Let's Talk: The Effects of Virtual Financial Advisor Interaction Mode and Gender Expression on Investor Judgments[*]

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ABSTRACT

A virtual financial advisor (VFA) is an emerging form of robo-advisor that interacts using either an oral or text interaction mode. We conduct three experiments to examine how a VFA's interaction mode and gender expression affect investors' judgments, predicting that the oral interaction mode exacerbates investors' sensitivity to VFA gender. Consistent with investors being more sensitive to a VFA's gender when it interacts orally, participants in our first experiment favor the female over the male VFA, but only when the VFAs interact orally. Our second and third experiments provide evidence as to *why*, demonstrating that VFAs' oral expressions amplify the impact of gender-based responsiveness stereotypes, which favor females. Our study contributes to the literature examining how technology affects investors' reactions to financial information and educates regulators and brokerage firms about the implications of two central features of robo-advisors.

Keywords: robo-advisors, speech capabilities, interaction mode, gender bias, virtual assistant

I. INTRODUCTION

A robo-advisor is an automated online service that uses computer algorithms to provide financial advice and manage investment portfolios. Traditional robo-advisors are portrayed as algorithms and interact with their clients indirectly, ascertaining clients' investment preferences from responses to questionnaires and providing periodic updates via online dashboards. A virtual financial advisor (VFA) is an advanced form of robo-advisor that interacts *directly* with clients through oral expressions or written text. VFAs have distinct identities and humanlike attributes (e.g., gender, name). In recent years, several wealth management firms have introduced a VFA to their clients. AllianceBernstein created *Abbie*, a VFA that presents as female and interacts orally (AB 2018), Bank of America created *Erica*, a VFA that presents as female and interacts via written text (Bank of America 2023), Morningstar created *Mo*, a VFA that presents as male and interacts orally (Lin 2023), and Apicil Group created *Nalo*, a VFA that presents as male and interacts through written text (Nalo 2023). In this paper, we use experimentation to examine whether an oral versus written interaction mode affects the significance of gender stereotypes for investors' reliance on a VFA's investment advice.

Investigating how a VFA's interaction mode and gender expression jointly affect investor behavior is important for at least two reasons. First, prior research demonstrates that a communicator's interaction mode and gender can affect investor behavior in a variety of contexts (Blankespoor 2018; Friedman 2020; Gu 2020; Jackson, Rennekamp, and Steenhoven 2024), which underscores the possibility that a VFA's interaction mode or gender might impact how investors react to the VFA. Despite this possibility and the widespread availability of VFAs that vary by interaction mode and gender, research has yet to investigate how these design features affect investors' judgments. Second, regulators such as the Securities and Exchange Commission

(SEC) and the Financial Industry Regulatory Authority (FINRA) have requested public comment on how the design features of VFAs might affect investors (SEC 2017; FINRA 2020; SEC 2021, 2023b, 2023a). Underscoring the importance of studying the consequences of VFAs' interaction mode and gender, regulators have explicitly asked for help in identifying research from the field of experimental psychology that investigates how digital engagement practices, including the design of robo-advisors, influence retail investors (SEC 2021).[1]

To guide our predictions, we draw on the Computers-Are-Social-Actors (CASA) paradigm (Nass and Moon 2000), which suggests that individuals frequently treat technologies in a social manner, relying on scripts and stereotypes from human-human interactions for their human-technology interactions (Gambino, Fox, and Ratan 2020; Lombard and Xu 2021). The paradigm further suggests that this behavior is more likely when the technology has attributes or characteristics that portray it as a social actor (Gambino et al. 2020).[2] Because oral expressions are more likely than text expressions to suggest a given technology is a potential source of social interaction, we expect investors are more likely to treat a VFA in a social manner when it interacts orally (Nass and Moon 2000; Cho, Molina, and Wang 2019). If oral expressions lead to more social treatment, then the potential impact of stereotypes such as those related to gender is likely greater when VFAs interact orally. For example, given the longstanding stereotype that males are more credible than females (Biernat and Kobrynowicz 1997; Petrides, Furnham, and

[1] Regulators use a variety of terms that are similar to or synonymous with VFAs, such as virtual assistants, conversational chatbots, virtual assistant applications, AI-investment advice tools, robo-advisors, and robos (FINRA 2020; SEC 2023a).

[2] The CASA paradigm and anthropomorphism are closely related, but distinct concepts. Specifically, the CASA paradigm generally concerns an automatic or involuntarily propensity to treat technologies with social attributes as if they were social entities (Reeves and Nass 1996; Gambino et al. 2020) whereas anthropomorphism generally concerns a mindful choice to ascribe human-like qualities (e.g., emotions) to non-human objects or beings (Epley, Waytz, Akalis, and Cacioppo 2008; Xu, Chen, and Huang 2022).

Martin 2004), it is possible that a VFA's oral expressions amplify the impact of a gender-based credibility stereotype favoring males.

We conduct three experiments using business students as participants to study how a VFA's interaction mode and gender expression affect investors' reliance on the VFA's investment advice. Experiment 1 has a 2 x 2 between-participants design wherein we manipulate a VFA's interaction mode (oral, written) and gender expression (female, male). A simulated VFA asks participants a few questions about their investment preferences and then offers an investment recommendation. After receiving the VFA's recommendation, participants respond to questions about their willingness to invest in the recommended security and their perceptions of the VFA's credibility. We design our first experiment to test whether (i) investors' sensitivity to VFA gender is greater when a VFA interacts orally versus when it interacts only via written text, and (ii) a VFA's oral expressions amplify the impact of gender-based credibility stereotypes favoring males. We find support for the former prediction, but not the latter. Specifically, results suggest that, relative to written expressions, VFAs' oral expressions indeed exacerbate investors' application of gender stereotypes. However, these oral expressions appear to amplify the impact of a gender-based stereotype that favors *females*, not a gender-based credibility stereotype that favors males.

Given Experiment 1's findings indicate that oral expressions amplify the impact of a gender stereotype that favors females rather than males, we reexamine the theory underlying our original prediction that a credibility-based stereotype favoring males would apply. First, recent research suggests that gender stereotypes have evolved such that individuals now tend to view females and males similarly in terms of competence and intelligence (Eagly, Nater, Miller, Kaufmann, and Sczesny 2020; Campbell and Hahl 2022; Schwarz and Coppock 2022). Second,

although most financial advisors are male, recent survey evidence suggests individuals generally view finance-related professions as gender-neutral professions rather than as male- (or female-) oriented professions (Hanna 2023). Thus, current credibility-based gender stereotypes are likely to favor male financial advisors relatively *less* than they have historically, if at all. Third, recent research suggests that individuals do not necessarily rely on traditional gender stereotypes related to credibility when interacting with highly advanced technologies. For example, Kim, Cho, Ahn, and Sung (2019) find that individuals perceive female and male gendered smart speakers as equally competent.

In our context, the CASA paradigm provides a compelling basis for our prediction that investors' sensitivity to VFA gender is greater when it interacts orally versus when it interacts only via written text, but it does not specify the particular stereotype(s) likely to be relevant. Given participants appear to apply a gender stereotype that favors females rather than the credibility-related gender stereotype that favors males, we postulate that VFAs' oral expressions amplify the impact of an alternative stereotype—namely, that females are more responsive to others' needs than males (Cho et al. 2019; Hentschel, Heilman, and Peus 2019). We believe the activation of this alternative stereotype is plausible because prior research finds that perceived responsiveness predicts individuals' acceptance of gendered bots and that individuals perceive female bots as more responsive than male bots (Borau, Otterbring, Laporte, and Wamba 2021). Further, while perceived differences between females' and males' credibility have diminished dramatically over time, perceived differences between females' and males' communal orientation have increased, with females always being viewed as relatively more communal (i.e., empathetic, responsive, etc.), but now to an even greater degree (Eagly et al. 2020). Thus, gender stereotypes related to responsiveness may be particularly relevant in VFA-investor interactions.

We conduct our second and third experiments to test whether a VFA's oral expressions amplify the impact of gender-based responsiveness stereotypes favoring females. Our second experiment is identical to our first, except we measure participants' perceptions of their VFA's responsiveness rather than participants' willingness to rely on their VFA's advice or their perceptions of their VFA's credibility. As expected, we find that participants perceive a female VFA that interacts orally as being more responsive to their needs, relative to a female VFA that interacts via written text or a male VFA (irrespective of interaction mode).

