

Influencing Retirement Saving Behavior with Expert Advice and Social Comparison as Persuasive Techniques

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Abstract. Numerous online communities and e-commerce sites provide users with crowd-based recommendations to influence decision making about products. Similarly, automated recommender systems often use social advice or curated knowledge provided by experts to give customers personalized product recommendations. Little, however, is known about the relative strengths of these approaches in repeated-decision scenarios. We used social comparison and an expert recommendation to examine the relative effectiveness of these methods of persuasion for users making repeated retirement saving decisions. We exposed 314 performance-incentivized experiment participants to a retirement saving simulator where they made 34 yearly asset allocation decisions in one of three user interface conditions. The gap between participants' retirement goal and actual savings was smallest in the expert advice condition and significantly better than the social comparison condition. Both conditions were significantly better than the control condition. In non-control conditions, users adjusted their behavior and achieved their saving goal more effectively.

Keywords: Retirement saving · Social comparison · Behavior change · Persuasive technology · Financial literacy

1 Introduction

Americans are estimated to hold \$19.4 trillion in 401(k) retirement accounts [1] in which people make yearly decisions about how to allocate funds between a mix of assets. Theory-driven design of such interfaces can potentially help us understand and inform people who save for retirement, persuading them to make better saving decisions. Providing persuasive user interface design interventions at key decision points can improve investing behavior and avoid costs that hurt savers in the long-term.

We selected expert advice and social comparison as conditions to study because of their proven use in other research to influence and persuade users. When expert advice is available, people take into account such advice in their decision making [2]. In online communities individual decision making changes when individuals are exposed to aggregate decision data of an online community at large [3]. Studies have shown that changing people's retirement saving habits continues to be challenging due to factors such as status quo bias [4], and people end up losing a great deal of retirement income due to poor saving and investing habits. Given the persuasive pow-

er of expert advice and social comparison, we have two hypotheses with respect to how applying these methods of influence will affect the behavior of individuals saving for retirement: first, we expect that showing expert advice will motivate individuals to follow the expert advice over their own choices as individuals; second, we expect social comparison advice will influence decision making as individuals are likely to take into consideration the opinions of others—though this effect will be weaker than expert advice used as a means to influence decisions.

Recent studies show most Americans have underfunded retirement accounts [5]. Two aspects of retirement saving make it particularly difficult for non-experts: first, savers have to make repeated decisions about asset allocations that should decrease in risk over time, and understand the effects of multiple saving decisions over long periods. Second, most people do not assess risk properly [6]. In particular, a common mistake savers make is attempting to maximize returns or minimize volatility rather than reach a pre-determined saving goal [6].

While savers are advised to plan their savings towards reaching the goal of a comfortable retirement income, many often do not manage their retirement funds appropriately. For example, Samuelson and Zeckhauser [7] showed university faculty retirement contributions through TIAA-CREF retirement programs are rarely altered from their defaults leading to much lower long-term returns and unmet savings goals. Studies by the Employee Benefit Research Institute [8] show most Americans will have to work longer before retirement or spend far less once they enter retirement.

In response to these common difficulties and to motivate people to save in more effective ways, financial firms introduced target-date retirement funds in the late 1980s [9]. Target-date retirement funds, also known as lifecycle, dynamic-risk or age-based funds, provide a simple solution to automating asset allocation decisions. A saver invests into the target-date fund each year without having to make decisions about asset allocations and the target-date fund automatically rebalances allocations of asset types annually based on the saver's age or expressed level of risk. Financial companies often charge higher fees to manage target-date funds compared to having savers rebalance their retirement portfolio themselves: the fees a saver incurs in target-date funds range from 0.17% to 1.05% [10]. Over the long-term, these fees can add up to tens of thousands of dollars for the average saver.

Automated solutions for investing exist, but they often involve fees, require complex technical knowledge, or hide the underlying financial concepts individuals must learn to become effective investors. Automated retirement saving platforms, such as Wealthfront [11] and Betterment [12], charge consumers fees to use algorithms that automatically rebalance a recommended set of Exchange-Traded Funds to create optimized retirement portfolios. Automated retirement savings platforms help increase the transparency of underlying investments, but consumers are required to pay fees and it can be unclear how rebalancing occurs over time. Our motivation for using expert advice and social comparison as persuasive techniques to influence investing is to help people understand underlying risk by showing them how experts and groups are investing—which in turn persuades the individual to invest more appropriately.

