as projecting the accumulation of savings over time.

Projections must be realistic, however, as individuals are susceptible to exponential growth bias – or a "tendency to linearize exponential functions when assessing them intuitively" (Stango and Zinman 2807). Practically, this bias often leads individuals to underestimate loan interest rates as well as future investment values. Simulations that provide realistic expectations of future values can overcome the exponential growth bias that individuals encounter when they are left to perform mental calculations on their own.

Experimentation and Applied Practice

Risk aversion can often lead consumers to maintain the current state of their personal finances – rather than experiment with new options – even if their current situation is not optimal (Braunstein and Welch 453). Simulations can provide a safe environment or "experimental sandbox" for users to perform repeatable exercises and evaluate options without the risk of real-

world consequences. Simulations also provide ample opportunity for users to apply and further develop financial knowledge and skills through repeated practice in a simulated environment.

User Interaction and Control

Most simulations are interactive – providing some semblance of user control over variable inputs, pace, and sequence. Within financial simulations, users often have control over variables such as dollar values, time, contract or loan terms, and resource allocation. Simulations that include dynamic inputs – in which users experiment with different values for the same input variable – best demonstrate the effects of users' decisions on outcomes. Such level of control over the system may enhance individuals' perceived locus of control (LOC) (Perry and Morris 299; Harper, Squires, and McDougall 119). LOC is also tied to self-efficacy, "an individual's belief in a particular context or situation that he/she has the resources, options, and ability to successfully execute the behavior required to produce an outcome" (Perry and Morris 302). Individuals with internal LOCs and high self-efficacy are more likely to take proactive steps to improve their financial situation and secure economic well-being.

Simulations may also allow users to provide personalized inputs based on their individual circumstances or goals. For example, mortgage calculator users can input data specific to the house they intend to purchase, or they can input data into a retirement calculator that accounts for expected medical or dependent-related expenses unique to them as individuals. Other factors that affect financial decisions include age, income, family, health, and lifestyle. Decision support simulations also typically allow contextual user inputs – providing just-in-time, just-in-place information specific to the users' decision context.

Simulations for Financial Education and Decision Support

Simulations can range from low- to high-fidelity in terms of user experience and media richness. Low-fidelity simulations include simple formats such as data project tables, visual aids, and flow charts. Mid-fidelity simulations are typically digital and include more interactivity, such as consumer utilities like loan or retirement savings calculators. More complex high-fidelity simulations include digital formats such as interactive games, branching narratives, and immersive virtual environments. Depending on the specific learning or behavioral objectives, user context, and a variety of other factors, a simple static data table may be more effective in achieving desired outcomes than a fully immersive virtual world. Chapter 3 elaborates on low- and mid-fidelity simulations and analyzes selected examples.

CHAPTER THREE: LOW- AND MID-FIDELITY SIMULATIONS

Chapter 3 describes the benefits and application of visual language for financial simulations, defines the scope of low- and mid-fidelity simulations for financial literacy, and includes analysis of example simulations for financial education and decision support.

Low financial literacy can often be attributed to consumers' difficulty comprehending financial communications. While financial companies often intentionally obscure costs and risks for consumers with legalese, jargon, and organizational issues that make financial communications inaccessible, consumers must educate themselves to become informed decision makers. The field of technical communication has produced a body of research on plain language and visual language in government and corporate communications. While much of the research has focused on government intervention in the form of disclosure regulation, technical communicators can leverage existing best practices to develop content for consumer simulations.

Comprehension is an interactive function of consumer financial literacy and format friendliness. A range of visual formats and tools exist to provide educational and decision support to consumers of all levels of financial ability.

<u>Visual Language</u>

Visual language serves as an alternative to presenting blocks of linear text which can often prove intimidating and inaccessible to readers. Audiences with nonverbal learning styles, low English proficiency, or low literacy typically prefer to consume information presented in visual media that focus attention on the most important information. Visual formats facilitate random access and efficiency in processing information – benefits that appeal to audiences at all

reading levels. Low- and mid-fidelity simulations primarily employ two forms of visual language: nonlinear text and data displays.

Nonlinear Text

Nonlinear text design presents words and numbers in non-paragraph form. Formats such as tables, flow charts, organizational charts, decision trees, and concept diagrams rely on the visual presentation of information to "[reveal] relationships instead of explaining them" (Kostelnick and Roberts 220). In addition to text, nonlinear design leverages graphic and spatial modes to convey information. Graphic elements include framing devices (for example, shapes that outline text units) and linking devices to illustrate sequence (for example, arrows or lines) (231).

Spatial systems – which include strings, matrices, and branching displays – demonstrate relationships between textual elements and assist the reader in making connections. Strings arrange units of text in a single direction (horizontal or vertical) and use graphical cues such as arrows to guide the reader (228). Strings (most commonly employed in flow charts) illustrate sequential steps or events and display simple processes. While some branching may occur, the paths usually reintegrate by the end of the process (229). Figure 1 provides an example of a string illustrating suggested sequential steps for allocating monthly income.

Fixed Expenses $\longrightarrow$ **Savings** $\longrightarrow$ **Discretionary Spending**

Figure 1: Suggested sequence for allocating monthly income

Matrices arrange text in two directions simultaneously: horizontally and vertically (Kostelnick and Roberts 228). Tables display verbal information (numbers, words, or symbols) in a visually accessible format of rows and columns. The format allows readers to quickly and randomly access specific pieces of information, easily compare values, and locate an output value associated with a particular combination of matrix parameters (Dragga and Gong 90). Tables are verbally-oriented and therefore typically prove most effective at providing information to readers who are motivated, educated, and familiar with the subject matter (88-89). Users who do not fit that criteria may find more visually-oriented formats more accessible.

Branching displays such as organizational charts or decision trees display units of text in hierarchical structures with multiple levels (Kostelnick and Roberts 229). Within a decision tree, each "split" represents a decision point where the user must choose between alternative states or actions and follow the resulting path to either the next decision point or the path's conclusion.

Data Displays

As opposed to nonlinear text, data displays "rely on nontextual signs ... [to transform textual elements] into images" that present quantitative information (Kostelnick and Roberts 263). Compared to linear and nonlinear text, data displays allow readers to compare numbers more easily. They also afford the ability to visually observe trends in data rather than presenting only discrete data points (264).

Formats most relevant to financial simulations include pie charts, bar charts, and line graphs. For a given data set, the ideal display format depends on the type of data, the relationships in need of emphasis, and the desired learning or performance outcomes. Generally,

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pie charts best represent percentages of a whole. For example, budgeting tools commonly

employ pie charts to display expense categories and associated percentages of a monthly total.

