

Empowering Investors with Social Annotation When Saving for Retirement

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ABSTRACT

Financial prospectuses, which are available to consumers who buy financial products, are intended to help inform decision-making. While prospectuses provide a wealth of information, they are complex and difficult to understand for the vast majority of their intended readers. To help non-experts make informed decisions, we investigated how social annotations with comparative statements embedded into online prospectuses influence users' decisions and perceptions about decisions. We recruited 31 pre-study users to annotate 10 retirement saving plan prospectuses. We then embedded these annotations in prospectuses provided to another set of 228 users (147 novices and 81 experts) in a 35-period retirement saving simulation. Novices benefited from exposure to social annotations, and were more likely to meet their retirement saving goals than those not exposed to annotations. Exposure to social annotations brought novices' performance level to that of experts, but at the same time, led them to lower perceived understanding of the prospectus.

Author Keywords

Personal finance; social annotation; decision making; behavior change; retirement saving.

ACM Classification Keywords

H.5.2. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION

When financial products such as mutual funds, stocks and bonds are offered to the public—directly or through other products such as retirement saving plans—the issuer is required to provide an investor with a prospectus document. Policy changes in many countries are increasingly shifting retirement saving decisions to individuals [6], and prospectuses are intended to help investors make informed financial decisions [17]. In the United States prospectuses must be filed with the Securities and Exchange Commission

[46], and in the European Union prospectuses must be published when securities are offered to the public [12]. Financial prospectuses are common throughout the world [48, 49], and they are increasingly offered electronically [46] to individuals saving for retirement [6, 37].

While prospectuses summarize fund information and should be understandable by consumers, they are often complex and filled with financial and legal jargon that is incomprehensible to non-experts. As a result, prospectuses do a poor job of answering consumers' questions [27]. Studies on financial literacy suggest that most people have a poor understanding of personal finance [50], and research on consumer financial behavior [25] suggests that consumers can easily be confused by the complexity of prospectuses—particularly by how fees are embedded into funds [44]. Moreover, studies have found that the convoluted nature in which prospectuses are written can allow financial firms marketing financial products to hide unfavorable information [44]. Consumers' poor understanding of financial documents led some researchers to suggest that tools for improving consumer financial literacy are needed in order to prevent future economic crises [50]. To address several of these issues the U.S. Federal Reserve Board created a handbook [25] to advise how to write clear disclosure documents in plain English [34].

While government mandates have helped improve financial documents to a degree [34], such an approach may still not address specific needs of consumers [17]. Efforts concentrating on simplifying financial prospectuses to make them easier to digest, for example, have proven to be ineffective [3]. An alternative approach we pursue in this study involves the use of social content, and in particular, we explore how exposing consumers to online comments of other users on financial prospectuses can help inform consumers' decision-making. Such contextual comments, known as social annotations, can affect user comprehension and improve task performance [1, 7, 13]. Prior research found that adding social content may influence how users write comments about products [16] and how they read and act on such comments [52].

The social annotations in our study provide users with insight into content that would otherwise be difficult to understand and contextualize. We find that novice investors exposed to social annotations rate their understanding of the prospectus material lower compared to those without social annotations,

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yet their saving performance is better than those not exposed to annotations, suggesting social annotations increased objective knowledge but reduced subjective knowledge among novices [21]. In contrast, expert investors were not affected by social annotations.

While our study focuses on financial products, it is applicable to other areas where product comparisons are necessary and where information may be too complex for novice users to interpret. For example, a user might need to select amongst several healthcare plans and could be inundated with too much information about the plans. Social annotations could be collected from independent annotation writers, and the annotation writers could be instructed to focus on healthcare plan deductibles and to compare plans in relation to one another. Showing users collected social annotations with comparative statements may help those users select more appropriate plans for their needs. Similar techniques could be applied to e-commerce websites where product comparisons are necessary.

BACKGROUND AND RELATED WORK

Social content in online financial forums is shown to impact investor decisions [43]. Research has shown that the format of an information source, whether a blog or online newspaper, for example, can influence users' financial decision-making [14]. Other studies on trading activities within financial forums show that users viewing forum activities make fewer trading errors [47]. Pan et al. [45] found that social influence can play an important role in user decision-making in financial markets. Gunaratne and Nov [19] have studied the influential nature of social content and how design interventions affect retirement saving [20].

In other areas, social content is shown to be useful to users seeking information online. For example, users who make use of social content in online information seeking, applying knowledge from peers, are more effective than those who do not make use of social content [9]. Research by Stuart et al. [52] proposed ways to understand how social transparency—information about social identity, social interaction, activity and credibility—affects how users are influenced. Mendel and Toch [35] have studied how the source of social influence affects susceptibility to adopt certain privacy behaviors.

Gilbert and Karahalios [16] have found that social content such as product reviews are often based on prior reviews written by other users. They advise websites soliciting reviews not to ask only for the pros of a product as this may introduce bias into how a product is evaluated. Gilbert [15] has also found that good content is not always properly surfaced on websites with social content. Too few user generated comments can lead to erroneous information being prioritized [15] whereas too many comments may result in redundant information [16]. Munson and Resnick [39] have found that users differ in how they respond to comments they agree or disagree with and highlighting agreeable items can change user satisfaction. Burke and Kraut [5] have found that

the subject-matter of a group affects its comment style. How rude or polite a comment is can affect responses to it [5].

Social Annotation

Social annotations consist of the resource (i.e. the text in question), the users, and the metadata created by the users [1]. Catutto et al. [7] emphasize that the set of users generating the comments should have little or no central coordination. Social annotations added to complex documents or discussions of complex issues invoking multiple perspectives are shown to expose users to different points of view and increase readers' comprehension [28, 41, 57]. While social annotations are typically useful to users, if the annotations are not distinctive enough from the content they describe, users may ignore them [40]. Furthermore, Kulkarni and Chi [29] found that annotation writers who are able to contextualize their social annotations serve readers better [29]. Gao [13] has shown that social annotation helps users generate more focused, thoughtful discussion. In controlled experiments, Nelson et al. [41] have demonstrated that users exposed to social annotations are better able to learn and retain information than those without such annotations. However, with no centralized authority controlling how social annotations are generated, there is a possibility that annotations convey inaccurate information or perceptions [7]. Despite this, other studies have shown that users tend to generate content that has a high degree of accuracy when writers are encouraged to validate existing information [2]. Lampe and Resnick [31] have shown that having a number of people moderate comments can help isolate high and low quality comments more consistently.

Research on consent forms shows that social annotations are effective in helping improve comprehension of complex documents. Balestra et al. [1] experimented with adding social annotations to online informed consent forms and found that users had greater confidence in their decisions.