Our objective is not to elicit more or less risky behavior, but rather, given a pre-determined saving goal, to identify which interventions lead participants to take

appropriate risks and stay on track toward their goal. We should note that increased proportion of stocks is not in itself more risky in the long run, since the alternative—allocating more to “safer” (but lower yield) assets—may lead to lower likelihood of achieving the goal and thus may not be effective in the long run. There are multiple ways to reach a retirement goal, and therefore the role of the interventions is to help users modify their behavior by suggesting a path to the goal.

Since investing is commonly done online in recent years, HCI research in behavior change and persuasive technology especially are well suited to study it, and inform and help people save for their retirement. Within the field of persuasive design and HCI, research specifically studying retirement saving is highly under-studied. In this study we contribute to persuasive design research by exploring the use of social comparisons and expert advice to help persuade users to make better retirement saving decisions.

2 Related Work

Prior research shows that social comparison strongly influences individual behavior. Drawing on social comparison theory, Chen et al [3] showed that when users of MovieLens, a movie rating online community, received information about others’ contribution, users below the median increased their contribution, whereas those above the median did not decrease their ratings. Konstan and Riedl [2] demonstrated that providing expert information using algorithms can dramatically affect how recommender systems users make decisions. Schafer et al have shown that in e-commerce, providing hard-coded knowledge from expert or mined knowledge from consumer behavior leads to increases in sales [13].

In many financial contexts, people benefit from both expert advice and being able to compare themselves with others. Research in microfinance has shown that when lenders and borrowers have access to financial data of others they are more likely to adjust incorrect inferences, thus improving lender decisions and help those seeking loans [14]. In a study of crowd-sourced stock picks in online forums, Hill and Ready-Campbell [15] used a genetic algorithm approach to identify experts within the crowd. The online crowd that used expert advice performed better, on average, than the S&P 500 [15]. When more weight was given to the votes of the experts in the crowd, this increased the accuracy of the verdicts, improving performance yields. Both expert advice and social comparison “advice” have the potential to benefit savers and persuade them to make better decisions. With respect to design interventions used to influence decision making in the financial services domain, Teppan et al [16] investigated the impacts of the asymmetric dominance and compromise effect to influence the choice of bonds over stocks and vice versa.

Providing expert advice to change decision-making is not new. Design interventions have provided expert advice to users in areas such as healthcare informatics and environmental sustainability. Fogg’s work in persuasive technology [17] has influenced research on how technology can be used to change behavior. Yun et al [18] used intervention techniques for encouraging energy conservation through the use of

information dashboards. Similarly, Froehlich and colleagues [19] used immediate feedback that changed on a daily basis to promote environmentally sustainable behavior in water usage. These studies show that displaying timely feedback and information about deviating from a goal can affect individual behavior.

With respect to risk adjustment and investing, the notion of adapting portfolio allocations and adjusting for risk over time dates back to early research by Nobel laureate Robert Merton [20]. More recently, economists have studied the benefits and drawbacks of target-date funds extensively. Poterba et al [9] examined target-date fund asset allocation strategies and how age and stage of life can be used to optimize asset allocation decisions. Mitchell and Utkus [21] have shown that target-date retirement funds are becoming an implicit means of investment advice for employees since the choice architecture of fund selection has become so complex.

HCI researchers have explored how people manage and think about their money [22, 23], and how real-time information about simulated financial transactions leads to a better understanding of those transactions. Cramer and Hayes [24] studied financial literacy within classroom settings using ubiquitous computing technologies to track simulated financial transactions between students. Providing real-time information about simulated financial transactions gave students a stronger understanding of economic transactions versus merely discussing the concepts in the abstract. HCI applied to finance and economics shows that timely data, conveyed in such a way that is applicable to the present, help people better understand the impact of their decision making, thereby leading to better decision making. Gunaratne and Nov [25] studied how applying behavioral economic theory to retirement saving in an HCI context can improve reaching saving goals, but little other HCI research focuses on technology-mediated saving behavior and how design interventions can be used to persuade users to make better decisions with respect to personal finance.