Having provided evidence that investors perceive our female VFA that interacts orally as being most responsive to their needs, we design a third experiment to provide convergent evidence that a VFA's oral expressions amplify the impact of gender-based responsiveness stereotypes favoring females and that this amplification explains why Experiment 1 participants favor the female VFA that interacts orally. Experiment 3 uses a 2 x 2 between-participants design wherein we manipulate the VFA's gender (female, male) and the presence of positive cues of its responsiveness (absent cues, present cues) while holding interaction mode constant such that all VFAs interact orally. Sometimes referred to as a moderation-of-process design (Asay, Guggenmos, Kadous, Koonce, and Libby 2022), we manipulate the presence of unambiguous, positive cues of the VFA's responsiveness to test the theory that investors' application of a responsiveness-related gender stereotype explains why they favor the female VFA that interacts orally. To support this theory, the effect of VFA gender should be muted when unambiguous, positive cues of VFA responsiveness are present because this scenario precludes the need to rely on *ambiguous* signals of responsiveness, such as gender. Indeed, we find that Experiment 3 participants are relatively more willing to rely on the female (versus male) VFA unless unambiguous, positive cues of VFA responsiveness are present. Collectively,

the results of our three experiments suggest that (i) investors are more sensitive to VFA gender when it interacts orally versus when it interacts only via written text, and (ii) a VFA's oral interactions amplify the impact of a gender-based responsiveness stereotype favoring females.

Our study contributes to practice in several ways. For the SEC and FINRA, our findings advance their efforts to better understand how robo-advisors and related technology affect investor behavior. Specifically, our findings suggest that adding speech capabilities to a VFA could increase investors' sensitivity to normatively unimportant factors such as the VFA's gender. For wealth management firms, our findings highlight how their VFA's interaction mode and gender expression could inconspicuously influence their clients' investment decisions. For investors, our findings should prompt those who use a VFA to consider how its design might influence their investment decisions.

Our study also contributes to the extant accounting literature, as we add to the limited body of research on robo-advisors. Specifically, we extend the findings of Hodge, Mendoza, and Sinha (2021), who demonstrate that humanizing a robo-advisor through the assignment of a human name decreases investors' reliance on the robo-advisor when it performs a complex task. Our study offers evidence that humanization is a multi-dimensional construct. Indeed, our findings suggest that humanlike attributes that portray robo-advisors as a source of social interaction (e.g., the capacity to interact orally) could be used to *increase* investors' reliance on robo-advisors. More generally, our study contributes to theory by demonstrating that giving a robo-advisor speech capabilities can evoke or exacerbate stereotypes typically relied upon in human-human interactions.[3]

[3] Some prior research in accounting investigates how variation in the delivery of financial disclosures (e.g., video, audio, text) affects investors' judgments (e.g., Cade, Koonce, and Mendoza 2020; Elliott, Loftus, and Winn 2024; Jackson, Wang, and Piercey 2025). Our research differs from this stream of research in that we focus not on how firm-specific information is communicated to investors, but on how robo-advisors and investors *interact*.

II. BACKGROUND AND THEORETICAL DEVELOPMENT

Robo-Advising

A robo-advisor is an automated online service that uses computer algorithms to provide financial advice and manage investment portfolios. The algorithms generally formulate and execute investment strategies based on clients' responses to questionnaires. Since the introduction of the first robo-advisor in 2010, assets under robo-advisor management have risen to approximately $1.8 trillion (Statista 2024b). Many investors now prefer to use a robo-advisor rather than a human-advisor because robo-advisors are more accessible and charge lower fees (Ji 2017; Oehler, Horn, and Wendt 2022). Indeed, from 2020 to 2024, the number of U.S. investors who use robo-advisors nearly doubled, increasing from 10.4 million to 20.6 million (Statista 2024b). By comparison, the number of U.S. investors who use human-advisors remained fairly consistent during this same timeframe, increasing from 60.8 million to 64.1 million (Investment Adviser Association 2023; Statista 2024a).

Virtual Financial Advisors

An estimated fifty-seven percent of Americans interact with virtual assistants (e.g., Amazon's *Alexa,* Apple's *Siri*) at least twice per month (Vixen Labs 2022), and as of 2024, an estimated 8.4 billion devices (e.g., iPhones) are connected to a virtual assistant (Moar and Escherich 2021). The proliferation of virtual assistants is likely driven, in part, by new use-cases or applications for virtual assistants. For example, virtual assistants now service individuals within a variety of business contexts, including eCommerce, human resources, and finance (McTear, Callejas, and Griol 2016; NextIT 2020). Within the finance sector, some firms have added finance-related capabilities to preexisting virtual assistants such as Amazon's *Alexa*. For example, J.P. Morgan clients can access market research through *Alexa* and TD Ameritrade

clients can access market research and trade securities through *Alexa* (J.P. Morgan 2018; TD Ameritrade 2019).

Several firms within the finance sector have also created their own virtual financial assistants to help clients manage their finances. For example, Bank of America created *Erica*, a virtual financial assistant that presents as female and interacts through written text (Bank of America 2023). *Erica* uses artificial intelligence to assist clients with "complex tasks and [to] provide personalized, proactive guidance to help them stay on top of their finances" (Miller 2020). Similarly, in early 2018, AllianceBernstein created *Abbie*, a virtual financial assistant that presents as female and interacts orally (Distenfeld, Skoglund, DiMaggio, and Switzer 2018). *Abbie* uses artificial intelligence to help traders assess bond pricing and liquidity data and execute orders. Finally, in 2023, Cleo AI released *Cleo*, a virtual financial assistant that presents as female and interacts through written text (Cleo 2025). In addition to monitoring users' finances, *Cleo* leverages ChatGPT to chat with users about their finances. Similar to virtual financial *assistants* like *Cleo*, virtual financial *advisors* (VFAs) interact directly with users through text or speech. However, unlike virtual financial assistants, VFAs function as robo-advisors, providing personalized investment advice and completing other investment-related tasks (e.g., rebalancing portfolios). One example is *Jarvis*, a VFA that presents as male and interacts through written text (Ventugrow 2025).

Virtual financial assistants like *Erica* and *Abbie* have transitioned or are transitioning from the role of a virtual financial assistant to the role of a VFA. For instance, Bank of America's *Erica* is now capable of providing investment advice to individuals with 401(k) retirement accounts at Merrill Lynch. Further, while Erica currently advises Merrill Lynch's clients, Bank of America has stated that *Erica* will soon be able to provide proactive and

personalized investment advice to Bank of America clients as well (Miller 2020; Merrill Lynch 2023). As for AllianceBernstein's *Abbie*, in late 2018, *Abbie* progressed to the role of a VFA when she became capable of recommending bond investments (Wigglesworth 2018).

With the introduction of VFAs, investors can now interact with robo-advisors in ways that increasingly resemble human-to-human interactions. Although VFAs complete the same tasks as other robo-advisors, VFAs offer a more humanlike experience in at least two respects. First, VFAs have distinct identities and are assigned humanlike attributes such as a name, gender, and voice. Second, VFAs interact directly with clients through written text or oral expressions. In contrast, traditional robo-advisors typically do not have distinct identities and do not interact directly with clients. Instead, traditional robo-advisors operate behind the scenes and interact indirectly with clients mostly through updates displayed on online dashboards.

Humanized Robo-Advisors

We investigate the implications of a VFA's interaction mode, in part, because adding or improving the oral capabilities of virtual assistants is a common practice (Wong 2018; Open AI 2023). As individuals often interact orally in their social interactions, the capacity to interact orally is a uniquely humanizing attribute in that it suggests the related technology is a potential source of social interaction (Nass and Moon 2000; Schroeder and Epley 2016). Research in the Computers-Are-Social-Actors (CASA) paradigm suggests that when individuals perceive a technology as a potential source of social interaction, they engage with it as if it were human, applying the same social rules and stereotypes that they apply to humans (Gambino et al. 2020).