Both bar and line graphs include two variables (x-axis and y-axis). However, bar graphs

highlight differences between two or more values, while line graphs better display trends (Clark

and Lyons 141). Bar and line graphs very commonly include time as one of the two variables,

which allows simulations to illustrate current or projected future values and trends. For example,

line graphs that display trends over time can help an individual visualize the long-term

accumulation of debt or wealth and therefore overcome exponential growth bias.

Low-Fidelity Simulations

Low fidelity simulations present static data in print or digital formats. Users may leverage

them for either education or decision support. Example formats include data projection tables

and graphs, flow charts, and other visual aids that illustrate a system or concept. By definition,

low-fidelity simulations do not include rich context. Their underlying data projection models rely

on mathematical formulas and basic assumptions to predict outcomes based on a static set of

circumstances – independent of the wide range of potential factors that can shape outcomes in

the real world.

Low-fidelity simulations support the development of mental models for decision-making.

For example, when consumers must decide between similar products, they may benefit from

simulations that project total costs and potential savings over time. Many financially literate

consumers rely on the unit price labeling present on retail and grocery shelves. The unit price

allows them to effectively compare items' cost per equal unit of weight or quantity – regardless

of packaging. As unit prices typically only differ by a matter of cents or fractions of cents, if

consumers do not have a concept of multiplied savings over time they may easily dismiss the difference as negligible. The unit price represents only one data point or variable in the larger equation that calculates total savings.

Given a choice in selection of one package size or brand over another, the average consumer does not use a calculator in the middle of the store aisle to determine how much they will save over the course of a single visit, a month, or a year. A static table can compare offerings within a category of items (such as laundry detergent) and use basic assumptions on frequency of purchase to project estimated savings over various time intervals.

Such a table might be used for decision support at the point of purchase, or as an educational tool to develop mental models related to the effect of differences in unit prices multiplied over time. Consumers tend to relate time periods such as a year to their annual salaries, a month to their monthly budgets, and two weeks to their bi-weekly paychecks. As multiplied savings increase over time, longer intervals such as a year may have a higher probability of impacting behavior.

Examples

Low-fidelity simulations are suitable for a wide range of applications within financial literacy. The following section includes analysis of several hypothetical or existing cases.

Differences In Unit Price Multiplied Over Time

Expanding the discussion of consumer simulations based on unit prices, the example simulation in Table 1 projects annual costs for name-brand soda consumption based on various options for the type of vendor and packaging. Assuming an average daily consumption of sixty-four fluid ounces, consumers who purchase 2-liter bottles at the grocery store will save

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considerably compared to consumers who purchase sodas at convenience stores, vending

machines, and fast food restaurants. While the difference in unit price between the least

expensive and most expensive options is roughly a nickel, over the course of a year the

difference equates to a potential savings of over $1,200.

Table 1: Example of differences in unit price multiplied over time

Purchase Options for Name-Brand Soda					
Vendor / Packaging	Fluid Ounces (fl oz)	Total Price*	Unit Price	Daily Cost of 64 fl oz	Total Annual Cost
Convenience store (bottle)	20	$1.49	7.5 ₵	$4.77	$1,740.32
Vending machine (can)	12	$0.75	6.3 ₵	$4.00	$1,460.00
Fast food restaurant (large)	32	$1.79	5.6 ₵	$3.58	$1,306.70
Grocery store (2-liter bottle)	67.6	$1.39	2.1 ₵	$1.32	$ 480.33
* Sample prices based on current local market					

Although prices were sampled from a single zip code, actual prices fluctuate according to

market conditions, geography, and specific vendor. A mid-fidelity simulation with dynamic

inputs would allow consumers to input real-time data with local prices, enhancing their ability to

make informed decisions. An even more flexible model would provide consumers with the

ability to input different types of products, sizes, unit measures, average consumption, and

projected time intervals to calculate the multiplied differences in unit prices (and potential

savings) across a wide range of products.

Minimum Payment Warning on Credit Card Statements

With the Credit Card Accountability Responsibility and Disclosure Act of 2009, the

federal government mandated that credit card companies include a "Minimum Payment

Warning" table on the first page of consumers' monthly statements (United States Congress H.R. 627 10-11). The simulation uses simple data projections to warn consumers that if in the short-term they pay only the minimum payment, they will incur higher interest charges in the long-term. The table also includes a row that simulates a scenario in which the consumer opts to pay a relatively small amount over the minimum. The sample data in Table 2 – which assumes a statement balance of $1,170, a required minimum payment of $37, and an APR of 24.99% – demonstrates that consumers can save $1,153 in interest and eight years of payments by adding only $10 to their monthly payment.

Table 2: "Minimum Payment Warning" from credit card statement (GE Financial Services)

Minimum Payment Warning		
If you make no additional charges using this card and each month you pay	You will pay off the Balance shown on this statement in about	And you will end up paying an estimated total of ....
Only the minimum payment	11 years	$2,829.00
$47.00	3 years	$1,676.00 (Savings = $1,153.00)

The static table provides enough data on projected finance charges and length of time to payoff to illustrate the effects of compounding interest on credit card debt. After the initial shock that the low-fidelity simulation provides, consumers would benefit from an interactive simulation which allows them to experiment with various inputs for their monthly payment and observe the dynamic effects on finance charges and length of time to payoff. Such a simulation could also take into account additional charges in subsequent months based on average spending habits –

thereby providing a more realistic data set and further emphasizing the tendency of revolving credit card debt to "snowball."

Discover Bank Personal Loans

Discover Bank offers consumers personal loans with a range of principal amounts, interest rates, and term lengths. Table 3 includes information from a direct-mail marketing pamphlet which outlines estimated monthly payments and total finance charges for each combination of term options. Literate consumers can use the table to make an informed decision on the best option and also develop or reinforce a mental model about the relationships between higher interest rates and longer loan lengths. While consumers observe relatively small differences between monthly payments based on the same principal amount and loan lengths but with different APRs, they can see a vast difference in total finance charges as the interest rate increases.

While consumers benefit from having access to the full data set for true decision support, less literate or otherwise more visually-oriented consumers would likely benefit from a supplemental line graph presentation of the same data – to more easily observe exponential trends. With banks unlikely to present information in a format that discourages consumers from selecting the loans from which the banks will potentially make the most profit, the need for unbiased educational and decision support materials emerges.