3 Study

3.1 Setting

This study attempts to understand how to motivate individuals to make prudent decisions when dealing with a complex, long-term series of activities such as retirement saving where there is uncertainty regarding investment return performance. Building on prior work [24, 26, 27], we examine the effects of feedback relating to objectives, goals and deviating from those goals, on user saving behavior. In particular, we wanted to examine the effects of how to mitigate the effects risk has in influencing and motivating investors to be either too conservative or too aggressive when making investment decisions by applying persuasive techniques.

We examined the effects of expert advice and social comparisons, which changes with each subsequent participant and each passing saving year, on retirement users' behavior. We created an interactive retirement saving simulator that borrowed features from popular commercial retirement management systems (e.g., Vanguard and Fidelity Investments). We asked users to save \$1.5 million over 34 years (2014-2048). A person who

saves \$10,000 per year over 34 years with returns of 7.5% can expect to save about \$1.5 million. Returns of 7.5% are a typical rate of return for a mix of stocks and bonds.

In each simulation “year” participants allocated their yearly savings (\$10,000) among the three basic asset classes of stocks, bonds and cash, after exploring the implications of their decision using the simulator’s interactive features. Stocks are the riskiest investment type, but provide the greatest return. Bonds are less risky, but provide a lower return. Cash has no risk and provides minimal return [28]. Once users clicked “submit” on their chosen yearly allocation of assets, they moved to the next simulation year. The interface then presented users with market behavior of the last year as well as their portfolio’s performance (Figures 1-3). To make the market performance realistic, the simulator used (unknown to the users) the Dow Jones Industrial Average for stock data and the Fidelity Investment Grade Bond for bond data, both from 1980 to 2014. Actual market data from 1980 represented the simulated year of 2014, 1981 represented 2015, and so on, ending with the simulated year 2048, which used actual market data from 2014.

3.2 Reward Mechanism

We recruited users via Amazon Mechanical Turk and limited participation to U.S. users who did at least 100 Human Intelligence Tasks (HITs) prior to our HIT at an approval rate greater than 99%.

Following the approach of achieving a retirement goal rather than maximizing returns or evading risks [6], we rewarded taking goal-driven moderate risk. Consequently, users’ compensation was based on a \$1.00 default pay and a maximum bonus of \$4.00 if they met the \$1.5 million retirement goal. Deviation from the goal either positively or negatively led to a proportionally lower bonus. This 4/1 bonus/default compensation ratio provides incentive to achieve the savings goal rather than maximizing returns with riskier behavior.

Retirement advisers recommend setting a savings goal based on a retirement replacement income and an appropriate level of risk rather than trying to maximize funds through risky investments. Risk tends to be especially important to mitigate the closer one gets to retirement. Meeting or exceeding a retirement goal is the core objective. However, missing a retirement goal can lead to loss of income in retirement. Given fluctuations in the stock market, experts recommend being more conservative in investing the older one gets. Certainly, one can continue to be aggressive and put substantial investments into stocks throughout one’s lifetime, but if the stock market plunges close to a retirement date there are few ways to recover the losses. For such reasons retirement advisers encourage diversification in stocks and bonds, shifting a greater portfolio allocation towards bonds the older one gets. In other words, investors should take risk when they are young, but be risk averse when they are old. Therefore setting a retirement goal is important, but taking too much risk to attempt to exceed that retirement goal is imprudent.

3.3 Experimental Conditions

Following a between-subjects experimental design, 314 users took part in the experiment. Their average age was 34.1 and 45.7% were women. They were divided between

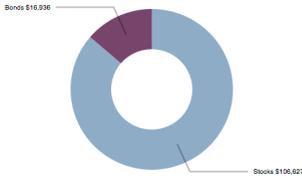
the expert advice group (103 users), the social comparison group (109 users) and the control group (101 users).

To match common retirement saving user interfaces we presented to users the asset allocation, the overall value of the user’s investments over time, the current year, and the year of retirement. To help participants understand how changing asset allocations can affect goal outcomes, we provided an interactive feature enabling users to check the potential outcomes of asset allocation alternatives prior to starting the simulator.