Although there is considerable variation in robo-advisors' resemblance to humans, there is little research on how investors respond to robo-advisors with humanlike attributes (i.e., humanized robo-advisors). One exception is Hodge et al. (2021), who find investors are less

likely to rely on recommendations from a named robo-advisor than from an unnamed robo-advisor.[4] Hodge et al. (2021) attribute the negative response to humanizing through name to the complexity of the robo-advisor's task in their experiment, theorizing that making a robo-advisor appear more humanlike simultaneously makes it appear more fallible when completing complex tasks. Importantly, although assigning a name and enabling oral interaction both increase a robo-advisor's resemblance to humans, we expect the capacity for oral interaction will portray it a social actor, whereas a name alone will not. That is, we broaden the concept of humanization to include variation in the human-likeness of the robo-advisor's *interactions*. Indeed, VFAs are an advanced type of robo-advisor characterized by their distinct identities and attributes (e.g., gender, name) as well as their ability to interact directly with clients through written text or oral expressions. Whereas Hodge et al. (2021) suggest that naming a robo-advisor affects investors' beliefs about the robo-advisor's fallibility in certain settings, we suggest that a VFA's interaction mode affects investors' propensity to apply social rules and stereotypes to the respective VFA.

III. EXPERIMENT 1

Hypotheses

Interactions among humans are governed by unwritten social scripts and rapid, conscious and subconscious judgments about others (Ambady and Rosenthal 1992; Bargh and Chartrand 1999; Goffman 2023). If the capacity to interact orally increases a VFA's resemblance to a social actor, then the Computers-Are-Social-Actors (CASA) paradigm (Gambino et al. 2020) would suggest that oral interactions likely also increase investors' application of social rules and stereotypical judgments that are normally relied upon in human-human interactions (Nass and Brave 2005; Cho et al. 2019) to the VFA. Naturally, how investors respond to a VFA that

[4] The specific manipulation employed by Hodge et al. (2021) informs participants either that "Your financial advisor is Charles, a computer algorithm from …" or "Your financial advisor is a computer algorithm from …"

interacts orally will depend on the specific social rules and stereotypes they apply. For example, if a VFA is assigned a name associated with a particular race, the VFA's oral expressions could exacerbate investors' reliance on stereotypes related to the particular race. Similarly, if a VFA is assigned a particular gender, oral expressions could exacerbate investors' reliance on gender stereotypes. Given our focus on VFA gender, we formalize the following hypothesis:

Hypothesis 1: *Investors' sensitivity to VFA gender is greater when a VFA interacts orally than when it interacts only via written text.*

One long-standing gender stereotype relates to credibility. That is, investors might perceive male VFAs as more credible than female VFAs because conventional gender stereotypes favor the perceived credibility of male financial professionals (Heilman, Wallen, Fuchs, and Tamkins 2004; Bloomfield, Rennekamp, Steenhoven, and Stewart 2021) as well as males in general (Biernat and Kobrynowicz 1997; Petrides et al. 2004). Seminal research within the CASA paradigm also suggests individuals perceive computers with a male computer-generated voice as more competent and compelling than computers with a female computer-generated voice (Nass, Moon, and Green 1997; Lee, Nass, and Brave 2000). If investors perceive male VFAs as more credible than female VFAs and the consequences of stereotypes are more pronounced for VFAs that interact orally (as hypothesized just above), then a VFA's oral expressions should exacerbate investors' application of the stereotype that males are more credible than females. Formally:

Hypothesis 2: *A VFA's oral expressions amplify the impact of gender-based credibility stereotypes favoring males on investor judgments.*

Experimental Design and Procedures

To test these hypotheses, we conduct a 2 x 2 experiment with a VFA's gender expression (female, male) and interaction mode (written, oral) manipulated between-participants.[5] Participants recruited from the business research lab participant pool of a large state-affiliated university begin the experiment by placing a pair of lab-provided headphones over their ears and completing a listening test. The purpose of the listening test is to ensure that participants can hear audio produced by their headphones and to allow participants the opportunity to adjust the volume before interacting with the VFA. In this test, participants listen to a brief recording of one of the following animal sounds: dog, horse, bird, or frog. Participants must correctly indicate which animal they heard to proceed. All participants are asked to wear their headphones for the remainder of the study.

Upon successful completion of the listening test, participants assume that they received a cash inheritance and that they are considering investing this inheritance in companies that sell home improvement products. Participants also assume they have sought out a virtual financial advisor (VFA) to help them with their investment decisions, and they receive a general description of VFAs to ensure understanding. After learning about VFAs, participants complete a comprehension check, read an introduction, and begin to interact with a simulated VFA.

Figure 1 presents the content of the communication in the interaction between the VFA and participants. The VFA initiates the interaction by introducing itself and by offering brief instructions to the participant. Because advisors often use questionnaires to assess their clients' investment preferences, we program the VFA to ask three questions that mimic those commonly found on questionnaires used by human and robo-advisors (Charles Schwab 2018; LPL Financial

[5] All studies reported received approval for the use of human participants by the Human Research Protection Office at the institution where data collection took place.

2020; RBC Wealth Management 2020; Wealthfront 2020). We present each question from the VFA on a separate screen. Participants must answer each of the VFA's questions to proceed. At the conclusion of the interaction, the VFA recommends investing in a fictional company called UPK Home Improvement Company (UPK) and provides relevant background information about UPK. Participants then respond to questions about their willingness to rely on the VFA's recommendation, assess the VFA's credibility, and complete a post-experiment questionnaire.[6]

Gender Expression Manipulation

We manipulate the VFA's gender expression (female, male) by using female or male gendered pronouns to reference the VFA within the introductory materials that participants read. For example, after the comprehension check, participants read "On the screens that follow, she (he) will ask you a few questions and she (he) will provide an investment recommendation to you. Please click the next arrow to begin interacting with her (him)." In total, we embed seven gender-specific pronouns in the information shown to participants before their interaction with the VFA begins.

Although a more salient gender manipulation could be used, our subtle manipulation conveys gender without introducing extraneous variables. For example, gender-specific names could be used to convey gender. Hodge et al. (2021), however, find that the name of a robo-advisor influences investors' likelihood of following the advisor's advice. Thus, although using gender-specific names could strengthen our gender manipulation, they could also affect our key dependent variables for reasons not related to our theory.

[6] In the post-experiment questionnaire of Experiments 1-3, we collect demographic information related to the number of accounting and finance classes completed, previous investing experience, intent on investing in the future, prior use of human financial advisors, prior use of robo-advisors, prior use of virtual assistants, first language, gender, age, and technophobia. Participants also use a 101-point scale with endpoints *Strongly Disagree* (0) and *Strongly Agree* (100) to indicate their agreement with "I believe that robo-advisors achieve higher investment returns than human advisors." Controlling for these factors in all reported analyses does not affect inferences.

Interaction Mode Manipulation

We manipulate the VFA's interaction mode (written, oral) by varying whether the VFA interacts with participants through text only or through text and speech, holding constant the content of the interaction. In the written interaction mode conditions, the VFA communicates exclusively through written text. In the oral interaction mode conditions, the VFA communicates through both written text and speech, with each screen containing a picture of a speaker (🔊) to alert participants to the presence of the VFA's speech. By including the written text in all conditions, we hold constant the availability of the communicated information. Without the written text, participants in the oral conditions would not have recourse if they inadvertently miss a portion of the VFA's speech. Further, as virtual assistants and VFAs generally present text transcripts when interacting orally, including the written text in all conditions is unlikely to threaten the external validity of our theory.

To manipulate interaction mode, we require a female sounding voice for our female-oral condition and a male sounding voice for our male-oral condition. While the perceived gender of each voice must differ, our results could be difficult to interpret if the voices were to differ on other important attributes such as human-likeness. To select two voices that differ by gender but are otherwise similar, we first use Google's Text-to-Speech synthesis service to generate five female voice recordings and five male voice recordings. For each recording, the transcript is: "Hello, I am a virtual assistant. I can answer users' questions and complete tasks like setting alarms. I can understand both written and spoken commands."

After generating these recordings, we conduct a pilot study in which 300 Amazon Mechanical Turk (AMT) participants listen to a recording of one of the ten voice recordings and rate the respective voice on six items. Specifically, pilot participants use seven-point bipolar

scales to rate the voice they hear on the following items: *Fake* (1) to *Natural* (7), *Machinelike* (1) to *Humanlike* (7), *Artificial* (1) to *Lifelike* (7), *Not at All Trustworthy* (1) to *Very Trustworthy* (7), *Not at All Competent* (1) to *Very Competent* (7), and *Not at All Credible* (1) to *Very Credible* (7). Pilot participants also estimate (in years) the speaker's age. Using pilot participants' ratings and age estimates, we identify one female voice and one male voice that are rated similarly on each of the six items listed above and are estimated to be of similar age ($t_{(57)} < 0.62$ for all comparisons, p-values > 0.54, untabulated).