Table 3: Estimated payments and finance charges for personal loans (Discover Bank)

Estimated Payments and Finance Charges								
$3,000								
	48 months		36 months		24 months		12 months	
APR	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges
5.99%	$70	$381	$91	$285	$133	$191	$258	$98
8.99%	$75	$583	$95	$434	$137	$289	$262	$148
11.99%	$79	$791	$100	$587	$141	$389	$267	$198
14.99%	$83	$1,007	$104	$743	$145	$491	$271	$249
$5,000								
	48 months		36 months		24 months		12 months	
APR	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges
5.99%	$117	$635	$152	$475	$222	$318	$430	$164
8.99%	$124	$971	$159	$723	$228	$482	$437	$247
11.99%	$132	$1,319	$166	$978	$235	$648	$444	$331
14.99%	$139	$1,678	$173	$1,239	$242	$818	$451	$415
$7,500								
	48 months		36 months		24 months		12 months	
APR	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges	Monthly Payment	Finance Charges
5.99%	$176	$953	$228	$713	$332	$477	$645	$246
8.99%	$187	$1,457	$238	$1,085	$343	$722	$656	$370
11.99%	$197	$1,978	$249	$1,467	$353	$972	$666	$496
14.99%	$209	$2,517	$260	$1,858	$364	$1,227	$677	$623

Simple versus Compound Interest and the Time Value of Money

The time value of money – which demonstrates the effects of compounding interest over time – serves as a foundational concept in financial literacy. Table 4 compares the relative effects of simple versus compound interest on an initial balance of $1,000 at an annual rate of 8%. While the tabular data presents accurate information that adequately distinguishes between the results on the two sets of balances, literate audiences with some prior knowledge of the concepts generally find tables more accessible than audiences with lower levels of literacy or prior knowledge.

Table 4: Comparison of simple versus compound interest with tabular data (Mayes)

Simple Interest Calculation				Compound Interest Calculation			
Year	Principal Amount	Simple Interest	Balance	Year	Principal Amount	Compound Interest	Balance
1	$1,000	$80	$1,080	1	$1,000	$80	$1,080.00
2	$1,080	$80	$1,160	2	$1,080	$86.40	$1,166.40
3	$1,160	$80	$1,240	3	$1,166.40	$93.91	$1,259.71
4	$1,240	$80	$1,320	4	$1,259.71	$100.78	$1,360.49
5	$1,320	$80	$1,400	5	$1,360.49	$108.84	$1,469.33

Figure 2 provides a more visual representation of the effects of compounding interest on the time value of money. The line graph illustrates the exponential growth of the balance with compounding interest, especially for audiences who rely on visual media to communicate complex mathematical concepts. The data display also provides a longer period of time in which to observe the eventual steep rise of the value curve. The 40-year interval better emphasizes the exponential nature of the concept and the importance of long-term savings and investments.
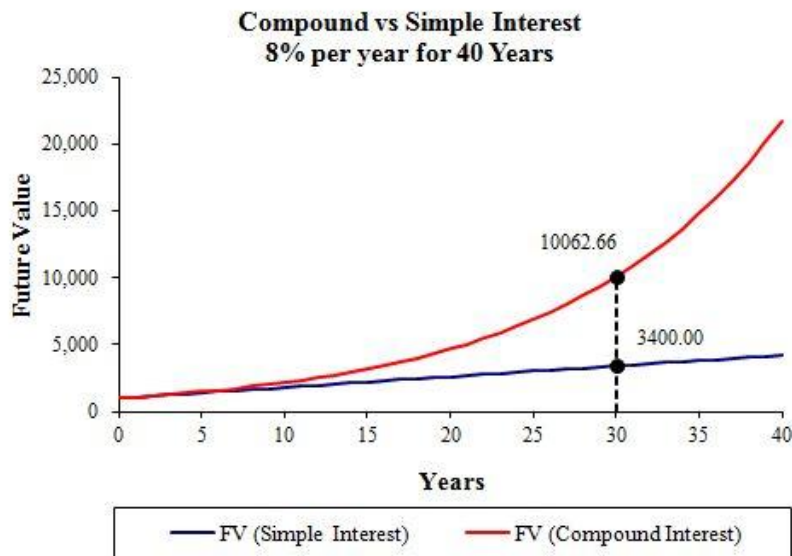

Figure 2: Visual representation of simple versus compound interest (Mayes)

<center>**Mid-Fidelity Simulations**</center>

Mid-fidelity simulations provide basic interactive tools in digital formats. In contrast to low-fidelity simulations, they have dynamic inputs which allow users to experiment with different assumptions and values – whether for the primary purpose of personalized decision support or for purely educational use. Example formats for finance include consumer utilities such as contextual calculators and wizards themed around loans, retirement planning, and budgeting.

Consumer utilities provide richer context than low-fidelity simulations. The tools allow users to input data based on personal circumstances and goals, whether they wish to assess how much money they need to save for retirement or simply experiment with loan terms to find the most appropriate options for their budget. Based on the inclusion of user interaction and dynamic variables, mid-fidelity simulations allow for more complex and flexible models – accounting for more external factors than static nonlinear text and data displays.

Examples

Mid-fidelity simulations are suitable for a wide range of applications within financial literacy – particularly for decision support. The following section includes analysis of several commonly used online support tools.

Discover Bank CD Rates

Rather than merely presenting potential customers with a static table listing tiered interest rates for certificates of deposit (CDs), Discover Bank's website offers an interactive tool (Figure 3). Users move sliders to adjust the deposit amount and term length and observe the effects on the CD's total yield at the end of the term. As the sliders move, each bar shifts up or down, with

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animation highlighting the movement. However, the size of the bars only relates to the difference between Discover Bank's interest rates compared to the national average. The size of the bar does not accurately reflect relative yield amounts according to the various input options. Therefore, users must rely on the textual signs (the monetary value label) rather than a purely visual representation.
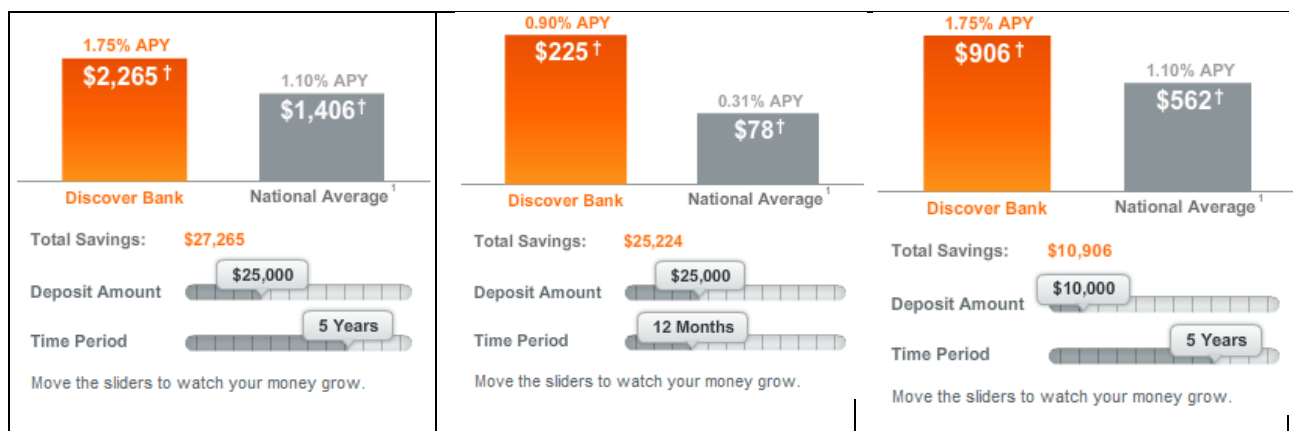
Figure 3: Discover Bank CD rates and yields (Discover Bank)

Retirement Calculator

Many investment companies and banks offer contextual calculators and wizards to support consumers in planning for retirement. Merrill Lynch and Bank of America offer consumers the opportunity to calculate their "Personal Retirement Number" (Figure 4) with personalized inputs for their age, current retirement savings level, monthly retirement savings allocation, annual income, investment style, and planned retirement age. Based on those variables, the simulation provides an individual's "personal retirement number" (PRN) – the estimated amount of money they will need to retire.

