

“Uncertainty and the Effects of Gender, Technical Background,  
and Social Capital on Venture Capital Evaluations”

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**Abstract**

Women remain under-represented in the upper echelons of most high-status work environments. In this study, we demonstrate how supply-side characteristics work in tandem with cultural beliefs about gender to influence the evaluative process that underlies venture capital decisions made in high-growth, high-tech entrepreneurship. Using an experimental design, we simulate funding decisions by venture capitalists (VCs) for men and women entrepreneurs that differ in technical background and social capital. We suggest that gender becomes relevant to evaluation under conditions of greater uncertainty. We find that the gender of the entrepreneur influences evaluations most when the person, rather than the venture, is the target of evaluation. Technical background qualifications moderate the influence of gendered expectations, and women receive more of a payoff than men from having a close contact to the evaluating VC. We discuss the implications for future research on gender and work.

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Women's continued under-representation in the upper echelons of most high-status work environments constitutes a significant stall in progress towards gender equality. Research on workplace inequality often focuses on supply-side disparities in the human and social capital, or demand-side differences in employer's expectations and behaviors. In this study, we demonstrate how supply-side characteristics work in tandem with cultural beliefs about gender to influence the evaluative process that underlies venture capital decisions made in high-growth, high-tech entrepreneurship.

A long history of social science research examines gender disparities among scientists in career attainment, productivity, and attrition (Long and Fox 1995; Xie and Shauman 2005; Long 2001). Focusing primarily on academic scientists, this work finds substantial gaps between women and men at each level of commercial and entrepreneurial activity (Ding, Murray and Stuart 2006; Lowe and Gonzalez Brambila 2005; Thursby and Thursby 2005; Whittington and Smith-Doerr 2005, 2008). Beyond the academy, gender stratification in entrepreneurship is also prevalent (Reynolds et al. 2004). Research on high tech entrepreneurs finds that women founded only 3% of technology firms and 1% of high-tech firms between 2004 and 2007 (Robb and Coleman 2009). In addition, women entrepreneurs are less likely than men to acquire venture capital. An extensive study of high-tech entrepreneurs in 2001 reveals that only 5% of venture capital investments went to women-owned high-tech firms (Brush et al. 2001).

With respect to this gender gap in venture capital allocation, some supply-side arguments suggest that women entrepreneurs may lack the human capital (e.g., technical background) that venture capitalists typically look for, and/or the social networks necessary for obtaining access to investors (see Robb and Coleman 2009 for a review). Yet women and men may not necessarily receive the same returns on their credentials. Rather, women's differential participation may stem from complex interactions between supply- (e.g., human and social capital) and demand-side (e.g., opportunities to participate) influences in the high-tech industry (Murray and Graham 2007; Stephan and El-Gainainy 2007). Research shows that gendered practices infuse the structural organization of work (Acker 1989; Whittington and Smith-Doerr 2008), the physical embodiment of workers in jobs (Acker 1990; Britton 2000), and the expectations that define the ideal worker (Kelly et al. 2010; Benard and Correll 2010), scientist and engineer (Long and Fox 1995; Wajcman 2010) and entrepreneur (Gupta, Turban and Bhawe 2008; Thébaud 2010).

Gender appears to provide a background from which evaluators make decisions about employees and candidates.

In this study, we ascertain how gender might influence evaluations in the venture capital context of high-growth, high-tech entrepreneurship. While the focus on decision-making at the workplace is often on a single endpoint, e.g., point of hire or promotion, evaluative behavior often involves myriad assessments by work superiors or job gatekeepers. Just as employers may evaluate candidates' work experiences and also their "fit" with the workplace, VCs may consider the marketability of the product and also the capabilities of the entrepreneur. At the same time, some social psychological research suggests that the extent to which gendered expectations influence decisions depends on the level of uncertainty that accompanies the evaluation being made (see, for example, Heilman, Block and Stathatos 1997; Heilman, et al. 2004). Drawing from this perspective, we compare and contrast evaluations of the entrepreneur and evaluations of the venture, two dimensions of the evaluative process that have been shown to invoke different levels of uncertainty among venture capitalists (Kollmann and Kuckertz 2010). Specifically, we explore how the contingent effects of supply-side factors and gendered expectations may differ across these two dimensions of venture capital evaluations. By focusing on the multi-faceted nature of the evaluative process, we can better understand the circumstances in which gender bias impact decision-making in the venture capital context.