Social Content in Retirement Saving

Research in computer-supported cooperative work has studied social content and financial decision-making. In a study of older users saving for retirement, Zhao et al. [56] found that adding social content to a retirement user interface led to more risk-neutral investment decisions. Studies on the financial behavior of retirees revealed a multitude of social aspects that influence decisions when using information technology to manage finances [54].

Heyman and Artman [24] have illustrated the social nature of financial decision-making, showing that individuals are more comfortable making financial decisions collaboratively with financial advisors rather than solely relying on raw financial information. Kilic et al. [26] have found that collaborative financial tools can help users capture information they would otherwise not reveal to a financial advisor. Nguyen et al. [42] showed that giving users too much information about the decision-making process financial advisors follow can lead users into making worse decisions. Rather than being too comprehensive in providing

information to users Nguyen et al. [42] recommend being succinct when communicating information that may affect decision-making. Yu et al. [55] have examined social, learning and financial strategies to encourage better output quality from crowd-sourced contributors, finding a combination of strategies results in optimal quality.

Novice Comprehension

Novices' lack of experience can lead to poor decision-making and mistrust. Heyman [23] showed that novices tend to distrust online financial advisory systems. Furthermore, novices' low levels of financial literacy make it difficult for them to understand the information online financial systems provide, leaving them feeling unmotivated and pessimistic about the benefits of investing. Novices also may not necessarily benefit from simplifying information shown to them. Beshears et al. [3] have shown that simplifying or summarizing financial information does not necessarily lead to better decision-making. While novices may have difficulty making decisions, it is possible to inform their decision-making. For example, Wu et al. [53] showed that healthcare user interfaces highlighting critical information using dynamic aids helped novices meet or exceed the performance of experienced hospital residents.

Financial Advice and Fees

One of the most agreed-upon ways to effectively save for retirement is to avoid paying fees that eat up capital over time [11]. Therefore, directing consumers towards low fee funds can help them save effectively. Despite this, Mullainathan et al. [38] have shown that financial advisors typically direct consumers towards funds with high fees and overhead costs.

Lee et al. [33] have shown that financial companies present mandatory information accurately in disclosures, but the readability of such information tends to be poor [33]. While the U.S. Securities and Exchange Commission has published guidelines for financial information to be written in plain English, which improved the understanding of financial documents [34], more work is needed to improve consumer comprehension of financial information. A study of online retirement interfaces by Fisch and Wilkinson-Ryan [11] showed that providing detailed fund information did not lead to better decision-making. Instead, decision-making was better influenced by short, instructional comments. Users who were given instructions to pay attention to fund fees in a detailed document performed better in fund selection.

MOTIVATIONS AND RESEARCH QUESTIONS

Prior research shows that social annotations can be useful to users and system designers for several reasons: first, writers of social annotations are shown to provide focused and thoughtful discussion of the content in question [13]. Second, users are likely to better retain information presented to them when content is accompanied by social annotation [41]. Third, decentralized, crowdsourced social annotations make it easier for system designers to provide high quality comments as content to accompany the primary content being presented to users [7]. Financial prospectuses include

complex, jargon-heavy content. This complexity makes it especially hard for readers to focus on key points in a document. The sheer length and depth of content contained in a single financial prospectus make it tedious for one individual to annotate. Social annotation can potentially offer a way for comments to be generated relatively quickly, and for consumers to benefit in their understanding of complex financial information.

Further, social annotation can be an effective way to circumvent social norms of avoiding a discussion of one's personal finances, often leaving non-experts to make important decisions alone, in front of a computer screen.

The goal of our study was therefore to examine the effects of exposing investors to social annotations embedded in prospectuses of retirement-saving products they consider. Specifically, we focused on the following research questions:

Does exposure to social annotations on a financial prospectus help users reach their retirement saving goal, and does investing experience play a role in the effect of annotation on performance?

Does exposure to social annotations affect users' confidence in their investment choices, and does this effect vary with the users' investing experience?

Does exposure to social annotations play a role in users' perceived understanding of the prospectus, and does this effect vary with users' investing experience?

METHODOLOGY

To understand how social annotations can influence financial decision-making and direct users towards low fee funds with reasonable levels of risk and returns, we used a retirement saving simulator we developed for this study (see Figures 1 and 2). The simulator applied transactional workflows from Vanguard Group's retirement website. Vanguard holds the largest amount of U.S. retirement savings of any financial company [51]. Similar to Vanguard's website, and many other retirement saving platforms, our simulator provided the ability to choose from a selection of funds to make yearly saving choices, as well as the ability to rebalance a portfolio of existing investments.

In experimental conditions, users could access fund prospectus information by clicking on fund links in the retirement simulator's fund selection screens.

Setting

An individual saving for retirement has to make decisions about what types of funds to select. Over the course of an investor's saving career, these decisions have to be made several times. On commercial retirement saving platforms, fund prospectuses are available to help investors make a decision. The retirement simulator used for this study created an environment very similar to what consumers encounter on popular commercial platforms such as those provided by Vanguard and Fidelity.

Retirement saving requires understanding how different asset types can be used in a retirement portfolio over time. Stocks are the riskiest investment type, but have historically provided the greatest expected return. Bonds can be less risky, but have historically provided a lower expected return over long time periods. Cash provides minimal return, but has some risk due to inflation [8]. Therefore, for consumers to achieve their saving goal they need to understand the appropriate mix of asset types (and the risks they carry) at different points in their saving career. Individuals must make repeated choices about these allocations and have the ability to change the risk they take on over time by changing the funds they hold in their retirement portfolio. Retirement saving also requires making comparisons in the selection of funds. When selecting a fund, one must understand the attributes of that fund, including its historical performance, volatility and fees, which all influence its ultimate return. It can be difficult to understand the interplay of these attributes. We designed our study to compel participants to change fund allocations as time progressed, decreasing the allocation of stock in their portfolio over time to more conservative bond investments—similar to how one would realistically manage a retirement portfolio over time.

For the purpose of this study, our retirement saving simulator (Figures 1 and 2) displayed ten artificial funds based on funds that are commonly offered in the marketplace using fund attribute data from Charles Schwab, J.P. Morgan and Vanguard. We modeled our funds' historical performance, volatility and fees on fund information provided in real fund prospectuses. We provided four groups of funds: stock funds, bond funds, lifecycle funds and a cash fund. To make the market performance realistic, we used price data from the S&P 500 and Fidelity Investment Grade Bond Fund (FBNDX). Lifecycle fund price data used a mix of data from the S&P 500 and FBNDX, and dynamically changed allocation over time using a lifecycle fund allocation model formula [28]. Lifecycle funds contain more stocks when consumers are younger and often can afford to take risk, and more bonds as consumers get closer to retirement. Actual market data from 1980 represented the simulated year of 2015, 1981 represented 2016, and so on, ending with the simulated year 2050.