While the simulation predicts the PRN based on a range of variable inputs and static assumptions, the underlying model does not allow users to input personalized data based on lifestyle factors, family situations, other assets or sources of income, or types of investments.

Figure 4: Personal Retirement Number wizard (Merrill Edge)

Mortgage Calculator

As the mobile app market expands, consumers increasingly have access to educational and decision support tools for finance. Available in the Apple App Store, "Mortgage Payment

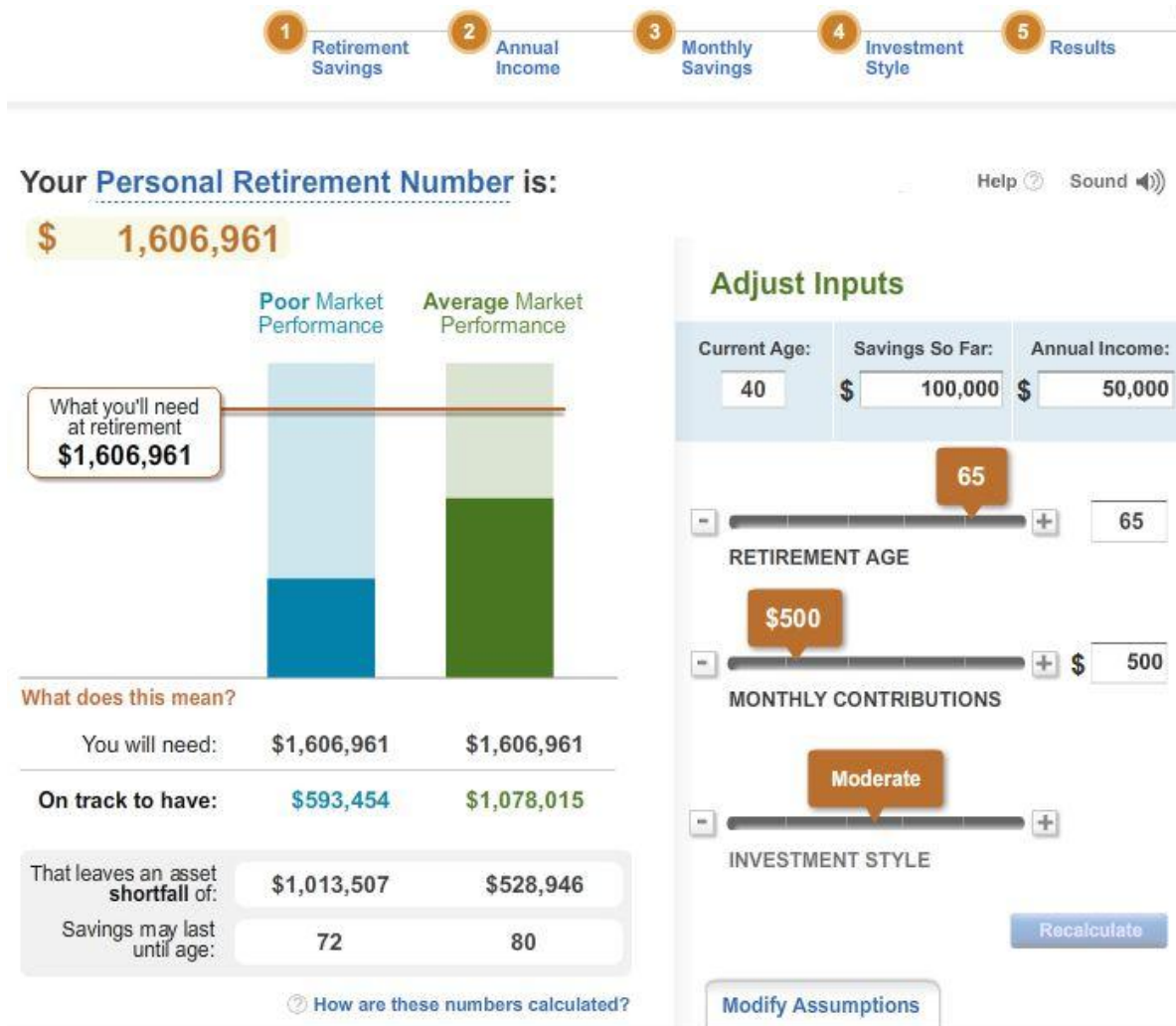Calculator" (Figure 5) provides consumers with a contextual calculator for home loans. Inputs include standard criteria such as purchase price, downpayment, interest rate, loan length, loan amount, and monthly payment. However, the calculator also takes into account monthly expenses like property tax, private mortgage insurance (PMI), homeowners' association fees (HOAs), and other expenses that many prospective homeowners do not always anticipate.

While users with low financial literacy will primarily use the tool to experiment with inputs and observe outcomes related to the monthly payment, more advanced users will scroll through the amortization table to determine long-term trends for principal-interest ratios of each monthly payment. However, in order to identify the total cost of financing (the cumulative interest charges over the life of the mortgage), user must navigate to the very bottom of the table. For the price and loan assumptions presented in Figure 5 – a standard loan with a 20% downpayment and no PMI – a borrower would pay $373,029 in interest over thirty years. Therefore, they would ultimately pay $873,029 for a $500,000 home. Ideally, such information should be more prominently displayed as an output value at the top of the screen.

iPad 📶   7:26 PM   ✳ 42% 🔋
Mortgage Payment Calculator

Loan Information

Purchase Price	$500,000
Down Payment	20%
Interest Rate %	5%
Years	30
Loan Amount	$400,000
Payment	$2,147