We intentionally use voices that are rated similarly on dimensions other than gender to ease the interpretation of our results and preserve the internal validity of our inferences. Important for our experiment, as credibility-related gender stereotypes are highly context dependent (Lyness and Heilman 2006; Paustian-Underdahl, Walker, and Woehr 2014), it remains possible for the female and male voices to be viewed differently when associated with gendered virtual financial advisors. Notwithstanding the benefits of using voices that are rated similarly in terms of competence and credibility, we acknowledge that the *external* validity of our inferences could be limited if the perceived competence and credibility of female voices and male voices vary in practice.

To investigate this possibility, we use our pilot data to examine the effect of the speaker's gender on perceptions of competence and credibility. We find that pilot participants rate all five female voices and all five male voices similarly in terms of competence ($F_{(1, 298)} = 0.13$, $p = 0.71$, untabulated) and credibility ($F_{(1, 298)} = 0.73$, $p = 0.39$, untabulated). Because we generate the female and male voices using a highly advanced, popular speech synthesis service (Google's Text-to-Speech) and observe that the speaker's gender does not significantly affect perceptions

of the speaker's competence or credibility, we conclude that using similarly rated voices in our experiment is unlikely to threaten the external validity of our inferences.

Investor Judgments

After participants receive the VFA's recommendation, participants respond to questions about their willingness to rely on the VFA's recommendation and their perception of the VFA's credibility. Participants then proceed to respond to two manipulation checks and a question about whether they would prefer that their VFA interact orally or through written text. Because participants in the written conditions might find it difficult to form a preference without having listened to their VFA, we present these participants with the same recommendation message they already received, but now via voice instead of text, taking care to match the gender of the voice to the gender conveyed by the pronouns earlier in the study. On the final screens, participants provide demographic data.

IV. EXPERIMENT 1 RESULTS AND DISCUSSION

Participants

Three hundred twenty-eight undergraduate business students at a large state-affiliated university complete our experiment at the university's dedicated business research lab in exchange for extra credit in a course of their choosing. Participants are, on average, 20.02 years old and are either currently enrolled in or have previously taken an average of 1.45 accounting courses and 0.75 finance courses. Forty-nine percent of participants have previously invested in the stock market and 92 percent plan to invest in the stock market in the future. Forty-eight percent of participants identify as male and 93 percent indicate English as their first language.

We believe undergraduate business students are appropriate participants to examine our research question for two reasons. First, participants do not need any specific expertise or level

of investing experience to understand our robo-advisor's communications. Second, undergraduate students and robo-advisors' clients are similar in terms of previous investing experience. Specifically, within each of these populations, there is a seemingly equal proportion of individuals with and without previous investing experience (Neal 2020; Iacurci 2022). Therefore, we match the knowledge base of our participants to the relevant task and setting (Libby, Bloomfield, and Nelson 2002).

Manipulation Checks

Ninety-seven percent of participants correctly respond to the question "Did your virtual financial advisor communicate through voice?" as dictated by their condition. Likewise, 90 percent of participants correctly respond to the question "What gender best describes your virtual financial advisor?" as dictated by their condition. These results indicate successful manipulations. Inferences below are robust to the inclusion or exclusion of participants who fail either manipulation check question or who fail a separate attention check question.[7]

Examination of Hypothesis 1 and 2

Our first hypothesis states that investors' sensitivity to VFA gender is greater when a VFA interacts orally than when it interacts only via written text. This hypothesis implies a more pronounced difference between participants' willingness to rely on the male versus female VFA's advice when the VFAs interact orally versus when they interact only via written text. Our second hypothesis states that a VFA's oral expressions amplify the impact of gender-based credibility stereotypes favoring males on investor judgments. This hypothesis implies

[7] To assess participants' attentiveness, we present participants with a seven-point scale with endpoints *Strongly Disagree* (1) and *Strongly Agree* (7) and ask participants to select *Strongly Agree* if they are paying attention. All but five participants select *Strongly Agree*.

participants should be more willing to rely on the male versus female VFA's advice, particularly when the VFAs interact orally.

Willingness to Rely on a VFA's Advice

We measure participants' willingness to rely on the VFA's advice from their responses to: (i) Are your feelings towards UPK's stock as a potential investment generally more positive or more negative?, and (ii) How willing are you to invest in UPK stock? (Asay, Hales, Hinds, and Rupar 2023). Participants respond to the former question on a seven-point scale with endpoints *Significantly Negative* (1) and *Significantly Positive* (7). Participants respond to the latter question on a seven-point scale with endpoints of *Very Unwilling* (1) and *Very Willing* (7). The two measures are internally consistent ($\alpha = 0.80$). Thus, we average the two measures to create one variable, *Reliance*. Table 1, Panel A reports descriptive statistics of *Reliance* and Figure 2 graphically displays the means of *Reliance* by experimental condition. Panel B reports results of a 2 x 2 (*Interaction Mode* x *Gender Expression*) ANOVA with *Reliance* as the dependent variable, and Panel C reports follow-up simple effects tests.

We observe a statistically significant *Interaction Mode* x *Gender Expression* interaction effect ($F_{(1, 324)} = 7.48$, $p < 0.01$). Consistent with our first hypothesis, we observe a more pronounced effect of VFA gender when the VFA interacts orally versus when it interacts via only written text. Specifically, we find that participants are more inclined to rely on a female VFA that interacts orally versus a male VFA that interacts orally ($F_{(1, 324)} = 6.81$, $p = 0.01$), and this gender effect diminishes when the VFA interacts via written text ($F_{(1, 324)} = 1.55$, $p = 0.21$). This pattern of results supports our prediction that investors' sensitivity to VFA gender is greater when a VFA interacts orally versus via written text.

However, finding that participants are most inclined to rely on the *female* VFA that interacts orally does not support our second hypothesis, wherein we predict that VFAs' oral expressions amplify the impact of a gender-based credibility stereotype that favors males. We also find that participants ascribe similar levels of credibility to their VFA irrespective of VFA interaction mode, gender, or the interaction of these factors (all *p*-values > 0.26).[8] Altogether, our results suggest that relative to written expressions, VFAs' oral expressions exacerbate investors' application of a gender stereotype that is unrelated to credibility and favors females.

Supplemental Analysis

Recall that we conducted a pilot study to ensure the male and female voices we use in our primary experiment differ by gender but are perceived to be similar on other key dimensions such as their naturalness, human-likeness, lifelikeness, trustworthiness, competence, credibility, and age. Still, one possible reason why participants react most positively to the female VFA that interacts orally is that participants perceive the female VFA's voice as superior to the male VFA's voice on some unobserved dimension. Another possible explanation is that participants are relatively more accustomed to female sounding computer-generated voices, making the male VFA's voice feel relatively less familiar. To investigate these potential explanations, we use participants' stated preference of which interaction mode they prefer. In particular, we examine the effect of VFA gender on the likelihood that a participant prefers the oral interaction mode. If participants are equally or more likely to prefer the oral interaction mode for male versus female

[8] We measure participants' perceptions of the VFA's credibility from their reported agreement with the following statements: "I believe that my virtual financial advisor is trustworthy" and "I believe that my virtual financial advisor is competent" (Giffin 1967; Mercer 2005) (both are seven-point scale with endpoints *Significantly Disagree* (1) and *Significantly Agree* (7)). Results of an untabulated 2 x 2 (*Interaction Mode* x *Gender Expression*) ANOVA with the average of the two credibility measures ($\alpha = 0.78$) as the dependent variable indicate that participants' perceptions of the VFA's credibility do not vary across conditions (overall model: $F_{(3, 324)} = 0.89$, $p = 0.45$).

VFAs, this would help rule out concerns that the female voice we chose is superior on some unmeasured dimension or that the female voice feels more familiar.