When users clicked on a fund link, they were shown a fund prospectus. Stock fund prospectuses in the retirement simulator were based on a prospectus document describing Vanguard Total Stock Market Index Fund Investor Shares. Bond fund prospectuses were based on a prospectus document for the Fidelity Investment Grade Bond Fund. Lifecycle prospectuses were based on Fidelity Freedom Fund prospectuses. Our artificial fund prospectus documents did not change language from the original prospectuses, but their names were modified to be more generic. For example, Fidelity Investment Grade Bond Fund became Financial Investment Grade Bond Fund.

We left the design and formatting of the prospectus documents largely untouched. Though we did not modify language in the prospectus, we did modify numerical information and charts pertaining to risk, rates of return and historical performance. These data came from the retirement simulator's database that stored performance information of the artificial funds that mimicked real-world fund attributes and performance. We customized each fund prospectus to show different fund information for each respective fund. Data tables, charts and informational text were updated to be applicable to the fund being viewed by the user.

Retirement portfolio simulator

Current year: 2024. Retiring in 2050. Current amount saved: **\$145,859.28**.

Allocate savings for this year

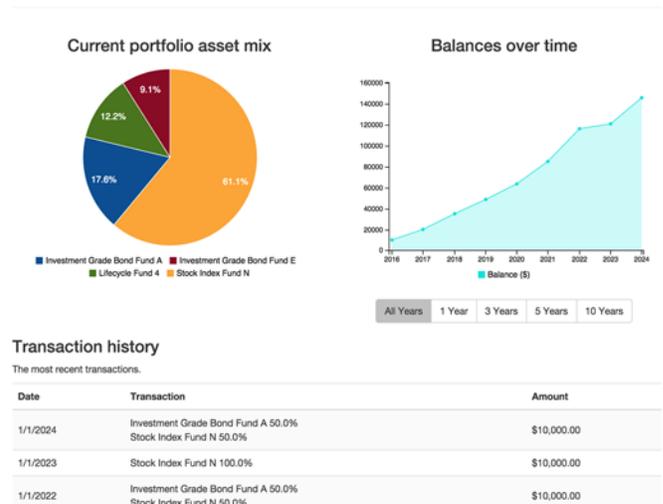


Figure 1. The retirement simulator home screen consists of a dashboard showing previous investment transactions and current funds within an investment portfolio.

Experimental Procedure

Prior to beginning the study, we provided all participants information on retirement investing and described the difference between stock, bond, lifecycle and cash funds and their respective risk and return rates. The background information page provided an interactive calculator to help participants understand compounding interest and risk over time. Additionally, we asked participants about their level of investing experience ranging from novice to expert (novice, intermediate, expert or none), and whether they had a retirement savings plan.

We asked users to accumulate \$1.5M over the course of 35 years (2015–2050). Each year participants invested \$10,000, which could be allocated across ten possible funds (or less, based on the user's choice). Stock, bond and lifecycle fund categories each had three individual funds to choose from, with different fees, volatility and rating attributes for a total of nine stock, bond and lifecycle funds. The three funds of differing quality in stock, bond and lifecycle categories consisted of: one fund which clearly had the best attributes of its category—i.e. low fees, high rates of return and low volatility; a second fund with the worst attributes of its

category—high fees, low rates of return and high volatility; and a third fund with attributes between the best and worst funds in its category. Fees, volatility and growth rates differed from fund to fund within each category. We also provided a cash-equivalent money market mutual fund that had no fees, zero volatility and no historical performance.

The retirement simulator consisted of a home screen displaying the current amount of money saved to date, a chart showing the amount of money saved over time, a list of previous transactions and a pie chart with the current fund composition of the participant’s portfolio (Figure 1). From the home screen, users could set this year’s savings mix or optionally rebalance their entire savings. Each of the selection screens consisted of lists of funds from which the participant could set asset allocations. The retirement simulator allowed participants to set asset allocations for either the \$10,000 saved for the year or to rebalance the entire portfolio of all years of saving (see Figure 2).

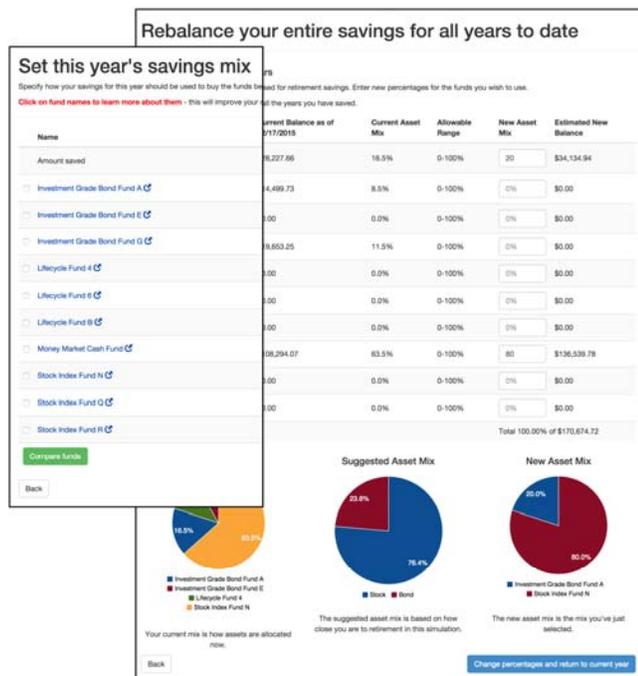


Figure 2. The simulator provided users ten funds with links to view respective fund prospectus documents. Participants set saving allocations each year and could also reallocate their entire portfolio.

On fund selection screens, we showed participants funds of the same category grouped together. However, within a category, funds appeared in arbitrary orders and had names that did not make it possible for participants to discern differences simply by reading the fund’s name. For example, we used the following names for lifecycle funds: *Lifecycle Fund 4*, *Lifecycle Fund 6* and *Lifecycle Fund B*. Once users clicked “submit” on their chosen asset allocation, they moved to the next simulation year. Users were then presented with market behavior of the previous year as well as their portfolio’s performance (Figure 2).

Pre-Study: Collecting Social Annotations

To generate annotations for our fund prospectuses, we conducted a separate pre-study. We recruited 31 participants via Amazon Mechanical Turk and limited participation to U.S. users with a record of at least 100 tasks at an approval rate above 99%. Users were shown the list of 10 funds (Figure 3a), and were randomly assigned to one fund. They could view a fund prospectus with attributes. We sought to elicit relatively focused annotations that would enable other users to navigate complex information and select appropriate products. We therefore asked annotation writers to: (1) make note of the best funds and where possible highlight numeric data; (2) emphasize specific fund attributes such as fees and rates of return; (3) make sure to use comparative terms such as “best” and “worst” to discuss funds; and (4) we allowed annotation writers to see a previous annotation to get a sense of what information may be important. Users could see the last annotation in each section from the previous pre-study user (Figure 3b). Gilbert and Karahalios [16] have shown that users may reference previous comments, leading to some content redundancy. In our study, some redundancy, reiteration and clarification of points was acceptable.