Retirement portfolio simulator

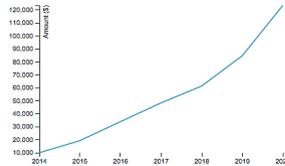
Your current retirement portfolio

The pie chart below shows your portfolio allocations for your **entire retirement savings** since you began saving in 2014.



This year: 2021; Retiring in 2048

The chart below shows the total value of your entire retirement portfolio over time since you started saving.



This year's retirement saving allocations

Use the fields below to adjust **this year's** savings allocation. Adjusting percentages changes your stock, bond and cash weights in your portfolio, affecting your risk and reward. Remember, you can try as many allocations as you wish before pressing Continue.

Percent stock
 Percent bond
 Percent cash
 Yearly amount saved

Percentages must add up to 100%

Based on recent research, this is the recommended allocation of your \$10,000 savings for the current year.

42%
Stocks

Your progress in savings towards retirement in 2048

Amount saved to date (Your actual present savings)

\$123,563

Based on recent research, this is the recommended allocation of your \$10,000 savings for the current year.

42%

Stocks

58%

Bonds

0%

Cash

This will move your overall portfolio towards 83% stocks and 17% bonds.

This will move your overall portfolio towards 83% stocks and 17% bonds.

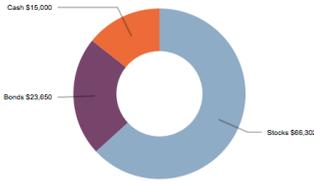
Fig. 1. Expert advice condition

In the condition emphasizing adaptive *expert advice* (Figure 1), we used a target-retirement formula [29, 30] that is typically used to determine stock and bond asset allocations based on an individual’s age. Most financial firms use this formula as the primary basis for determining stock and bond allocations in a target-date retirement fund. For the purpose of this study we applied the formula in such a way to ensure the final amount a participant would save if she followed the formula exactly would be near \$1.5 million. To convey this as expert advice to participants we stated: “*Based on recent research, this is the recommended allocation of your \$10,000 savings for the current year.*” Following this statement we showed recommended yearly percentage allocations of stocks, bonds and cash, followed by how this would affect the overall balance of the entire retirement portfolio. This condition aimed to convey an expert opinion to participants. We expected participants to follow the expert advice, though they were free to make any allocation choice they deemed fit to achieve the \$1.5 million goal.

Retirement portfolio simulator

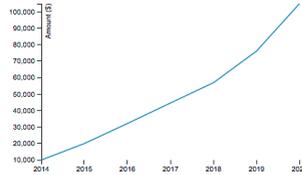
Your current retirement portfolio

The pie chart below shows your portfolio allocations for your **entire retirement savings** since you began saving in 2014.



This year: 2021; Retiring in 2048

The chart below shows the total value of your entire retirement portfolio over time since you started saving.



This year's retirement saving allocations

Use the fields below to adjust **this year's** savings allocation. Adjusting percentages changes your stock, bond and cash weights in your portfolio, affecting your risk and reward. Remember, you can try as many allocations as you wish before pressing Continue.

- Percent stock
- Percent bond
- Percent cash
- Yearly amount saved

The percentages below are the average allocations made by other people in this study for the current year.

69%
Stocks

69%
Stocks

23%
Bonds

8%
Cash

Your progress in savings towards retirement in 2048

Amount saved to date (Your actual present savings)

\$104,953

Fig. 2. Social comparison condition.

The *social comparison* condition (Figure 2) displayed the average yearly asset allocation percentages other participants in the study used for the current saving year. To convey this to users we stated: “The percentages below are the average allocations made by other people in this study for the current year.” The asset allocations shown to users varied since each subsequent participant would change the average asset allocations presented. We expected showing percentages in this light would serve to anchor participants’ asset allocations decisions, but would not influence participants as strongly as expert advice. To seed average asset allocations for the initial participants we used data from a prior study that captured asset allocation percentages, but in the prior study we did not reveal those percentages to participants.