We conceptualize the VC process in response to exploratory interviews and focus groups with venture capitalists in Silicon Valley. We use an experimental design to see 1) whether having the "right" credentials matter differently for women and men entrepreneurs; 2) whether having social ties to the investor influences the evaluations of women and men entrepreneurs differently; and 3) whether gender effects, if found, differ in strength depending on what is being evaluated (the venture or the entrepreneur). We focus on the initial stage of the VC process, when business plans are first seen and screened – an important point of access for entrepreneurs. Our findings reveal that decision-making arises through complex interactions between general beliefs about gender and the level of uncertainty under which evaluations are made.

## **BACKGROUND AND FRAMEWORK**

There is much research demonstrating the impact of gender beliefs on expectations and behaviors. Studies show that contemporary cultural beliefs in the U.S. describe men as generally

more competent than women in tasks with the highest social value, especially if they require traits such as agency and instrumentality (Fiske et al. 2002; Spence and Buckner 2000). These beliefs have power because, as explained by expectation states theory (Berger et al. 1977), in situations where gender is salient, cultural beliefs about gender will influence what individuals expect from each other and how individuals behave. Empirical research shows, for instance, that men exercise more influence and are assessed as more competent when given a masculine-typed or gender-neutral task, while women garner more status and assessed competence when given a feminine-typed task (Dovidio et al. 1988). Importantly, gender beliefs may affect behavior even when men and women consciously endorse gender equality and are motivated to behave in unbiased ways, simply because people are aware that *others* believe men are generally more competent than women (Ridgeway and Correll 2004). In the venture capital context, for example, if the venture capitalist personally believes that a female entrepreneur is a good candidate for CEO, the fact that *most* people don't think women are as competent as men in this position may still bias the VC's evaluation.

Additionally, research shows that status-based expectations, under certain conditions, create double standards for competence (see Foschi 2000). Whereas men's success at a male-typed task reinforces beliefs in their competence, women's success appears inconsistent with performance expectations and is often attributed to factors such as luck. Even when evaluators perceive a woman and a man to have performed equally well in the past, they may still expect men to have higher ability than women (Wagner, Ford and Ford 1986). Meanwhile, failure confirms expectations for women, but not for men. A double standard hence emerges, as women must demonstrate greater success and make fewer errors in order to be seen as equally competent as men. Support from this theory has emerged from studies of both experimental (e.g., Biernat and Fuegen 2001) and non-experimental designs (e.g., Lyness and Heilman 2006).

The venture capital industry is one where, above all, good ideas are emphasized, and investment decisions are more or less perceived to be gender-blind (Brush et al. 2006). However, recent research indicates that perceptions of meritocracy in an occupational culture can actually obscure (Castilla 2008) and even encourage gender-biased decision-making (Castilla and Benard 2010). Further, the industry is one in which we might expect gender to be highly relevant since high-tech entrepreneurship is a stereotypically masculine career in Western society (Lewis 2006; Wajcman 2010), and cultural beliefs hold masculine characteristics to be essential for successful

entrepreneurship (Gupta, Turban and Bhawe 2008; Thébaud 2010). We can expect, then, that gender bias plays a role in how male and female entrepreneurs are evaluated in the venture capital process.

At the same time, we consider research on the conditions that may hinder or facilitate the influence of gendered assumptions on the evaluative process. As Ridgeway (2009) explains, while culturally shared gender beliefs provide guidelines for how to act, they provide only abstract and diffuse instructions, and how gender stereotypes influence judgments and behaviors depends on the particular situation at hand (Ridgeway 2009; 2011). Specific to the workplace, an important aspect that may be central to gender's impact on decision-making is the level of uncertainty associated with the evaluation being made. In their study of affirmative action stigma, Heilman, Block and Stathatos (1997) found that in the context of male-typed jobs, women identified as beneficiaries of affirmative action were evaluated as less competent than men in the absence of performance information about them, but not when there was information about their performance success. Likewise, Foddy and Smithson (1999) found that for a male-typed task, people expect men to outperform women when there is no information on prior performance information, but not when there is explicit evidence of performance success. The implication, therefore, is that stereotypes affect evaluative behavior most when performance information is ambiguous. In a similar vein, in her study of promotions in law firms, Gorman (2006) found that work uncertainty increases reliance on gender as a source of inference about a candidate's ability. When the tasks and strategies necessary for success are uncertain, a candidate's past performance becomes a less useful indicator of ability, while gender becomes more relevant. Thus, when a firm's work involves greater uncertainty, the firm is less likely to promote women to partnership.