Counter to both explanations, we find that participants are significantly *more* likely to prefer the oral interaction mode when the VFA is male versus female (proportion preferring oral interaction: male VFA = 78%, female VFA = 68%; Wald $\chi^2_{(1)} = 4.47$, $p = 0.04$, untabulated). Because participants' stated preferences work in the opposite direction of their willingness to rely on the VFA's recommendation, it seems unlikely that our primary result is explained by the particular voices used or a general preference for female sounding computer-generated voices.

Potential Explanation of Unexpected Experiment 1 Results

Consistent with our expectations, participants in Experiment 1 appear more likely to apply gender stereotypes to VFAs that interact orally versus VFAs that interact via only written text. However, we did not expect participants to apply a gender stereotype that favors females. In attempting to reconcile this unexpected finding, we found recent research that suggests gender stereotypes related to credibility are not necessarily applicable in interactions with highly advanced technologies. For example, Kim et al. (2019) find that individuals perceive female gendered AI assistants and male gendered AI assistants as equally competent, and Stroessner and Benitez (2019) find that individuals perceive female gendered humanoid robots and male gendered humanoid robots as equally competent. If individuals recognize that technologies like AI assistants, humanoid robots, and VFAs are highly advanced, ambiguous cues of credibility (e.g., gender) may be irrelevant (Kunda and Sherman-Williams 1993; Rubinstein, Jussim, and Stevens 2018).

Recent research also suggests that gender stereotypes have evolved such that individuals now tend to view females and males similarly in terms of competence and intelligence (Eagly et

al. 2020; Campbell and Hahl 2022; Schwarz and Coppock 2022). Moreover, although most financial advisors are male, recent survey evidence suggests that individuals do not necessarily view finance related professions as male-oriented professions. Specifically, in a 2023 survey about gender stereotypes and professions (Hanna 2023), 26 (30) percent of respondents indicate that the financial analyst profession is typically a female (male) profession, and 44 percent of respondents indicate that this profession is a gender-neutral profession. Collectively, recent research suggests that credibility-related gender stereotypes are not necessarily applicable in interactions with highly advanced technologies and that whether credibility-related gender stereotypes continue to favor male financial professionals and males in general is unclear.

Considering this recent research, it is arguably unsurprising that participants' credibility assessments in Experiment 1 were similar irrespective of their VFA's gender and interaction mode. While there is no evidence to suggest that participants relied on credibility-related gender stereotypes in Experiment 1, our results support the theory that participants relied on some alternative stereotype that favors females. As outlined below, we theorize that the observed differences in participants' willingness to rely on their VFA across conditions could be explained by perceptions of responsiveness.

We focus on the concept of responsiveness for three reasons. First, research suggests that individuals generally perceive females as more communal (e.g., empathetic, responsive) than males, and the gap between perceptions of females' versus males' communality has grown over the past seven decades (Eagly et al. 2020). Thus, unlike credibility-related gender stereotypes, communal-related gender stereotypes are becoming more pervasive and therefore, potentially more impactful. Second, research finds that individuals apply communal-related gender stereotypes to highly advanced technologies. For example, Borau et al. (2021) find that

individuals perceive female bots are more responsive than male bots and that perceived responsiveness predicts individuals' acceptance of the gendered bots. Third, because investors have differing preferences and goals, investors' willingness to rely on a VFA's advice likely depends on their perception of how responsive the VFA is to their unique needs. Indeed, results of MorningStar's 2023 Investor Survey suggest investors view their advisors' responsiveness as an especially important attribute, with 27 percent of respondents stating that "finding the best financial advisor to meet my unique investing needs" is *the most important* component of their investment strategy (Morningstar 2023).

Based on Experiment 1 findings and the reasons outlined above, we continue to expect VFAs' oral expressions to exacerbate investors' application of gender stereotypes relative to written expressions. However, we now predict that the relevant stereotype is one that favors females—particularly, that females are more responsive to others' needs than males. Formally:

> Hypothesis 3: *A VFA's oral expressions amplify the impact of gender-based responsiveness stereotypes favoring females on investor judgments.*

V. EXPERIMENTS 2 AND 3

Overview

We begin our examination of Hypothesis 3 by rerunning Experiment 1 after replacing all dependent measures with measures about perceived VFA responsiveness. If perceptions of responsiveness help explain why Experiment 1 participants are most likely to follow the advice of the female VFA that interacts orally, then investors should perceive this VFA as being more responsive than the female VFA that interacts via written text and both male VFAs. After verifying this key premise, we conduct a third experiment using a moderation-of-process design (Asay et al. 2022) to provide direct evidence that investors are more inclined to rely on a VFA

that interacts orally when it presents as female *because* investors apply gender-based responsiveness stereotypes that favor females.

Experiment 2

Design and Measures

Experiment 2 follows the same 2 x 2 design as Experiment 1, with the VFA's gender expression (female, male) and interaction mode (written, oral) manipulated between-participants. However, to measure perceived VFA responsiveness, we replace the investment-related dependent measures used in Experiment 1 with two measures adopted from the Perceived Partner Responsiveness scale (PPR) (Crasta, Rogge, Maniaci, and Reis 2021): (i) My virtual financial advisor is responsive to my needs, and (ii) My virtual financial advisor is attentive to my needs. Participants rate these statements on five-point scales with endpoints *Not at All* (1) and *Completely* (5). We intentionally exclude the investment-related dependent measures from Experiment 1 to eliminate the potential for carryover effects (Asay et al. 2022).

Participants

One hundred eighty-six undergraduate business students from the same population drawn from in Experiment 1 complete our second experiment in exchange for extra credit in a course of their choosing.[9] Participants are, on average, 19.92 years old and are either currently enrolled in or have previously taken an average of 0.90 accounting courses and 1.02 finance courses. Fifty-one percent of participants have previously invested in the stock market and 95 percent plan to invest in the stock market in the future. Forty-nine percent of participants identify as male and 89 percent indicate English as their first language. Concerning the effectiveness of our

[9] In our post-experiment questionnaire, we ask participants to indicate whether they have previously participated in a version of our study. We exclude 66 participants who indicate that they have either already participated in a version of our study or that they cannot recall and retain the remaining 186 participants who affirm that they have not already participated in a version of our study.

manipulations, we find that 85 percent of participants correctly identify their VFA's gender and 96 percent correctly indicate whether their VFA interacts orally or via written text. Inferences are robust to the exclusion of participants who fail either manipulation check question or who fail a separate attention check.[10]

Results

The two measures of perceived VFA responsiveness are internally consistent ($\alpha = 0.87$), so we average them to create one variable, *Responsiveness*. Table 2, Panel A reports descriptive statistics of *Responsiveness* and Figure 2 graphically displays the means of *Responsiveness* by condition. Panel B reports results of a 2 x 2 (*Interaction Mode* x *Gender Expression*) ANOVA with *Responsiveness* as the dependent variable, and Panel C reports simple effects tests.

Recall that we conduct Experiment 2 to verify that investors in our setting perceive the female VFA that interacts orally as being more responsive to their needs than the other VFAs. To that end, we expect to show that *Responsiveness* is greater in the condition with the female VFA that interacts orally relative to the other three conditions. The ANOVA model is significant ($F_{(3, 182)} = 2.20$, $p = 0.09$), suggesting some differences in *Responsiveness* across conditions. Because we expect *Responsiveness* to be greater in one particular condition versus the other three conditions, we turn to the relevant simple effects tests despite no statistically significant interaction ($F_{(1, 182)} = 1.00$, $p = 0.32$). The simple effects tests in Panel C suggest that participants indeed perceive the female VFA that interacts orally as being most responsive to their needs. In particular, participants report that the female VFA that interacts orally is more responsive to their investment needs than any of the other three VFAs (all $F_{(1, 182)} >= 2.14$, all $p < 0.07$, one-tailed).

[10] To assess participants' attentiveness, we present participants with a five-point scale with endpoints *Not at All* (1) and *Completely* (5) and ask participants to select the midpoint (3) if they are paying attention. All but one participant selects the midpoint.

Overall, results of Experiment 2 suggest that investors perceive the female VFA that interacts orally as being most responsive to their needs.