From this procedure we obtained three to five comments for each section in a prospectus document, for a total of 215 unique comments for all prospectus documents, ranging between 21 and 29 annotations per prospectus. Pre-study users spent an average of 30.1 minutes reading and commenting on the prospectuses and were paid \$11.00. The mean level of pre-study participants’ investment experience was 2.4 on a scale of 1 (novice) and 4 (expert). The pre-study user population was different from the population of the main simulation study. The pre-study writers of social annotations were not part of the following retirement simulation experiment.

Prospectus Documents

First, click on the **blue links** below to view fund prospectus documents. Please read over each prospectus document blue link. When you have finished reading a document, press the back button at the top of the prospectus document links as many times as you wish.

Once you have finished reading all of the blue link prospectus documents, click on the **red link** prospectus document.

On the red link prospectus document please leave comments about how the red link prospectus document compares to other documents. You should comment on things such as fees, rates of return and risk, noting how the red link fund compares to other funds. A useful comment to other users would be something such as “This is a great fund with low fees of 0.2% and a high rate of return of 7%” or “This is a bad fund, worse than any of the others. Stay away! almost 2%.”

Be sure to write in your comments if the red link fund is better, same or worse than other blue link funds!

When you are finished, scroll to the bottom of the red link prospectus document and click submit.

Fund Name

[Stock Index Fund N](#)

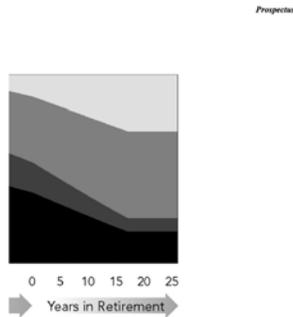
[Stock Index Fund Q](#)

[Stock Index Fund R](#)

[Investment Grade Bond Fund A](#)

Figure 3a. Pre-study users could view any of the 10 fund prospectus documents, but were asked to write comments for only one fund highlighted in red in the list.

overall investment objective. International equity funds (developed and lying Financial funds). A "neutral" asset allocation strategy shown in the domestic equity funds, 7% in international equity (approximately 10 to 19 years after the year 2050).



2. Investment Strategies and Risks
Sections: Please add a comment or comments to help other readers of this section know what information is important. Give specific examples of what readers should pay attention to in the section – in this particular fund – such as percentages, numbers or any other information.

For example, a previous participant left the following comment about this section:

Pay attention to the types of funds that will make you the most money in the time that you have allotted. Although some are higher, make sure you check the volatility of that fund also.

Figure 3b. Pre-study users commented on a fund by entering information into an input field and could comment anywhere in the document.

Saving Simulation, Participants and Reward Mechanism

For the main study, we recruited participants via Amazon Mechanical Turk and limited participation to U.S. users with a record of at least 100 tasks at an approval rate above 99%. To motivate participants to achieve a retirement saving goal rather than maximize returns or evade risks—which is a common mistake retirement investors make [36]—we rewarded goal-driven moderate risk. Consequently, participants’ compensation was \$2.00 base pay and a maximum bonus of \$4.00 if they met the \$1.5M retirement goal. This compensation represented an hourly rate of \$7.40 (based an average bonus of \$1.24 or a total payout of \$3.24, and an average of 26 minutes to complete the task). Deviation from the goal either positively or negatively led to a proportionally lower bonus. This 3/1 full pay/base compensation ratio represents substantial incentive to achieve the savings goal. Such goal-driven payment is an effective mechanism to align Mechanical Turk participants’ desire to maximize payment with a study’s goal to incentivize optimal participant performance. We believe this technique can be applied in other Mechanical Turk studies where it is beneficial to incentivize making optimal decisions, while catering to real-world desires to maximize payment—aligning a study’s simulated goal with the participant’s real world goal. Mechanisms in social computing systems to pay users in such a way that align study goals with the user’s real world goal of maximizing Mechanical Turk earnings should be considered (e.g. payment based on the number or quality of social annotations, or payment based on another goal supported by the social computing system). It should be noted that using Mechanical Turk has limitations. Participants were likely more computer literate, more technically adept than the broader population, and our only direct knowledge of what participants read came from written post-study feedback.

Experimental Conditions

Participants were allocated randomly to one of the following conditions:

Social Annotation Condition

The social annotation condition (Figures 4a and 4b) displayed up to five user generated comments on the margins of the prospectus document. We placed comments on the left and right margins of the page to maximize the number of comments visible to the user without having to scroll. The content of sticky notes came from the 31 pre-study users not part of the retirement simulation who annotated the 10 prospectus documents. We collected comments randomly from pre-study comment writers and then displayed comments in the same order to study users. We expected users to start reading the top-left comments and end with the bottom-right [18] of the screen viewport as they scrolled down the page.

Performance

The following information is intended to help you understand the risks of invest. The information illustrates the changes in the performance of the fund's shares f year and compares the performance of the fund's shares to the performance of a market index and a hypothetical composite of market indexes over various perio indexes have characteristics relevant to the fund's investment strategies. Index d appear in the Additional Index Information section of the prospectus. Past perfor an indication of future performance.

Visit www.401k.com and log in for updated return information.

Year-by-Year Returns

Calendar Years	2006	2007	2008	2009	2010	2011	2012	2013	20
	4.90%	9.18%	-4.64%	-37.69%	33.85%	16.26%	5.37%	9.47%	8.8



The performance section gives an indication of the return a fund has given over time. The past performance is not an indicator of future success, but it can be helpful information if used correctly. The Lifecycle Fund 6's conservative approach has led to returns that are in the mid-range between the stock index funds on the high end and the investment grade bond funds on the low end.

Compared to other funds, it is better than some and worse than others. Its performance is average, but it is still better than many funds as its lowest return is -23.74% compared to some of the others which are -26.89% and -33.35%. So it is safe to invest in this fund.

There is an element of risk in any investment however this

Figure 4a. The social annotations appeared as yellow sticky notes in the margins of the fund prospectus.

The fees for this fund are reasonable, but not the lowest of any investment grade bond fund. Over 10 years, having invested \$10,000, you will end up paying close to \$1,000 in total expenses and fees. Compared to Investment Grade Bond Fund G, the fees are about 4 times as high. Compared to Investment Grade Bond Fund E, however, the fees are less than half. This bond fund falls squarely in the middle.

While this fund has no shareholder fees, the annual operating expenses amount to 0.78% of the value of your investment.

The total annual fees tells an investor how much it will cost them to be a part of this fund. The higher the fees and expenses, the more the investor will have to pay. The Lifecycle Fund 6's fees (1.87%) are on the high end of the available funds.