Other Monthly Expenses

Property Tax	$5,000
PMI	$0
HOA	Home Owners
Other Expenses	$0
Payment After Expenses	$7,147

| Effective Tax Rate % | 35% |

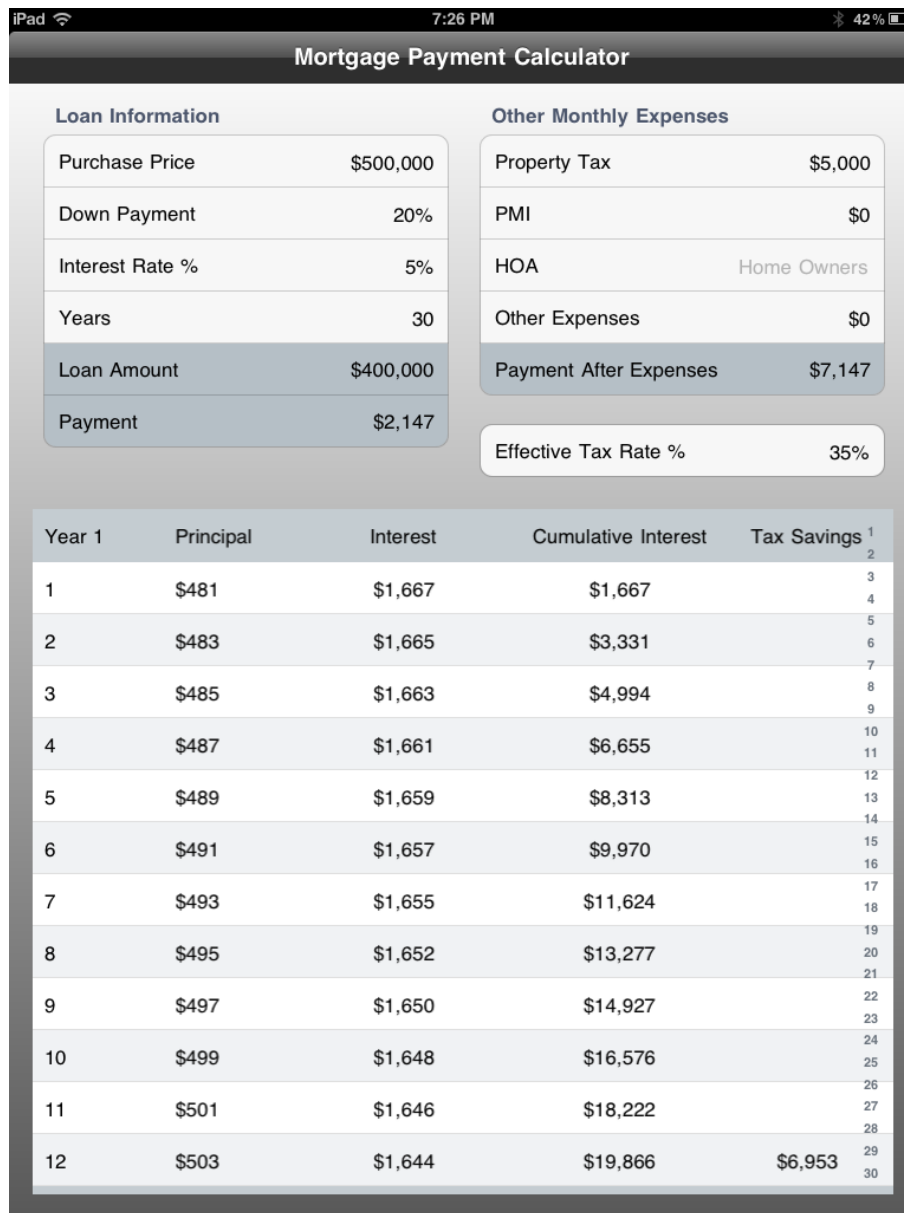| Year 1	Principal	Interest	Cumulative Interest	Tax Savings
1	$481	$1,667	$1,667	
2	$483	$1,665	$3,331	
3	$485	$1,663	$4,994	
4	$487	$1,661	$6,655	
5	$489	$1,659	$8,313	
6	$491	$1,657	$9,970	
7	$493	$1,655	$11,624	
8	$495	$1,652	$13,277	
9	$497	$1,650	$14,927	
10	$499	$1,648	$16,576	
11	$501	$1,646	$18,222	
12	$503	$1,644	$19,866	$6,953

Figure 5: Mortgage payment calculator and amortization table (Null Technologies)

Chapter 4 examines the theoretical foundation of the design and effectiveness of high-fidelity simulations for education and decision support and includes analysis of selected examples.

CHAPTER FOUR: HIGH-FIDELITY SIMULATIONS

Experiential simulations for financial literacy seek to produce educational outcomes. Users adopt authentic roles within the simulation's narrative and must apply knowledge and skills to solve problems and achieve goals. Simulations for financial education may take the form of games (with rules, points, and challenges) or merely open-ended learning environments that serve as sandboxes for exploration and experimentation. They leverage dramatic elements of story and narrative to immerse learners within deep contexts that reflect real-world complexity of systems and human behavior.

Chapter 4 focuses on the use of dramatic elements to create interactive narratives for high-fidelity experiential simulations and provides analysis of selected examples.

Dramatic Elements

Experiential simulations incorporate dramatic elements to form an over-arching narrative that shapes the user experience and drives motivation and engagement. Narratives frame the action within a simulation environment, defining the premise and rules (if applicable) as well as the users' roles, objectives, and modes of interaction within the dramatic arc.

Story

Experiential games and simulations rely on stories to describe setting, characters, and conflict. The initial premise defines a simulation's context and orients the user within the fictional environment (Fullerton 93). After the scene is set, the full story plays out as the user progresses through the narrative, seeking to resolve the central conflict. Some games have very simple stories that serve merely as exposition or static transitions over which users exert no control. More sophisticated branching narratives allow users to affect outcomes at various

decision points within the story's structured design. Such branching forms decision trees that resemble "choose your own adventure" modes of storytelling. In the context of financial simulations, the branching affords users greater opportunity to observe and learn from the consequences of various decisions.

Open-ended simulations provide flexibility for emergent storytelling and afford the greatest amount of user control. While branching simulations allow users to choose courses of action based on pre-defined paths, open-ended simulations contain less structure. Emergent stories develop purely as a result of users' actions instead of according to a structured narrative design (Fullerton 100-101). Such stories align with the notion of play – in which users have free reign to operate within the high-level rigid structures of a simulation's rules and constraints. From that freedom, the story and user experience emerge (91). For example, online environments such as Second Life have virtual economies in which users buy, sell, and trade virtual assets. Users create a virtual character (or avatar) that represents them in the environment, where they freely engage in social interaction and a wide range of virtual activities.

Stories serve as powerful tools for framing instructional content. They support transfer of learning by situating abstract concepts within applied contexts – allowing learners to solve problems grounded in realistic settings and situations. For example, a simulation about the potential negative consequences of using alternative financial services (AFS) might situate concepts related to credit, savings, and investment within the story of an immigrant family planning for their children's college education.