Experiment 3

We design our third experiment to provide convergent evidence that a VFA's oral expressions amplify the impact of gender-based responsiveness stereotypes favoring females. To do so, we introduce an experimental manipulation likely to limit participants' tendency to favor the female VFA that interacts orally *if* a difference in perceived responsiveness underlies this tendency. Specifically, we manipulate the presence of unambiguous, positive cues of the VFA's responsiveness because we expect participants to be less inclined to rely on ambiguous cues of responsiveness, such as gender, when unambiguous cues of responsiveness are present. Thus, if investors are indeed relatively more willing to rely on the female VFA that interacts orally because they perceive this VFA as being more responsive to their needs, the presence of unambiguous, positive cues of the VFA's responsiveness should limit this tendency. Hence, we expect participants to favor the female VFA that interacts orally to a lesser extent when responsiveness cues are present, as measured by their willingness to rely on their VFA.

Design

Experiment 3 has a 2 x 2 between-participants design, with VFA's gender expression (female, male) and responsiveness cues (cues absent, cues present) as manipulated, independent variables. Each VFA interacts orally such that the gendered VFAs in this experiment are identical to the gendered VFAs in the oral interaction mode conditions of Experiments 1 and 2. Also as in the prior experiments, we manipulate the VFA's gender expression by using female or male gendered pronouns to reference the VFA within the information we present to participants.

We manipulate responsiveness cues by varying the presence of unambiguous, positive cues of the VFA's responsiveness. In the cues present condition, we add the following excerpts to our introductory materials: "This virtual financial advisor is specifically designed to be exceptionally responsive to the unique needs of each client," and "Recall that you have been assigned a virtual financial advisor who is exceptionally responsive to the unique needs of each client." In the cues absent condition, we do not add these excerpts. Except for the additional excerpts in the cues present condition, participants in Experiment 3 view the same introductory materials as participants in Experiments 1 and 2.

After participants view the introductory materials, participants proceed to interact with their VFA. The VFA's correspondence with participants (i.e., the introductory message, questions, and investment recommendation) is identical to that of our prior experiments (see Figure 1). Once participants receive the VFA's recommendation, participants respond to questions about their willingness to rely on the VFA's recommendation (as in Experiment 1). Participants then respond to two manipulation checks and provide demographic information.

Participants

Two hundred seventy-two undergraduate business students from the same population drawn from in Experiments 1 and 2 complete our experiment in exchange for extra credit in a course of their choosing.[11] Participants complete our study in the same controlled laboratory setting as our prior experiments. Participants are, on average, 19.58 years old and are either currently enrolled in or have previously taken an average of 1.45 accounting courses and 0.70

[11] In our post-experiment questionnaire, we ask participants to indicate whether they have previously participated in a version of our study. We exclude 40 participants who indicate either that they have already participated in a version of our study or that they cannot recall and retain the remaining 272 participants who affirm that they have not already participated in a version of our study.

finance courses. Forty-six percent of participants have previously invested in the stock market and 94 percent plan to invest in the stock market. Forty percent of participants identify as male and 94 percent indicate English as their first language.

Results

Manipulation checks. To assess the effectiveness of our gender manipulation, we ask participants to identify the gender that best describes their VFA. Ninety-four percent of participants correctly identify their VFA's gender, according to experimental condition. To assess the effectiveness of our responsiveness manipulation, we ask participants to indicate which of the following statements is an excerpt from their introductory materials: (i) You have been assigned a virtual financial advisor, or (ii) You have been assigned a virtual financial advisor who is exceptionally responsive to the unique needs of each client. Seventy-three percent of participants correctly identify the statement, according to condition. Inferences are robust to the exclusion of participants who fail either manipulation check question.[12]

Examination of Hypothesis 3. Our third hypothesis states that a VFA's oral expressions amplify the impact of gender-based responsiveness stereotypes favoring females on investor judgments. Experiment 1 results support the theory that oral expressions amplify the impact of VFA gender and Experiment 2 results suggest that investors' willingness to rely on a VFA mirrors their perceptions of the VFA's responsiveness. We conduct Experiment 3 to provide additional, convergent evidence that it is investors' application of a responsiveness stereotype that causes them to respond more favorably to a VFA that interacts orally when it is female. To that end, the following pattern of results would provide this evidence: (i) when responsiveness cues are absent, investors are more willing to rely on a female VFA than a male VFA (replicating

[12] All participants pass a separate attention check.

the results of the identical conditions in Experiment 1), and (ii) when responsiveness cues are present, the extent to which investors favor the female VFA over the male VFA decreases.

As in Experiment 1, we create one variable, *Reliance*, by averaging participants' responses to: (i) Are your feelings towards UPK's stock as a potential investment generally more positive or more negative?, and (ii) How willing are you to invest in UPK stock? ($\alpha = 0.78$). Table 3, Panel A reports descriptive statistics of *Reliance* and Figure 4 graphically displays means of *Reliance* by experimental condition. Table 3, Panel B reports results of a 2 x 2 (*Responsiveness Cues* x *Gender Expression*) ANOVA with *Reliance* as the dependent variable and Table 3, Panel C reports follow-up simple effect tests. Results reveal a statistically significant *Responsiveness Cues* x *Gender Expression* interaction effect ($F_{(1, 268)} = 3.07$, $p = 0.08$), suggesting that the effect of a VFA's gender expression on investors' willingness to rely on the VFA's advice depends on whether unambiguous responsiveness cues are present.

Follow-up simple effects reveal that the nature of the interaction is consistent with expectations. In particular, we find that when responsiveness cues are absent, participants are more willing to rely on a female VFA than a male VFA ($F_{(1, 268)} = 3.43$, $p = 0.03$, one-tailed). In contrast, when responsiveness cues are present, we find no statistically significant difference in participants' willingness to rely on the female versus male VFA ($F_{(1, 268)} = 0.36$, $p = 0.55$). Further, we find that participants are more willing to rely on the male VFA when responsiveness cues are present versus absent ($F_{(1, 268)} = 5.29$, $p = 0.01$, one-tailed) and equally as willing to rely on the female VFA when responsiveness cues are present versus absent ($F_{(1, 268)} = 0.03$, $p = 0.87$). Collectively, results from our three experiments support Hypotheses 1 and 3, suggesting that VFAs' oral expressions exacerbate investors' application of gender stereotypes relative to

written expressions—particularly the stereotype that females are more responsive than males to others' needs.

VI. CONCLUSION

We conduct three experiments to examine how a VFA's interaction mode affects the relevance of gender stereotypes for investors' reliance on a VFA's investment advice. In our first experiment, we predict and find that investors' sensitivity to VFA gender is greater when a VFA interacts orally versus via written text. However, we do not find support for our prediction that a VFA's oral expressions amplify the impact of gender-based credibility stereotypes favoring males. Instead, results suggest that VFAs' oral expressions exacerbate investors' application of a gender stereotype that is unrelated to credibility and favors females. We conduct two additional experiments to examine an alternative hypothesis—VFA's oral expressions amplify the impact of gender-based *responsiveness* stereotypes favoring *females*. In our second experiment, we find that participants believe the VFA that presents as female and interacts orally is most responsive to their investment needs. Our third experiment provides convergent evidence that relative to VFAs' written expressions, VFAs' oral expressions exacerbate investors' application of the stereotype that females are more responsive to others' needs than males.

Our study is the first to document how investors respond to a VFA's interaction mode and gender expression. In doing so, we inform the SEC and FINRA on two prominent digital engagement practices or design elements—VFA's interaction mode and gender expression—that likely affect investor judgments despite being normatively irrelevant. Our findings also inform wealth management firms on how their VFA's interaction mode and gender expression could affect their clients. We also contribute to the accounting literature by documenting that

humanization is a multi-dimensional construct that is capable of evoking gender stereotypes and affecting investors' reliance on robo-advisors.

As with all research, our research is subject to limitations. We select a female voice and a male voice for our VFAs based on pilot participants' subjective assessments of ten different voice recordings. Although we select two voices that were rated similarly on each of the seven attributes we measured, these voices could differ on a relevant dimension that we did not measure. Further, investors who interact with a VFA that is capable of interacting orally could likely choose whether their VFA interacts orally or through written text. We prioritize internal validity by not allowing participants to choose their VFA's interaction mode. Additional research is needed to test the generalizability of the theory supported by our findings. The limitations of our study offer interesting avenues for future research.

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FIGURE 1
Interaction Between Participants and a Simulated Virtual Financial Advisor

1. Hello, I am a virtual financial advisor. Before I provide an investment recommendation to you, please answer a few questions so that I can better understand your investment preferences. After you answer each question, please select the 'next' arrow.