The expenses are higher for this fund compared to the other ones. If you look at 'other expenses', you'll find that it's comparatively higher. Other funds have as low as .05%. The total annual expenses are much higher than the other funds. They can go as low as .18%. If you look at how much you'll be paying in total expenses if you sell all of your shares, it is much higher than the other funds. So avoiding this fund is better when it comes to fees.

Figure 4b. Examples of social annotations in the fees section of a prospectus document for a medium-fee fund (left) and a high-fee fund (right).

Prior work [15, 16] has shown that having too few comments may emphasize erroneous information whereas too many comments may lead to redundant information. We purposely did not curate comments, allowing for some inaccurate information, to reflect what a real-world, unmanaged system would provide to users. In the spirit of adhering to definitions of social annotation whereby no centralized authority has control [7], the comments were displayed in the order they were collected and not manipulated in any way.

While one comment we collected contained incorrect information (e.g. a comment writer incorrectly interpreted fund fees or performance data), for the most part the comments accurately described fund characteristics and their implications. For example, the three stock index funds had fees of 0.18%, 0.78% and 1.87%. *Stock Index Fund R* in the simulation had highest fees of 1.87%, and several users noted this in their comments. Consistent with the majority of users' comments about *Stock Index Fund R* fees, one user said "I feel that is a little high for the fees." However, one user misunderstood high fee information and incorrectly said, "The fees here are very similar to the other two stocks..." The social annotation comments were illustrated as yellow sticky notes in the retirement simulation. All users participating in our retirement simulation saw comments in the same order.

Control Condition (Without Social Annotations)

The control condition (Figure 5), allowed users to view prospectus documents, but without the social annotations. This condition is akin to the experience of viewing a prospectus document on a conventional commercial financial website. Aside from the lack of social annotations, this condition was identical to the annotation condition.

Performance

The following information is intended to help you understand the risks of investing in the fund. The information the fund's shares from year to year and compares the performance of the fund's shares to the performance of a set over various periods of time. The indexes have characteristics relevant to the fund's investment strategies. Index Information section of the prospectus. Past performance (before and after taxes) is not an indication of future performance.

Visit www.financial.com for updated return information.

Year-by-Year Returns

Calendar Years	2006	2007	2008	2009	2010	2011	2012
	1.62%	4.44%	3.31%	-8.83%	18.56%	7.09%	8.93%



Figure 5. Users in the control condition viewed fund prospectus documents without any social annotations.

To examine differences in investors' confidence and perceived understanding, we administered a questionnaire following the retirement simulation, and asked users if they thought they made informed decisions ("I made informed decisions when selecting funds for my retirement portfolio."), if they thought they made the right decisions ("I made the right decision for me."), and if they understood the material presented to them ("I understood the material

presented and have no additional questions"). Focusing on the social annotation comments in isolation from the financial prospectus, we asked users if they read the comments, if they were influenced by them, if the comments helped their decisions, and if comments helped them understand the financial prospectus. Users provided answers on a scale of 1 (strongly disagree) to 5 (strongly agree.)

Comparisons and Measurement

In line with the recommendation to focus on saving toward a pre-defined goal [21] and our reward mechanism, we recorded gaps between users' actual savings and their goal (\$1.5M), and the proportion of savings users had in low-fee funds. We compared users' likelihood of reaching a final saving amount within a 10% range of their goal, and the mean percent of savings invested in low-fee funds. These comparisons were made using a Pearson chi-square test. In addition, we compared the gaps between users' final saving amount and their goals using ANOVA and post-hoc Bonferroni correction.

RESULTS

228 users participated in the retirement simulation. Their average age was 35.2, and 41.2% were female. Because only three participants self-identified as experts, we defined as experts as those participants who rated themselves as intermediate or experts, and as novices those who self-identified as novice or having no investment experience. Overall, users were distributed in the following way: 73 (32.0%) novices who were exposed to social annotations, 74 (32.5%) novices who were not exposed to social annotations, 36 (15.8%) experts who were exposed to social annotations, and 45 (19.7%) who were not.

To understand if the ordering of funds affected selection, we examined which funds a user selected and a fund's rank in the list. Given a ranking of the first fund in the list as 1 and the last fund as 10, the rank order of a preferred fund had a mean of 6.9, median 8.0, and a standard deviation of 3.1. This reflects that users selected funds closer to the bottom of the list rather than the top.

Novice Investors

The mean gap between novices' savings and their goal in the social annotation condition was \$151,949, significantly lower than a mean gap of \$191,266 ($p=0.043$) for novices in the control condition (Table 1). The likelihood of novices in the social annotation condition to reach within 10% of their goal was 0.55, significantly higher than 0.36 for novices in the control condition ($p=0.026$). We also compared users' proportion of savings invested in low-fee funds. Novices in the social annotation condition had 41.8% of their portfolio allocated towards low-fee funds, a significantly higher proportion ($p<0.01$) than the 30.7% allocated by novices in the control condition.

Expert Investors

Experts in the social annotation condition had a mean gap from goal of \$143,089 (Table 2) compared to experts in the control condition with \$133,901. The difference was not

significant. The likelihood of experts in the social annotation condition to reach within 10% of their saving goal was 0.67 compared to 0.53 for experts in the control condition. This difference also was not significant. Lastly, experts in the social annotation condition and control condition had 35.2% and 45.9% of their portfolio allocated toward low-fee funds, respectively. This difference too was not significant.

Condition	Mean goal gap (\$) / Likelihood of reaching within 10% of goal	Mean % in low-fee funds
Annotation (Novice)	151,949* / 0.55*	41.8%**
Control: No Annotation (Novice)	191,266 / 0.36	30.7%

Table 1. Performance of novices across conditions. Difference from control (novice) group: **significant at $p<0.01$; *significant at $p<0.05$.

Condition	Mean goal gap (\$) / Likelihood of reaching within 10% of goal	Mean % in low-fee funds
Annotation (Expert)	143,089 / 0.67	35.2%
Control without Annotation (Expert)	133,901 / 0.53	45.9%

Table 2. Performance of experts across conditions. No significant difference between groups.

Comparing Novice to Expert Performance

Novices and experts in the social annotation condition performed similarly (Figure 6, Table 3). There were no significant differences in mean gap from goal, likelihood of reaching within 10% of the goal and the mean percent in low-fee funds. There were, however, significant differences between novices and experts in the control condition across all measures: mean gap from goal (\$191,266 vs. \$133,901, $p<0.01$), likelihood of reaching goal (0.36 vs. 0.53, $p<0.01$), and mean in low-fee funds (30.7% vs. 45.9%, $p<0.01$).