Stories also motivate and emotionally engage learners – both positively and negatively. Individuals become vested in the outcomes of the narrative and often personalize the narrative journey. While some stories provide inspirational motivation, other story-driven financial

simulations serve as warnings. Such simulations can incorporate elements of human drama to vividly illustrate the full range of effects that poor financial decisions can have on a person's health, career, and relationships. For example, a simulation might use the story of a father who cashes out his retirement plan early to purchase a luxury car, or a young woman whose fiancé is wary of her bad credit and recent bankruptcy.

Financial simulations often incorporate story elements to enhance realism. Authentic obstacles heighten awareness of the vast array of factors that can affect financial stability. Although contextual calculators have dynamic inputs for some values and assumptions, the simplicity of the model does not reflect the full range of real-world variables. Experiential simulations introduce complexity in the form of unexpected events and other realistic pressures that influence an individual's financial decisions.

A single unexpected event can often provide a shock to an individual's financial well-being and lead to debt accumulation and the possibility of eventual loan default or bankruptcy. Common trigger events include a change in family situation (for example, divorce or the birth of a child), individual or family health problems, loss of employment, home or auto-related expenses (for example, a new roof, home air conditioning unit, or car transmission), uninsured or underinsured property loss or personal liability, or even identity theft. Many experiential simulations include such triggers as either scheduled or random events within the narrative. The nature and associated consequences of the events serve to emphasize that even when users budget for fixed expenses and control discretionary spending, the potential for unanticipated events requires setting aside a "rainy day" savings fund. Such simulations encourage users to expect the unexpected – a mental schema that may guide real-world behaviors and increase individuals' future-orientation.

Character

Characters serve vital roles as the agents of action and drama within story-driven simulations. System-controlled non-player characters (NPCs) and user-controlled characters (usually the narrative's protagonist) emotionally engage users and perform the actions that drive the narrative forward. According to Tracy Fullerton, "By identifying with a character and the outcome of their goals, the audience internalizes the story's events and empathizes with its movement toward resolution" (96).

A simulation's story establishes character motivations – their wants, needs, hopes, and fears (97). Typically, users exert complete control over the protagonist, and the character serves as their virtual surrogate – reflecting their own values and desires. Within some simulations, however, the character may exercise a certain degree of free will beyond the control of the user. In such cases, the character's motivations and behaviors will potentially conflict with the desires of the player – leading to dramatic tension (99). Tension between characters and users represents a rich opportunity in the design of financial literacy simulations – where situations might arise in which users must counterbalance the actions and motivations of the character. For example, if a character seeks to maximize short-term benefit, the user may need to step in to prioritize needs and wants, make sacrifices, and balance the character's short- and long-term well-being.

Users may also help characters constructively deal with realistic pressures that influence decision-making, such as personal obligations, family situations, physical and emotional health, and peer status. For example, a character may be caught in a vicious cycle in which stress leads them to engage in "retail therapy" – which in turn leads to over-indebtedness resulting in additional stress.

Goals and Objectives

Experiential simulations define a set of goals that users need to achieve to progress through the narrative. Simulations must provide constant feedback to inform users of their progress in meeting goals and incremental sub-goals (Rouse 11-12). Narrative goals that outline what users need to achieve within the simulation are distinct from learning objectives, which define what users will learn. Effective instructional simulation design ensures that users must apply specific knowledge and skills aligned to learning objectives to successfully achieve the overall goals of the game or simulation (Alessi and Trollip 280). For example, in a simulation where users manage an investment portfolio to save for retirement, they must apply knowledge and skills related to investment vehicles, the time value of money, and risk management.

Games and simulations model real-world systems and often include simulated economies in which users must acquire and allocate resources to meet specific objectives (Fullerton 417). Based on the popularity of simulation games such as *Sim City* and *Farmville*, instructional designers have adapted similar frameworks for financial literacy games. Within such simulations, users take on the roles of resource managers and strategists as they seek to accumulate and distribute assets effectively within the simulated economy.

Challenge

Simulations must challenge users in order to maintain motivation. Challenge provides a sense of accomplishment when users successfully meet objectives and also ensures continuous development of knowledge and skills. Mihaly Csikszentmihalyi's theory of flow describes a state in which individuals are fully engaged in an enjoyable activity. They immerse themselves in the experience and focus on the task at hand rather than the outside world. Ultimately, they gain

satisfaction as they strive toward a challenging but attainable goal and exert control over outcomes.

To allow individuals to reach the flow state, an activity's level of challenge must increase in accordance with participants' level of ability. From the participants' point of view, an activity without some inherent challenge is not worth pursuing. The alignment of challenge to ability serves to maintain individuals' presence in the ideal flow state – in which they are neither frustrated nor bored (Fullerton 87). Therefore, challenge must dynamically evolve within a simulation – both according to users' initial levels of ability as well as over the course of their progressive achievements. For example, at the beginning of a financial education simulation, users might select from beginner, intermediate, and advanced skill levels (according to age or subject matter experience). From that point, to avoid the user becoming bored, the challenge level must increase as the user develops relevant skills and knowledge. If the user fails to demonstrate increased ability, the simulation may provide opportunities for additional feedback and practice to prevent frustration.

Fantasy

For audiences of all ages, fantasy also serves an important role in motivation. Younger audiences respond to imaginary fantasy as a means to motivate and engage them within educational games and simulations. While adults may enjoy entertainment games based in purely imaginary worlds outside the realm of possibility, for educational purposes they generally appreciate simulated environments with premises and scenarios grounded in realistic fantasy. Such narratives reflect desired achievements in adults' personal and professional lives and the

settings in which they will apply their knowledge, leading to a better transfer of learning (Alessi

and Trollip 229).

<u>High-Fidelity Simulations</u>

Users rely on experiential simulations for financial education rather than immediate

decision support. Compared to low- and mid-fidelity simulations, high-fidelity simulations offer

higher levels of user control and engagement, as well as enhanced context in the form of rich

narratives that incorporate dramatic techniques to motivate and engage users.

Examples

The following section provides analysis of several popular games and simulations for

financial literacy.

Financial Football

The National Football League (NFL) and Visa partnered to release desktop and mobile

app versions of *Financial Football* – a game targeted to various age groups to assess players'

financial literacy. Unlike many financial literacy games, the simulation does not model financial

systems or concepts. Instead, the application embeds the learning content as text-based PDF

modules for students and teachers to review. Once users kickoff the gameplay component, on

each down of football they select easy, medium, or hard "plays" from their team's offensive or

defensive playbook and answer multiple choice financial questions of corresponding difficulty.