2. Let's get started. Of the options below, which best describes your primary financial goal?
   - Options: Wealth preservation, Retirement planning, Wealth accumulation

3. Great. What is the time frame in which you hope to achieve your financial goal?
   - Options: 0 - 4 years, 5 - 9 years, 10 years or longer

4. To help me understand your tolerance for investment risk, what would you do if your portfolio lost 10% of its value in a month due to a market decline?
   - Options: Sell all of my investments, Sell some, Keep all, Buy more

5. Thank you. Based on my review of market and business data, I recommend that you invest in UPK Home Improvement Company. In my opinion, UPK is a stock that is poised for strong performance. For your convenience, please see below for more information about UPK.

UPK Home Improvement Company

About

UPK Home Improvement Co. (UPK) is a specialty retailer engaged in selling home improvement products. The company's product portfolio includes appliances, tools, patio furniture, paint, and more. UPK serves a loyal customer base of both general retail customers and specialty construction contractors. UPK offers well-known brands such as Maytag, Milwaukee Tool, Weber, Sherwin-Williams, and John-Deere. In addition, UPK offers popular and profitable private brand labels.

Income Statement	**Year Ended**		
	Recent	**1 Year Ago**	**2 Years Ago**
Sales Revenue	$480M	$470M	$452M
Expenses			
Cost of Goods Sold	$290M	$287M	$276M
General and Administrative	$95M	$94M	$90M
Other Expenses	$15M	$14M	$13M
Net Income	$80M	$75M	$73M

Stock Performance	**Year Ended**		
	Recent	**1 Year Ago**	**2 Years Ago**
Shares Outstanding	146M	146M	146M
Stock Price	$13.75	$14.04	$12.50
Earnings Per Share	$0.55	$0.51	$0.50

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Figure 1 presents the messages communicated by the VFA to participants in Experiments 1-3.

FIGURE 2
Experiment 1 Results - Willingness to Rely on the VFA's Investment Recommendation

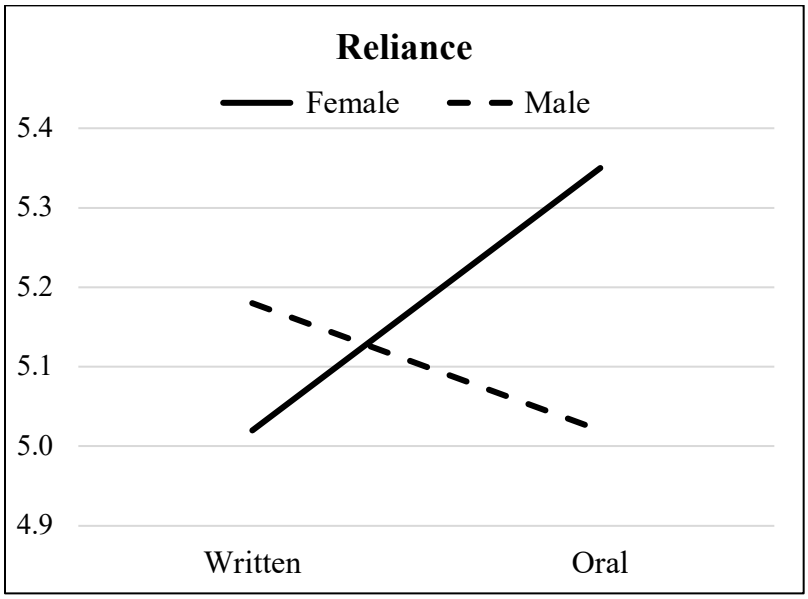

Figure 2 graphically presents the means for participants' investment judgments in Experiment 1. We manipulate *Interaction Mode* (oral, written) by varying whether the VFA interacts orally or via written text. To manipulate *Gender Expression* (female, male), we use gender-specific pronouns when describing the VFA to participants. After interacting with a VFA and receiving the VFA's investment recommendation, participants respond to two questions designed to measure willingness to rely on the VFA's recommendation: (i) Are your feelings towards UPK's stock as a potential investment generally more positive or more negative?, and (ii) How willing are you to invest in UPK stock?. Participants respond to the former question on a seven-point scale with endpoints *Significantly Negative* (1) and *Significantly Positive* (7) and to the latter question on a seven-point scale with endpoints *Very Unwilling* (1) and *Very Willing* (7). We average the two measures ($\alpha = 0.80$) to create one variable, *Reliance*. See Table 1 for related descriptive statistics and analyses.

FIGURE 3
Experiment 2 Results – Perceived Responsiveness of the VFA

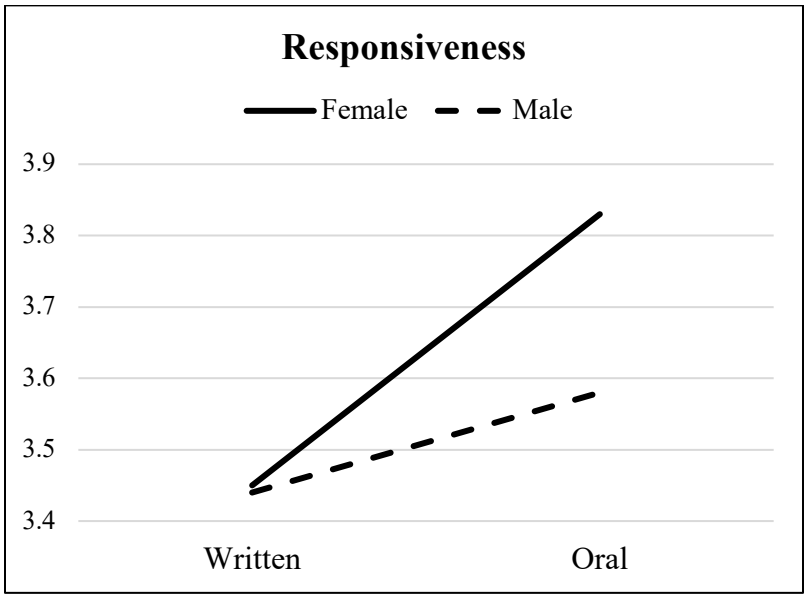

Figure 3 graphically presents the means for participants' perceptions of how responsive the VFA is to their investment needs in Experiment 2. We manipulate *Interaction Mode* (oral, written) by varying whether the VFA interacts orally or via written text. To manipulate *Gender Expression* (female, male), we use gender-specific pronouns when describing the VFA to participants. After interacting with a VFA and receiving the VFA's investment recommendation, participants rate the extent to which the following statements describe their VFA: (i) My virtual financial advisor is responsive to my needs, and (ii) My virtual financial advisor is attentive to my needs. Participants rate these statements on five-point scales with endpoints *Not at All* (1) and *Completely* (5). We average the two measures ($\alpha = 0.87$) to create one variable, *Responsiveness.* See Table 2 for related descriptive statistics and analyses.

FIGURE 4
Experiment 3 Results - Willingness to Rely on the VFA's Investment Recommendation