Following the empirical evidence above, we suggest that the relevance of gender to the venture capital evaluative context may turn on the level of uncertainty in the decision at hand. Below, we discuss our hypotheses first regarding the role of uncertainty in moderating the effects of gender on evaluations of the entrepreneur and venture, and second the role of gender in moderating the effects of human and social capital on evaluation outcomes.

### **Uncertainty and Evaluations of the Entrepreneur vs. the Venture**

Although decision-making in the workplace may ultimately rest on single action points such as the point of hire or promotion, work superiors and job gatekeepers often formulate multiple assessments when making these decisions. For instance, employers may consider whether a candidate for hire or promotion has produced consistent results, while also considering whether the candidate has the ability to perform well on future tasks. Likewise, empirical research on VC decision-making reveals VC assessment criteria to involve not only the assumed qualities of the proposed venture (e.g., uniqueness and marketability of the product), but also the assumed qualities of the entrepreneur (e.g., background qualifications and capabilities) (see Kollmann and Kuckertz 2010 for a review).

As aforementioned, since performance standards in high-tech entrepreneurship advantage masculinity, prior research would suggest that women entrepreneurs will be held to higher standards of competence. However, the level of uncertainty with which venture capitalists make decisions depends on what is being evaluated – specifically, the entrepreneur or the venture. To be sure, making investment decisions is a process fraught with uncertainty (Gompers and Lerner 2000), but some parts of the evaluation process are more uncertain than others. As Kollmann and Kuckertz (2010) found, venture capitalists express a high level of uncertainty when evaluating the entrepreneur’s personal characteristics (e.g., “VC character,” leadership capabilities), but less uncertainty when evaluating the venture itself (e.g., innovativeness, patentability, fit with the firm’s investment strategy). While VCs feel more confident deciding whether a venture is unique and operates in an industry of interest, they find it more difficult to assess the capabilities of the entrepreneur, especially in the early screening phase when evaluations are based solely on business plans (Kollmann and Kuckertz 2010; Smart 1999). Whereas product assessment is more tangible – the VC can read about, assess and situate the product within the industry – entrepreneur’s qualities are much less clear.

The variation in the degree of uncertainty across the two evaluative contexts (evaluating the entrepreneur vs. evaluating the venture) is important given the evidence that uncertainty promotes reliance on cultural stereotypes. Specifically, the difference in the level of uncertainty may result in the venture capitalist relying less on conventional indicators of ability (e.g., education and experience) when assessing the entrepreneur’s personal qualities than when assessing the potential success of the venture. If uncertainty promotes reliance on gender as a

source of inference, it is important to explore both *evaluations of the entrepreneur and evaluations of the venture*.

### **Human and Social Capital Influences**

Widely discussed explanations for gender gaps in high-tech entrepreneurship focus on human and social capital – i.e., women have less success in entrepreneurship because they are less likely than men to have education and experience in technology (Greene et al. 2003; Simard et al. 2008), and/or ties to strategic entrepreneurial networks (Brush et al. 2006). But while human and social capital can be important signals of entrepreneurial knowledge and capabilities, research showing gender differences in the effects of education, experience, and social networks on career outcomes suggests that background characteristics and social capital may be necessary but not sufficient conditions for explaining women’s differential access to venture capital (Burt 1998; Long and Fox 1995; Fox 2001). In the following sections, we posit that variation in the effects of human and social capital may turn on the extent to which such information reduces the level of uncertainty at hand. We ask whether having relevant education and experience, or not having it, confers the same advantage or disadvantage to women and men entrepreneurs; and further, whether having ties to investor networks matter differently for women and men entrepreneurs.

#### *Variations in Human Capital*

We focus on candidates’ human capital as indicated by the presence (or absence) of a technical degree and background. A number of studies found that relevant education and industry experience of the entrepreneur positively predicts venture investment (Smart 1999; Carter et al. 2003) and venture survival and success (Cooper, Gimeno-Gascon and Woo 1994). Further, the more specific an entrepreneur’s human capital is to the venture, the more likely the business will be successful (Cooper, Gimeno-Gascon and Woo 1994; Pennings, Lee and van Witteloostuijn 1998). In this context, technical education and experience are strong predictors of entrepreneurial success (Colombo and Grilli 2005), and having such technical background can therefore signal to investors potential for success.