On offense, players gain positive yards with each correct answer and lose yards if they answer

incorrectly. On defense, each correct answer results in negative yardage for the opposing team,

while incorrect answers lead to gains for the opponents. Players continue answering questions to march down the field and score points and prevent the other team from scoring against them.

The actual football game assesses knowledge but does not serve as the primary mode of instruction. The game's artificial intelligence simulates the rushing and pass plays within the stadium atmosphere merely to create a sense of fantasy, motivation, and challenge. Within the knowledge assessment, users mostly recall knowledge instead of applying knowledge or skills to solve contextual problems. While the football theme is promising, incorporating financial simulation into the narrative and gameplay would enhance users' learning opportunities. For example, designers of similar games might allow users to take on the roles of general managers responsible for overseeing teams' resources and payrolls – or even the roles of rookie athletes who need to develop the skills, experience, and discipline to manage their newfound fortunes.

Celebrity Calamity

Celebrity Calamity emphasizes fantasy and challenge to engage users and illustrate concepts related to managing credit. Sponsored by the D2D Fund, the simulation places users in the role of personal shopper and financial manager to three fictional celebrities – including an actress, sports star, and singer – that serve as non-player characters (NPCs). Users strive to keep their jobs by satisfying their clients' extravagant demands while also keeping the celebrities out of debt. The users' success (and job security) is defined by their clients' happiness meter, which ranges from angry or anxious to content or happy. As users progress through the simulation's levels, they build achievements in the form of titles of increasing importance (for example, coffee fetcher, gopher, impersonal assistant, and executive partner). Meanwhile, the NPCs

ascend within their own careers, such as the actress who graduates from infomercials, to soap operas, TV sitcoms, and eventually blockbuster films.

Gameplay occurs via two different modes. Users act as personal shoppers in an arcade-style mode, where they must move their avatar across the screen to catch money (income) and merchandise (items on the shopping list) that literally fall from the sky. After each shopping round, users shift focus to their finance manager role, in which they use credit or debit cards to pay the monthly shopping bills while attempting to avoid finance charges and snowballing debt.

While *Celebrity Calamity* demonstrates the impact of compounding interest, high APRs after low introductory periods, cash advances, and other common situations that lead to credit card debt, the focus rests primarily on credit and debit transactions rather than budgeting. In addition, for the sake of simplifying gameplay, the simulation limits the scope of the shopping to expensive discretionary items such as jewelry, designer clothing, and electronics. The simulation's model for consumer spending does not include fixed expenses like housing and transportation or discretionary expenses related to travel, entertainment, or dining. Therefore, users do not have the opportunity to build or manage a realistic budget, as they observe the effects of a sub-set of consumer spending but have little control over it. Rather, they merely make decisions on how best to pay monthly shopping bills to avoid significant finance charges.

The NPCs introduce complexity by exercising their free will. After users have completed the shopping round, the NPCs often surprise them by announcing random impulse purchases the celebrities bought on their own. For example, the actress NPC decides to buy an airplane to airlift hungry kittens, purchase a sustainable farm despite knowing nothing about farming, and buy two grand pianos even though she does not remember whether or not she actually plays. Aside from the humorous aspects of the celebrities' extravagance, from an instructional

perspective the users would perhaps benefit from the ability to influence the NPC's behavior more directly. Instead of having to satisfy the clients' demands to maintain the happiness meter, users could help guide their behavior and encourage them to live within their means.

SPENT

Urban Ministries of Durham developed *SPENT*, an online simulation to engender empathy with the plight of the working poor. The simulation challenges users to place themselves within the shoes of a single parent who has lost his or her home and savings as a result of sudden unemployment. Although not explicitly stated in the simulation, *SPENT* serves as a cautionary tale for families who do not have sufficient emergency savings. The simulation illustrates the vulnerability of the working poor. In aggregate, what may seem to be a series of relatively minor random events can have devastating consequences on a family's well-being.

At the beginning of the simulation, users choose a job from a variety of unstable low-wage options and then make difficult choices to support themselves and their child – such as where to live, whether to purchase health insurance, and how to put food on the table. Users see how each decision affects the amount of money they have left and struggle to make it through the end of the month while living paycheck to paycheck and dealing with unexpected expenses. As users progress through each simulated day, they encounter obstacles such as illness, accidents, and obligations that can deplete their income.

Most importantly, users see how certain obstacles affect their children. For example, they may have to miss their child's school play because they have to work an evening shift. If the family dog gets sick, they may decide to put the pet to sleep because the vet bill would be too expensive otherwise. They may even deal with the fallout of their child's humiliation over

receiving free lunches at school – faced with a decision to risk their child refusing to eat or else give them lunch money. Each situation represents a decision point in which users must choose whether to focus on meeting their child's physical versus emotional needs. Such narrative elements stir emotional responses, as users empathize with the need to balance financial pressures with the desire to be good parents.

Chapter 5 proposes best practices and design guidelines, ethical considerations, and areas of future research for financial literacy simulations.

CHAPTER FIVE: CONCLUSIONS

As the complexity of the financial marketplace increases, consumers' responsibilities for securing their economic well-being continue to expand. To function in society, consumers must seek out knowledge and skills to make informed decisions. Simulations provide a method of enhancing financial literacy through education and decision support. Such simulations illustrate abstract financial concepts, provide a means of safe experimentation, and allow consumers to make informed choices based on a longitudinal comparison of decision outcomes.

Technical communicators play an important role in developing simulations for financial literacy. They develop content based on best practices and conduct evaluations to ensure that simulations present information that is accessible, usable, and focused on the end-user. They also consider ethical and cultural issues to maintain simulations' credibility and integrity within particular contexts. As public and private organizations are increasingly leveraging new media to deliver financial literacy interventions, the role of technical communicators will expand.

Chapter 5 proposes best practices and design guidelines, ethical considerations, and areas of future research for financial literacy simulations.

Best Practices and Design Guidelines

The following section presents high-level focus areas for creating effective simulations for financial literacy. Technical communicators and designers should strive to develop simulations that are accessible, usable, user-centered, engaging, and instructionally sound.

Accessibility and Usability

During the simulation development cycle, technical communicators take active roles in content design and development. They communicate complex financial concepts and information

in terms that users can understand and apply to decision-making. In recent years, usability experts and plain language initiatives have largely focused on revising and regulating government and corporate financial communications and disclosures. Technical communicators have the opportunity to apply the same guidelines to creating consumer simulations – with a focus on plain language and visual language. Plain language seeks to increase user comprehension by using simple and straightforward terminology. The style avoids jargon, legalese, passive voice, and overly complex sentence structures that mask true meaning. The use of visual language also helps users comprehend financial information – especially individuals with limited knowledge, cognitive ability, or English proficiency.