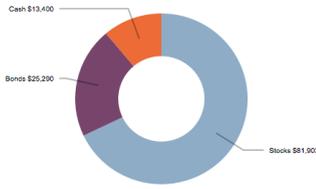
The *control condition* (Figure 3) presented a user interface similar to that of a typical online retirement savings firm (such as Fidelity or Vanguard) where asset class distributions accompany a historical investment performance chart. In addition to these charts, users can modify retirement saving allocations for the current year by altering the percent of stocks, bonds and cash.

We recorded gaps between users’ actual savings and their goal (\$1.5M), as well as the number of asset allocation changes during the simulation. We compared these data across the experimental conditions using ANOVA and a Bonferroni post-hoc test. Another measure, less susceptible to outliers, we used for comparing saving performance across conditions, was users’ likelihood of reaching a final saving amount within a 10% range of their goal. This comparison was made using a Pearson chi-square test.

Retirement portfolio simulator

Your current retirement portfolio

The pie chart below shows your portfolio allocations for your **entire retirement savings** since you began saving in 2014.



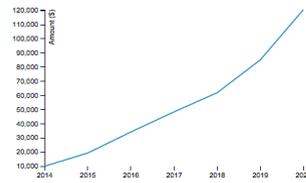
This year's retirement saving allocations

Use the fields below to adjust **this year's** savings allocation. Adjusting percentages changes your stock, bond and cash weights in your portfolio, affecting your risk and reward. Remember, you can try as many allocations as you wish before pressing Continue.

Percent stock <input type="text" value="80"/>	80 %
Percent bond <input type="text" value="20"/>	20 %
Percent cash <input type="text" value="0"/>	0 %
Yearly amount saved <input type="text" value="10000"/>	10000

This year: 2021; Retiring in 2048

The chart below shows the total value of your entire retirement portfolio over time since you started saving.



Your progress in savings towards retirement in 2048

Amount saved to date (Your actual present savings)

\$120,593

Fig. 3. Control condition

4 Results

The results of the ANOVA ($F_{2,310}=15.39$; $p<0.001$) and post-hoc test revealed that the gap between participants' goal and actual savings (see Table 1 and Figure 4) was smallest, on average, in the expert advice condition (\$74,792) and significantly smaller than in the social comparison condition (\$110,085). Both gaps were significantly smaller ($p<0.01$) than the gap in the control condition (\$154,806). In addition, the difference between the expert advice and the social comparison conditions was significant ($p<0.05$).

Users' likelihood of reaching a final saving amount within a 10% range of their goal (Pearson chi-square=34.23; $df=2$; $p<0.01$) also differed significantly between the experimental conditions: the likelihood of reaching this range among users in the expert advice condition (93.2%) was significantly higher ($p<0.01$) than the likelihood of social comparison users to reach the same range (77.1%). Furthermore, the likelihood of reaching the 10% range among social comparison was significantly higher ($p<0.01$) than that of users in the control condition (58.4%). Users also differed in their allocation change behavior: those in the expert advice and social comparison conditions made, on average, significantly more adjustments to their asset allocations than the control group (24.0, 20.7 and 16.2 respectively; $p<0.01$).

Table 1. Differences from the control group: *significant at $p < 0.01$

Condition	Mean gap from goal (\$)	Average number of asset allocation changes	Likelihood of ending up within 10% range of saving goal (%)
Expert advice	74,792* (SD=71,583)	23.96* (SD=9.02)	93.2*
Social comparison	110,085* (SD=109,579)	20.66* (SD=10.16)	77.1*
Control	154,806 (SD=121,695)	16.24 (SD=11.62)	58.4