Condition	Mean goal gap (\$) / Likelihood of reaching within 10% of goal	Mean % in low-fee funds
Annotation (Novice)	151,949 / 0.55	41.8%
Annotation (Expert)	143,089 / 0.67	35.2%
Control: No Annotation (Novice)	191,266*** / 0.36***	30.7%***
Control: No Annotation (Expert)	133,901 / 0.53	45.9%

Table 3. Performance of all users across conditions. Difference from annotation (novice) group **significant at $p<0.01$; *significant at $p<0.05$. Difference from control: no annotation (expert) group: **significant at $p<0.01$.

A logistic regression with likelihood of reaching within 10% of the goal as the dependent variable, controlling for demographics and taking into account experience and time

spent shows that the interactions between experience and time spent and the interaction between experience and intervention are significant (see Table 4).

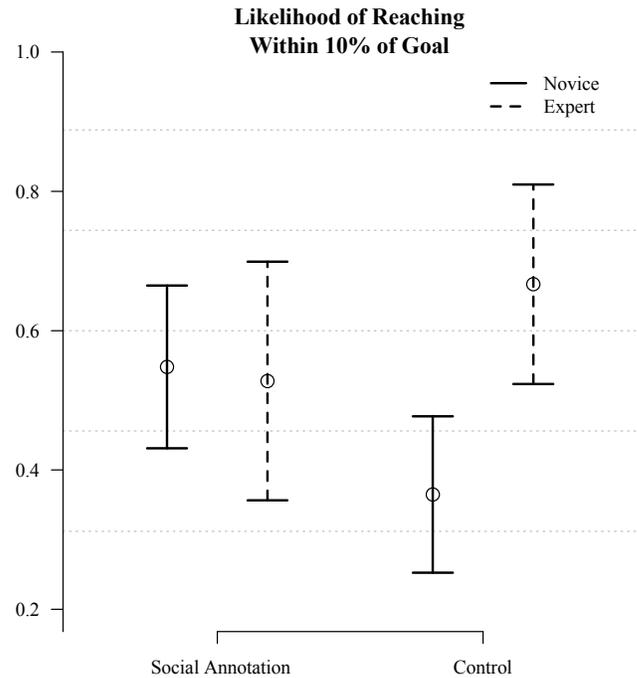


Figure 6. Novices exposed to social annotations performed similarly to experts. Novices in the control condition (not exposed to social annotations) performed worse than experts. Error bars represent 95% confidence intervals.

	B	SE	Wald	p
Age	.008	.014	.346	.557
Gender	.203	.288	.495	.482
Novice	3.067	.966	10.069	.002
Annotation present	.751	.338	4.948	.026
Time spent	.020	.016	1.554	.212
Novice*time spent	-.067	.032	4.210	.040
Novice*annotation present	-1.465	.584	6.294	.012
Constant	-1.515	.676	5.016	.025

Table 4. Regression results. DV= likelihood of reaching within 10% of the goal.

Number of Annotations and Asset Allocation

The number of social annotations shown on prospectuses and the average percent allocated towards its corresponding fund (i.e. how popular the fund was): BFA (Bond Fund A) was 27 annotations and 10.7% allocation; BFE, 29 annotations and 7.6% allocation; BFG, 21 annotations and 10.4% allocation; LC4 (Lifecycle Fund 4), 24 annotations and 6.6% allocation; LC6, 21 annotations and 6.1% allocation; LCB, 21 annotations and 3.7% allocation; SFN (Stock Fund N), 24 annotations and 17.3% allocation; SFQ, 24 annotations and 21.5% allocation; SFR 24 comments and 13.0% allocation.

There was a 0.16 Pearson correlation between the number of annotations on a prospectus and the percentage users allocated to a fund, but this was not significant. The most popular fund selected was Stock Fund Q (SFQ), which had the lowest fees (0.18%) of the stock funds.

Erroneous Annotation Influence

The first social annotation, displayed prominently at the top of the page, on *Stock Index Fund R's* (SFR) prospectus document contained erroneous information about fees. The erroneous annotation stated, "The fees here are very similar to the other two stocks. Right here you cannot say if any of the funds are better or worse than the other funds. This is an example of average fees." Contrary to the user's remark, the fees for SFR were much higher than the other comparable stock funds. SFR was one of the worst funds due to its high fees. The remaining 23 annotations about SFR on its prospectus document reflected accurate information.

Condition	Mean goal gap (\$) / Likelihood of reaching within 10% of goal	Mean % in low-fee funds
Selected worst fund with annotation error	165,029 / 0.46	35.8%*
Selected worst fund no annotation	192,652 / 0.40	30.0%

Table 5. Performance of users who selected the worst stock fund. Difference from selected worst fund no annotation group: *significant at $p < 0.05$.

Condition	Mean goal gap (\$) / Likelihood of reaching within 10% of goal	Mean % in low-fee funds
Avoided worst fund with annotation error	97,939 / 0.89	56.1%
Avoided worst fund no annotation	84,339 / 0.84	70.8%

Table 6. Performance of users who avoided the worst stock fund. No significant difference between groups.

To understand how an erroneous annotation affected user performance and fund selection, we examined if a user selected SFR and if the user was exposed to annotations. Users who selected SFR, which had a prospectus with an erroneous annotation as well as accurate annotations (Table 5) were significantly more likely to select low-fee funds compared to users who selected SFR without annotations (35.8% and 30.0%, respectively, $p = 0.042$). The higher mean percent in low-fee funds in the annotation condition indicated users did not act on the erroneous information when it was exposed to them. Users who avoided SFR (Table 6) did not have any significant difference in performance or fund selection when comparing those who were exposed to the erroneous annotation as well as accurate annotations to those who saw no annotations. Novice users who selected SFR and were exposed to the annotations allocated significantly more (21.5%, $p < 0.01$) of their portfolio to low-

fee funds compared to those who saw no annotations (allocating 14.7%). There were no significant differences amongst experts.

User Confidence and Perceived Understanding

We compared how novices and experts rated their confidence and perceived understanding of the prospectus material in both conditions (Table 7). In the social annotation condition, there was a significant difference in how novices and experts rated all the material, with experts giving higher scores (3.68 versus 4.44, $p < 0.01$). In the control condition without annotations, there was a significant difference in novice and expert ratings that their decision was informed (3.64 versus 4.04, $p < 0.01$) and in rating that they understood all the material (3.99 versus 4.40, $p < 0.01$). However, unlike in the no annotation control condition, novices exposed to social annotations had confidence ratings similar to experts when asked if they made an informed decision (3.78 versus 4.00, no significant difference). With regard to understanding of all the material, there was a weakly significant difference ($p = 0.066$) between the novices in the social annotation condition (3.68) and the novices in the no annotation control condition (3.99), with novices in the social annotation providing lower ratings.

Overall, novices had lower average levels of confidence (mean 3.82) than experts (mean 4.17, $p < 0.001$). This was true in both the social annotation condition (mean 3.80 vs. 4.16, $p < 0.01$) and the no annotation control condition (mean 3.79 vs. 4.15, $p < 0.01$). There were no significant differences in how novices and experts rated questions related to whether or not they read and were influenced by comments displayed in the social annotation condition.