In addition to language translation, content may require cultural translation or localization. Even when content is visually-oriented and available in multiple languages, technical communicators must often take steps to make it culturally appropriate. For example, while Visa created a Spanish-version of *Financial Football* to reach a broader audience in the U.S., they redesigned the framework entirely when they deployed the game for an international audience. They themed the new game around soccer instead of American football and also adapted supplemental classroom materials to appeal to local cultures. In South Africa, the supplemental materials converted monetary values to the local currency, included character artwork representative of local demographics, and covered content related specifically to the South African economy and financial system.

User-Centered Design

Financial literacy simulations must focus on the end-user's needs and goals. Major design considerations include the context in which the user will access the simulation, learning and

performance objectives, the user's prior knowledge and skill level, and relating abstract concepts to the individual.

In addition to the context of an individual's personal finances, designers must take into account the context of the user's interaction with the simulation. For example, a contextual calculator for unit price comparisons should be accessible on mobile devices, as users will most likely use the tool at the point of purchase. Designers can accommodate a variety of user contexts by creating content flexible enough to be delivered via multiple formats and platforms. Digital formats offer the most flexibility and often allow users to customize their experience based on their own specific objectives and skill level.

An individual's prior level of knowledge and skill also determines a simulation's ideal level of complexity. For users with low levels of prior knowledge or skill, simulations with complex models and interaction modes may lead to confusion. In contrast, advanced users typically benefit from a higher degree of control over the simulation, including a wider range of input variables (Alessi and Trollip 233-234). As learners develop knowledge and skills, some simulations will adapt to their increased abilities. Such simulations have dynamic levels of complexity based on either learner performance or sequential increases between modules or levels (235).

Individuals respond to simulations that allow them to relate abstract and complex concepts to their own personal experience. Decision support simulations such as contextual calculators rely on users to define the decision context. User-generated inputs for data values and contextual assumptions provide a means of personalizing an otherwise static representation of reality.

Instructional Design

While simulations leverage best practices from instructional theory and practice, creating financial literacy interventions requires additional design considerations. As a lack of CFC often leads to unsustainable financial behavior, simulation designers must orient users toward the future. Simulation's primary affordance for financial literacy relates to users' ability to compare the short- and long-term outcomes of various decisions. Therefore, simulation designers implement models that allow users to simulate time progression according to various intervals. The ideal time interval varies according to the simulation's objectives. For simulations focused on spending and budgeting, weekly or monthly intervals demonstrate the effect of even small purchases on the balance of monthly income. Simulations that project savings (such as unit price comparisons or retirement planning) or debt rely on much longer time intervals to demonstrate long-term accumulation and exponential growth.

To adequately convey the relevance and importance of content topics, simulations must emphasize how consumers benefit from engaging in sustainable behaviors. Simulations that address the question of "What's in it for me?" tend to successfully motivate and engage users. Such users are more likely to invest the time and energy necessary to interact with the simulation if they can foresee potential benefits beyond knowledge for the sake of knowledge. When simulations offer actionable information and inspiration, users will likely pay attention and at least consider alternative mental models.

High-fidelity simulations rely on theories of applied and contextual learning to ground financial concepts in reality and relate them to individuals. Scenario-based narratives situate content within authentic contexts, allowing users to solve problems in realistic settings. To support the transfer of learning, simulation designers should embed content within multiple

contexts. When learners encounter the same concepts applied within a variety of situations, they "develop a more flexible representation of knowledge" (Mayer et al. 66).

Ethical Considerations

Technical communicators and instructional designers have ethical obligations to their users to present information that is accurate and unbiased, easily understood, and respectful of users as individuals. Simulations for financial literacy are fundamentally rhetorical and often use persuasive techniques to shape human understanding and behavior. However, to make effective decisions, consumers need reliable and trustworthy sources of information. Therefore, simulation designers must ensure that simulations seek to develop healthy and sustainable behaviors focused on individuals' well-being – rather than steering consumers in particular directions to satisfy commercial or political agendas.

Financial misinformation is prevalent in society and the media and can have a tremendous impact on consumers' economic security and personal well-being. Simulations that contain unbiased and accurate information provide tools for empowerment and allow users to cut through the haze and develop appropriate mental models of financial systems and processes. Simulation designers should include third-party validation of a simulation's models, formulas, and content as part of the testing and quality assurance phase. While data projections sometimes only provide estimates or predictions, the underlying model and assumptions used to perform the calculations should be grounded in reality.

Simulation designers should also avoid deceptive graphics that can mislead users into drawing the wrong conclusions about financial products or decision outcomes. Various techniques related to selection, emphasis, and framing can affect how readers perceive tables,

figures, and other graphics (Allen 88-89). Thorough and iterative usability testing and revisions will ensure that users comprehend and act on visual information appropriately.

Respecting users as individuals means empowering them to succeed financially but also avoiding heavy-handed value judgments or overly prescriptive instruction. Consumers will make decisions based on their personal circumstances and values. Simulations can demonstrate alternative courses of action and ways of thinking, but the ultimate responsibility and freedom to act rest with the individual.

Areas for Further Research

Over the course of this thesis, I have presented theories on the affordances of simulations for enhancing financial literacy. I have also proposed a taxonomy of simulation formats for financial education and decision support based on the fidelity of the underlying models and interaction modes. This research can serve as a foundation for future empirical evaluation of the effectiveness of simulations for financial literacy.

To date, empirical research on the effectiveness of financial education for promoting changes in cognition, attitudes, and behavior has primarily focused on whether subjects had received some form of financial literacy intervention – without regard to the quality or format of the instruction. Future research should focus more specifically on content and delivery. Researchers will need to measure how and to what degree specific simulation interventions enhance cognition and develop mental models of financial concepts and processes.

Researchers must also evaluate to what degree enhanced understanding will translate to action. The primary goal of financial literacy programs is to promote sustainable behaviors. Therefore, researchers must study both the immediate and longitudinal effects of simulation on

consumer attitudes and behavior – focusing on the cognitive, psychological, and social factors that shape individuals' decision-making.

Socio-cultural issues represent another important opportunity for research. While financial literacy is a vital domestic issue for the U.S. economy, international audiences – and arguably the global economy as a whole – stand to benefit from increased education as well. For example, simulation-based financial literacy content may prove an effective component of microfinance programs in the developing world. Microloans provide access to start-up capital for local entrepreneurs. To successfully repay the loans and operate a business, the entrepreneurs must have a basic understanding of finance. Among other design concerns, culturally appropriate programs would likely rely heavily on visual language to overcome literacy barriers and also take into account the differing concepts of time prevalent in the developing world.

Based on lessons learned from further research, technical communicators and simulation designers will refine instructional content and delivery methods. They will also assess best practices for accessibility and usability and compare the effectiveness of various formats and design features for different contexts. From the empirical results, they will develop best practices and design standards for using simulations to shape sustainable consumer behaviors.

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