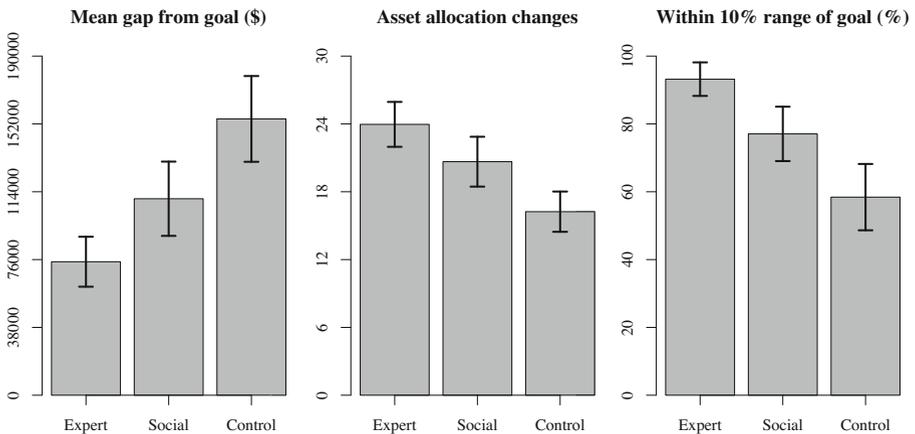


Fig. 4. Comparison between experimental conditions. Error bars represent a 95% confidence interval

5 Discussion and Conclusion

Small changes in interactive user interface design can lead to differences in how people approach saving and persuade them to mitigate risk. Participants in the study most closely reached their savings goal when using the expert advice interface condition, followed by the social comparison interface condition. The control condition, similar to current popular retirement saving interfaces, was least effective. In both the expert advice and social comparison conditions participants made more asset allocation changes than the control condition.

In the expert advice condition, we showed participants that research recommended specific asset allocation decisions to correctly balance their retirement portfolio. These recommendations used a commonly used target-fund asset allocation formula that financial

firms use. Consistent with prior research [2, 3, 13], this framing of information as expert advice (asset allocation advice provided by a formula [29, 30]), was likely to influence participants, and make them adjust their allocations more frequently than others. Participants focused on their retirement goal guided by an expert opinion rather than maximizing their return (a more risky strategy [6]).

The weaker performance of the social comparison condition relative to the expert advice condition may be explained by two factors: first, participants who see peer advice may perceive the advice as a suggestion that may be correct or incorrect, as opposed to validated advice, and only loosely follow other participants; and second, average asset allocations that affect the final retirement goal amount are generated by the participants themselves, and therefore perpetuate others' mistakes common to retirement investing, such as allocating too little towards stocks at the beginning of one's career and too much when approaching retirement. However, some participants are probably familiar with good practices to follow for retirement investment portfolio allocation. These informed participants may skew the overall averages towards the correct portfolio allocations. This is similar to how experts surfaced in Hill and Ready-Campbell's study in online investment forums [15]. The existence of these experts within the crowd would account for why the social comparison condition outperformed the control condition. The social comparison condition outperforming the control condition also shows that being able to see what peers are doing provides an advantage to acting alone without such information. This illustrates the power of the wisdom of the crowd [15] compared to acting alone.

As prior work shows [3, 13], showing expert advice and social comparison data to users can change and influence their behavior. Expert feedback provided at a decision point helps users make better decisions. People struggle to understand abstract concepts of risk and return [21], and advice provides savers a means to make better decisions about asset allocations. Social comparison data is a useful mechanism to help further influence decision-making and prevent people from deviating too far from a mean, which can be helpful with respect to staying on track for retirement saving. These techniques are especially useful in the context of personal finance and retirement saving where longitudinal studies of retirement saving by Thaler and Benartzi [4] have shown that it is difficult to motivate and persuade people to make sound financial decisions over time. The findings are also consistent with HCI research by Froehlich et al [27] and Bauer et al [31] which show that timely, relevant feedback is provided to users at a decision point to help them make better, more informed decisions.

In future work we would like to study how combining both expert advice and social comparison affects persuasion of a user interface including how individuals perceive the advice of a single expert versus multiple experts. We also envision allowing users to control the yearly saving amounts to study how saving is influenced by risk.

Our application of persuasive design to retirement saving has important design implications: government and private financial institutions who regulate and manage retirement saving can help the public by applying these concepts to interactive user interfaces design for retirement saving. In particular, displaying information with actionable and easily digestible expert advice, and social comparison data to motivate

people to stick to norms. In our study we found these two means to present data to have effects. Such an approach carries minimal cost to financial institutions, and can help non-expert investors make informed decisions. Savers benefit by being able to manage retirement portfolios independently at a lower cost than a target-date fund.

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