Question	Annotation		No Annotation	
	Novice	Expert	Novice	Expert
Decision was informed	3.78	4.00	3.64	4.04**
Made right decision	3.89	4.03	3.86	4.07
Understood all the material	3.68	4.44**	3.99†	4.40**
Read comments	3.48	3.22	-	-
Influenced by comments	3.41	3.17	-	-
Comments help decision	3.42	3.14	-	-
Comments help understanding	3.45	3.36	-	-

Table 7. Responses to questions about confidence and understanding. Difference from novice group: ** significant at $p < 0.01$. Difference from the annotation condition (novices) group: † $p = 0.066$.

User Feedback About Social Annotations

After users rated their confidence and perceived understanding, we asked them to enter free-form text about

the study. Several users who had access to social annotations made remarks indicating they read, understood or applied suggestions from the social annotations when making decisions, particularly with respect to selecting low-fee funds. P1 had clear motivations to pick low-fee funds when shown comments, saying “I really went with fees.” P2 didn’t mention a specific fund attribute the social annotations helped surface, but said, “I did like viewing the other users’ comments. However, it was too much information for me to read all at once.” P3 said, “I chose the funds with the lowest expenses, per conventional wisdom.” P4 also used a strategy of selecting low-fee funds saying, “All I know is to go with an index to match the market and get the lowest fees possible. Stuff like Vanguard offers. I really only looked at the fees when I was investing. Once I got close to the goal, I dumped it all in money market and edged closer to the goal. That was fun!” Not all users benefited from the social annotations. P5, a more advanced user, said, “I mainly used my own experiences when deciding instead [of] relying on the comments since the few times I relied on the comments and recommendations, my funds dropped considerably.”

Users who could not view social annotations expressed confusion about how to interpret the prospectus documents. P6 said, “It’s very complicated and I don’t understand any of the information. I just tried different things and saw how it turned out,” and P7 said, “[The] prospectus was too long and confusing to pay much attention to.” P8 and P9 expressed frustration in a lack of domain knowledge, saying, “Without a degree in finance or background in banking/investing it is confusing for the average person,” and “I don’t know whether my choices that I made are correct.” Other users either chose the wrong investment strategy or simply guessed. For example, P10 invested blindly, saying, “As the years progressed the information never updated so I just felt like I was guessing blind.”

DISCUSSION

Social annotations can help users by providing them information that contextually summarizes, interprets and reflects on text or other information [1, 7]. Such socially generated content can be useful in influencing decision-making and helping users interpret information [9, 41]. However, it is important that annotations displayed to users are as accurate as possible, as there is a possibility that erroneous annotations can affect decision-making [16]. In this study, one indication that users are taking into account social annotations and applying it in decision-making is the extent to which users allocate their portfolios to low-fee funds. Many of the social annotations shown to users emphasized the differences in fees amongst funds, highlighting the lowest and highest cost funds. We find a significant difference in the percentage of low-fee funds in a user portfolio when comparing the social annotation condition to the no annotation condition.

Discussing personal finance can be hampered by social norms of avoiding topics about financial issues [30]. As a

result, for many people financial decision-making tends to be a solitary activity done in front of a computer screen. Another factor complicating discussion about personal finance is that financial advisors may provide biased information that works against consumers’ interests [38]. As prior work has shown, complexity of financial information can further exacerbate a novice’s reservations, mistrust and pessimism about financial decisions [23]. Similar to how social media has helped facilitate discussion of issues difficult to talk about in other settings [4], social annotations can change the dynamics around discussing financial issues.

Findings from our study demonstrate that social annotations can help harness some of the wisdom of the crowd while keeping the decision-making powers with the individual user. When it comes to financial documents, the usefulness of social annotation appears to differ based on experience level. Novices benefited measurably when social annotations accompanied prospectus documents. Novices in the social annotation condition selected more low-fee funds than those exposed to no annotations, and had a significantly lower mean gap from the savings goal than novices in the control condition. Similarly, novices in the social annotation condition had a significantly higher likelihood of reaching within 10% of the retirement goal.

Social annotations appear to guide novices toward better saving practices and selection of funds in ways that a prospectus document alone cannot. This can be explained by a number of factors: First, studies examining the language used in financial literature show that most consumers find financial jargon challenging to understand and are prone to misinterpreting financial language [34, 44, 50]. The social annotations collected for this study came from a broad range of users, and much of the language used in the comments tended to be written in plain English as opposed to financial jargon. The more approachable, concise writing style of the social annotations compared to the prospectus writing style likely helped improve novice user comprehension and thus their performance. This is consistent with research showing that consumers benefit from plain language in financial documents [25, 27]. A second factor may be the comparative nature of the comments presented to users. The comments collected for the study tended to contrast fund attributes. For example, comments on fees would explain that a low-fee fund had fees lower than other similar funds in its class. Comments on risk and return used similar comparisons. Such comparisons likely made it more obvious to novices which funds to choose and avoid. Finally, social annotations helped point out important pieces of information in the financial prospectus users may otherwise have ignored.

In contrast to novices, experts appear not to be influenced by social annotations and sometimes choose to disregard the annotations. It may be that such experts are already familiar with financial terminology used in prospectuses. For these users, social annotations may not have enough depth or value to warrant their attention. Alternatively, experts may simply

be more inclined to be more autonomous in decision-making given their higher levels of confidence and therefore disregard the social annotations.

Though social annotations have utility for user decision-making, prior research has found that erroneous or misleading comments can also influence users [16, 39]. While social annotations containing errors may potentially misguide users or hinder decision-making, we did not find strong evidence of that in our study, perhaps due to the small amount of erroneous annotations. Only one annotation out of 24 in the SFR prospectus document contained a misleading remark. It is possible that if there were more misleading, erroneous annotations, user performance could be adversely affected.

We guided pre-study participants who authored the social annotations towards producing certain types of annotations with comparative language. However, it is possible the comparative annotations shown to users would appear organically if we did not explicitly ask pre-study users to compare funds to one another. Research by Lee et al. [32] applying behavioral economic theory in asymmetric choice strategy to HCI applications suggests that users naturally make comparisons when given several choices where one choice is clearly superior.

While novices in the social annotation condition were closer to retirement goals and selected more low-cost funds than those not exposed to annotation, social annotations do not appear to affect user confidence and perceived understanding (see Figure 6). Novices did not think they made more informed or correct decisions, nor did they feel they understood material better. In fact, novices in the social annotation condition rated their understanding (3.68) lower than those not exposed to social annotations (3.99), though this was weakly significant ($p=0.066$). This finding suggests that with social annotations novices may become more aware of their lack of understanding of financial concepts.