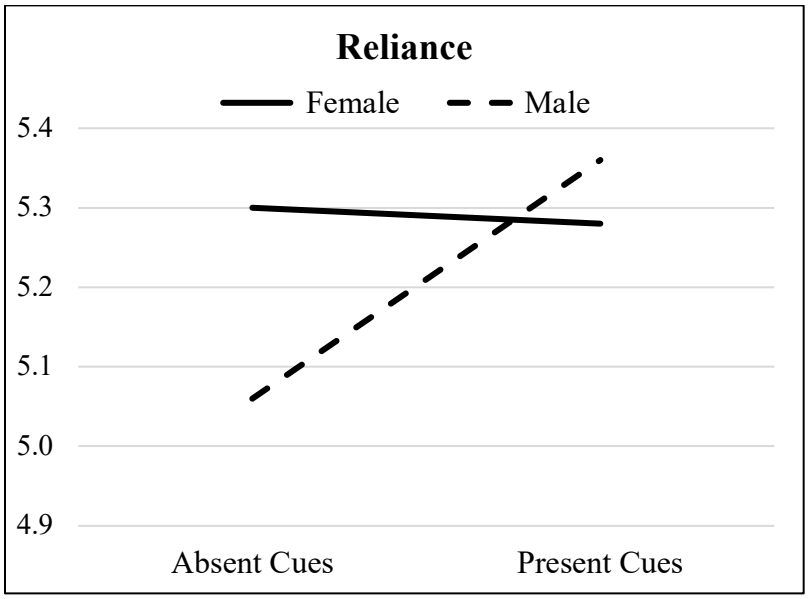

Figure 4 graphically presents the means for participants' investment judgments in Experiment 3. We manipulate *Responsiveness Cues* (absent cues, present cues) by varying whether the description of the VFA includes an additional sentence indicating that the VFA is highly responsive to investors' needs. To manipulate *Gender Expression*, we use gender-specific pronouns when describing the VFA. We hold constant the VFA's interaction mode such that each VFA interacts orally. After interacting with a VFA and receiving the VFA's investment recommendation, participants respond to two questions designed to measure willingness to rely on the VFA's recommendation: (i) Are your feelings towards UPK's stock as a potential investment generally more positive or more negative?, and (ii) How willing are you to invest in UPK stock? Participants respond to the former question on a seven-point scale with endpoints *Significantly Negative* (1) and *Significantly Positive* (7) and to the latter question on a seven-point scale with endpoints *Very Unwilling* (1) and *Very Willing* (7). We average the two measures ($\alpha = 0.78$) to create one variable, *Reliance*. See Table 3 for related descriptive statistics and analyses.

TABLE 1

Experiment 1 Results – Willingness to Rely on the VFA's Recommendation

Panel A: Descriptive Statistics for *Reliance*, mean (standard deviation), *n* = 328

	Interaction Mode		
Gender Expression	Written	Oral	Row Means
Female	5.02 (0.89) *n* = 82	5.35 (0.77) *n* = 84	5.19 (0.85) *n* = 166
Male	5.18 (0.75) *n* = 82	5.02 (0.84) *n* = 80	5.10 (0.80) *n* = 162
Column Means	5.10 (0.83) *n* = 164	5.19 (0.82) *n* = 164	

Panel B: Analysis of Variance (ANOVA) – Dependent Variable is *Reliance*

Source of Variation	df	*F*-Statistic	*p*-Value
Interaction Mode	1	0.94	0.33
Gender Expression	1	0.93	0.34
Interaction Mode x Gender Expression	1	7.48	< 0.01
Error	324		

Panel C: Simple Effects Tests

Source of Variation	df	*F*-Statistic	*p*-Value
Female Oral vs. *Female Written*	1	6.91	0.01
Male Oral vs. *Male Written*	1	1.52	0.22
Female Oral vs. *Male Oral*	1	6.81	0.01
Female Written vs. *Male Written*	1	1.55	0.21

Table 1 presents results for participants' investment judgments in Experiment 1. We manipulate *Interaction Mode* by varying whether the VFA interacts orally or via written text. To manipulate *Gender Expression*, we use gender-specific pronouns when describing the VFA to participants. Participants respond to two questions designed to measure willingness to rely on the VFA's recommendation: (i) Are your feelings towards UPK's stock as a potential investment generally more positive or more negative?, and (ii) How willing are you to invest in UPK stock? Participants respond to the former question on a seven-point scale with endpoints *Significantly Negative* (1) and *Significantly Positive* (7) and to the latter question on a seven-point scale with endpoints *Very Unwilling* (1) and *Very Willing* (7). We average the two measures ($\alpha = 0.80$) to create one variable, *Reliance.* Panel A presents descriptive statistics for *Reliance* by condition. Panel B presents a 2 x 2 ANOVA with *Interaction Mode* and *Gender Expression* as the independent variables and *Reliance* as the dependent variable. Panel C presents simple effects tests. All *p*-values are two-tailed.

TABLE 2

Experiment 2 Results – Perceived Responsiveness of the VFA

Panel A: Descriptive Statistics for *Responsiveness*, mean (standard deviation), $n = 186$

	Interaction Mode		
Gender Expression	Written	Oral	Row Means
Female	3.45 (0.86) $n = 51$	3.83 (0.84) $n = 46$	3.63 (0.86) $n = 97$
Male	3.44 (0.77) $n = 43$	3.58 (0.81) $n = 46$	3.51 (0.79) $n = 89$
Column Means	3.45 (0.81) $n = 94$	3.70 (0.83) $n = 92$	

Panel B: Analysis of Variance (ANOVA) – Dependent Variable is *Responsiveness*

Source of Variation	df	*F*-Statistic	*p*-Value
Interaction Mode	1	4.45	0.04
Gender Expression	1	1.15	0.28
Interaction Mode x Gender Expression	1	1.00	0.32
Error	182		

Panel C: Simple Effects Tests

Source of Variation	df	*F*-Statistic	*p*-Value
Female Oral vs. *Female Written*	1	5.04	0.01†
Female Oral vs. *Male Written*	1	4.88	0.01†
Female Oral vs. *Male Oral*	1	2.14	0.07†

Table 2 presents results for participants' perceptions of the responsiveness of the VFA in Experiment 2. We manipulate *Interaction Mode* by varying whether the VFA interacts orally or via written text. To manipulate *Gender Expression*, we use gender-specific pronouns when describing the VFA. After interacting with a VFA and receiving the VFA's investment recommendation, participants rate the extent to which the following statements describe their VFA: (i) My virtual financial advisor is responsive to my needs, and (ii) My virtual financial advisor is attentive to my needs. Participants rate these statements on five-point scales with endpoints *Not at All* (1) and *Completely* (5). We average the two measures ($\alpha = 0.87$) to create one variable, *Responsiveness.* Panel A presents descriptive statistics for *Responsiveness* by condition. Panel B presents a 2 x 2 ANOVA with *Interaction Mode* and *Gender Expression* as the independent variables and *Responsiveness* as the dependent variable. Panel C presents simple effects tests. † *p*-values are one-tailed for directional predictions.

TABLE 3

Experiment 3 Results – Willingness to Rely on the VFA's Recommendation

Panel A: Descriptive Statistics for *Reliance*, mean (standard deviation), *n* = 272

	Responsiveness Cues		
Gender Expression	Cues Absent	Cues Present	Row Means
Female	5.30 (0.64) *n* = 66	5.28 (0.67) *n* = 71	5.29 (0.65) *n* = 137
Male	5.06 (0.93) *n* = 65	5.36 (0.71) *n* = 70	5.21 (0.84) *n* = 135
Column Means	5.18 (0.80) *n* = 131	5.32 (0.69) *n* = 141	

Panel B: Analysis of Variance (ANOVA) – Dependent Variable is *Reliance*

Source of Variation	df	*F*-Statistic	*p*-Value
Responsiveness Cues	1	2.30	0.13
Gender Expression	1	0.84	0.36
Responsiveness Cues x Gender Expression	1	3.07	0.08
Error	268		

Panel C: Simple Effects Tests

Source of Variation	df	*F*-Statistic	*p*-Value
Responsiveness Cues given Female	1	0.03	0.87
Responsiveness Cues given Male	1	5.29	0.01†
Gender Expression given Cues Absent	1	3.43	0.03†
Gender Expression given Cues Present	1	0.36	0.55

Table 3 presents results for participants' investment judgments in Experiment 3. We manipulate *Responsiveness Cues* by varying whether the description of the VFA includes a sentence indicating that the VFA is highly responsive to investors' needs. To manipulate *Gender Expression*, we use gendered pronouns when describing the VFA. We hold constant interaction mode, with each VFA interacting orally. Participants respond to two questions designed to measure willingness to rely on the VFA's recommendation: (i) Are your feelings towards UPK's stock as a potential investment generally more positive or more negative?, and (ii) How willing are you to invest in UPK stock? Participants respond to the former question on a seven-point scale with endpoints *Significantly Negative* (1) and *Significantly Positive* (7) and to the latter on a seven-point scale with endpoints *Very Unwilling* (1) and *Very Willing* (7). We average the measures ($\alpha = 0.78$) to create a variable, *Reliance.* Panel A presents descriptive statistics for *Reliance* by condition. Panel B presents a 2 x 2 ANOVA with *Responsiveness Cues* and *Gender Expression* as the independent variables and *Reliance* as the dependent variable. Panel C presents simple effects tests. † *p*-values are one-tailed for directional predictions.