Social annotations appear to close the gap between novice and expert perceptions of feeling informed. There was a significant difference in experts' rating of feeling informed compared to novices when not exposed to social annotation (i.e. experts felt more informed than novices), but no such difference was observed for the social annotation condition.

Written free-form feedback from users following the retirement simulation shows that users with access to social annotations made use of the comments they read and indicated they selected more low-fee funds. The less advanced users benefited more from the social annotations than the more advanced users. Users without access to social annotations exhibited more confusion about the prospectus documents, often expressing apprehension and ambivalence about what specifically in the documents to focus on when making decisions. More importantly, users with access to social annotations focused on the most relevant factors (e.g. fees), whereas users without social annotations did not.

Feedback from users indicates that those without social annotations were overwhelmed with the extensive information shown in the prospectus documents and sometimes used the wrong criteria or no criteria to make decisions compared to users who had access to social annotations, who would consistently focus on fees. Such qualitative data from the free-form written feedback from users is consistent with the quantitative performance data with respect to users selecting more low-fee funds in the social annotation condition.

Reading social annotations to compare prospectuses when saving for retirement is different from reading social annotations in other contexts. Users reading annotations need to have access to objective information written in an analytical style to make decisions optimally. In such a context, personal unsubstantiated opinions are less relevant, and in fact, as our qualitative data indicate, users may dismiss comments that do not reflect adequate understanding of a complex document. We also find that many users are apt to take social annotations at face value and act on instructions shown in comments rather than consider the comments as opinions or suggestions.

Design Implications

Our findings have a number of design implications: First, adding social annotations to complex financial documents can benefit users, particularly those with little to no financial expertise. Therefore, it is important to distinguish between novice and more experienced consumers. Future work could explore formalizing ways of distinguishing between the novices and experts, for example, through a more comprehensive pre-study questionnaire covering retirement saving knowledge and understanding of financial information. Additionally, we believe a more comprehensive qualitative follow-up study that delves into what specifically users read and ignore (e.g. using a semi-structured interview to understand how users are influenced by comments and what users read) could help us understand what novices and experts, respectively, find beneficial.

Specifically targeting novices and presenting them with social annotations can bring their performance up to expert levels. Findings from our study indicate that social annotations influence decision-making positively for novices. Simply asking for a user's level of experience is sufficient indication to determine whether or not he or she will benefit from the presence of social annotations.

Second, it is important to have mechanisms in place to ensure the accuracy and integrity of annotations. Having a few inaccurate or erroneous annotations may not harm users, but prior research [15, 16] suggests there is likely a threshold where such annotations may begin to affect users negatively. For this reason, since it takes time for readers to identify good comments, it is important to provide the ability for inaccurate annotations to be flagged or removed either by the readers or by the moderators of the system [31].

Third, displaying user-generated comments in context, especially in financial documents where jargon is used extensively, can potentially improve comprehension. Because social annotations are displayed near the resource in question (e.g. a specific fund), they are easier for users to contextualize. Social annotation can be more effective than other venues of social content such as forums and discussion groups, which are not shown in the context of a specific resource in question. For that reason, when collecting social annotations, it is important to inform comment writers of the context in which their comments will be used.

Finally, it can be useful to have social annotations focus on a few key attributes to help readers focus on these attributes. In the case of our study, we found social annotations to be helpful in highlighting fees, motivating users in selecting low-fee funds. Selecting such funds is particularly important in retirement saving.

With respect to the differences in impact across conditions, consider novices' performance of having a gap of \$151,949 (0.55 likelihood of reaching the goal) in the social annotation condition, compared to a \$191,266 gap (0.36) in the control condition. When trying to reach a \$1.5 million goal, this amounts to a rate of return of 6.45% vs. 6.59%, meaning the annotation condition provided an additional 0.14% rate of return. Missing out on a 0.14% rate of return, which in the terms of this study would amount to losing nearly \$40,000, could have noticeable lifestyle impact after retirement.

Participants in our study, however, were not incentivized to maximize rates of return and instead were trying to accumulate a total as close to \$1.5 million as possible. Social annotations had a substantively large effect on the likelihood novices accumulated in total within 10% of the target amount, increasing this likelihood by 19 percentage points. Additionally, social annotation had a substantively large effect on novices' portfolio allocation strategy, increasing the amount invested in low-fee funds (a key factor in long-term wealth accumulation) by 11 percentage points. These effects are striking when compared to the results typically found from interventions trying to improve financial literacy or financial knowledge [22]. Fernandes et al. [10] conducted a large meta-analysis and found that interventions to improve financial literacy explain only 0.1% of the variance in downstream financial behavior.

The degree to which annotations should be curated by an external authority requires further research. While the vast majority of comments collected in our study accurately reflected the funds they discussed, in one instance a comment was inaccurate. Such inaccuracies, even if minor, may make financial companies reluctant to show social annotations for liability reasons. Because novices appear to be influenced by social annotations, there is potential for interested parties to exploit such annotations [47]. Those providing social annotations to users need to ensure the comments are accurate.

LIMITATIONS

Users' reported level of expertise in our study was subjective. We suspect that more accurately identifying novices and experts would result in finding greater differences in reaching a retirement saving goal between the two groups and in how social annotations affect their decision-making abilities.

There are a number of factors that may have affected participant decision-making that we could not easily control or study. It is possible that the ordering of social annotations or the influence of specific annotations may have affected participants' decision-making. However, we did not attempt to measure ordering effects or the influential effect of a single comment and focused on how all comments together affected users.

CONCLUSION

System designers should consider using social annotations to help expose users to issues they should consider. Annotations highlight the concerns of others and put the user in a more powerful position compared to a user who independently makes decisions. The performance data we collected together with the quotes provided by users in this study indicate that users were either influenced by social annotations or more aware of pertinent issues when making decisions due to social annotations.

Social annotations can empower novices, and allow them to perform better when saving toward retirement. With social annotations, novice investors' performance becomes similar to that of expert investors. Novices not only exhibit better performance, but they also exhibit more prudent choices by selecting more low-fee funds. It is important to ensure the vast majority of comments are accurate, because too many inaccurate comments may misguide users. Despite the better performance of novices exposed to social annotations compared to those who are not, how novices rate their confidence and decision-making capacity when evaluating financial information does not appear to change significantly with the addition of social annotations. Additionally, how novices rate their perceived understanding after reading financial prospectuses is lower for those exposed to social annotations compared to those without annotations.

Firms providing retirement savings plans can augment their user interfaces in areas with complex information using social annotations. In addition to prospectuses, documents such as annual shareholder documents, tax reporting information and legal financial information augmented with social annotations could improve user decision-making.

In addition to financial services companies, the findings can inform policy makers who regulate such companies and determine what information should be provided to consumers. Social annotation can be an effective way to augment complex financial information, and empower non-experts who often make uninformed decisions.

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