As was earlier discussed, gender influences judgments and behaviors to the extent that it is salient in a particular situation (Ridgeway 2009; 2011), and gender beliefs can be less

important to performance evaluations when there are measurable qualities, such as human capital, relevant to the task at hand – i.e., when performance information is present. For example, when given explicit information that a candidate for a masculine-typed job achieved high ratings in a past performance review, evaluators rate female and male candidates similarly in terms of competence (Heilman et al. 2004). Indeed, having a technical background may help establish ability for women entrepreneurs: a survey of women business owners in 2000 found that having an advanced degree positively predicts acquisition of equity funding (Carter et al. 2003), and a recent study found that successful women entrepreneurs – those who have founded high-tech companies – are similar to their male peers in their education and experience (Cohon, Wadhwa and Mitchell 2010). Conceivably, the effects of gender are mitigated by the presence of information (such as technical background) that reduces uncertainty. We hence expect that *when a person has task-relevant skills (e.g., a technical background), uncertainty is reduced and gender bias should be a less important factor in decision-making made about the entrepreneur.* We may observe similar evaluations for women and men entrepreneurs who possess technical backgrounds.

By contrast, without a technical degree, performance information remains ambiguous. While not having a technical degree likely decreases any entrepreneur's chance of obtaining favorable VC ratings, women may be more disadvantaged by a lack of credentials than men. Without performance cues such as technical backgrounds, uncertainty is raised and cultural assumptions that women are less competent in technical fields may be reinforced. As Heilman et al. (2004) also found, while male and female candidates receive similar ratings of competence when they both have favorable performance reviews, the female candidate is rated as less competent when there is no such information – i.e., when performance information is unclear. Moreover, when women entrepreneurs appear to have less industry experience, investors may undervalue their existing credentials and experience (Brophy 1992).

Without information that would reduce uncertainty, evaluators may rely on background gender beliefs to make inferences about a woman entrepreneur's ability. Meanwhile, as cultural beliefs assign greater competence in technical and entrepreneurial domains to men, the lack of technical background may not be as disadvantageous to men. Gender may interact with technical background in that having such credentials helps women gain footing with men, while not having them disadvantages women more than men. We thus hypothesize a double standard



*in which not having a technical background constitutes a stronger disadvantage to evaluations of women entrepreneurs than those of men entrepreneurs.*

### *Variations in Social Capital*

In addition to human capital, social capital can also serve as a source of inference for the entrepreneur's potential for success. Research demonstrates that social ties to important others can lead to significant workplace advantages, extending from the point of hire (Petersen, Saporta, and Siedel 2000; Fernandez, Castilla, and Moore 2000) to promotion opportunities (Burt, 1998) to enhanced worker output and creativity (Castilla 2005; Fleming, Mingo, and Chen 2007). In the venture capital context, research shows that social connections in the industry can help one gain access to and favorable impressions and funding decisions from venture capitalists (Shane and Cable 2002). Importantly, social ties are also useful to VCs, who may use them to infer the potential of the entrepreneur and the proposed venture. Especially in the early stage of screening business plans, social ties may provide investors with additional information and confidence in the promise of the entrepreneur and venture (Shane and Cable 2002).

We ask whether women and men receive similar or differential compensation for the same type of tie to their evaluators. Women's limited access to influential mentor and career networks is posited to be an important reason for their differential gains in career opportunities and attainment in technical work settings (Long and Fox 1995; Etzkowitz et al. 2000; Long 2001). Research suggests that the origins of gender differences in networks are largely structural – that is, women and men with similar occupations, education, and organizational rank tend to have comparable network positions and locations (Brass 1985; Ibarra 1992; Moore 1990). However, research also reveals a greater ability among men to leverage credentials (e.g. hierarchical rank, existing network contacts, educational degrees) into centralized network positions, and that women are often excluded from the most resourceful networks despite their career location (Miller, Lincoln, and Olson 1981; Miller 1986; Ibarra 1992). Furthermore, some studies suggest gender differences in the rewards for social capital (Ibarra 1997; Burt 1998). For example, Burt (1998) finds that women are more likely to be promoted when in possession of many close, strong ties to superiors rather than diverse, weak ties from which men typically benefit. The implication is that close ties provide a sense of legitimacy to women's ability to assume leadership positions. While there is considerable suggestive evidence to support this

implication, there has been no experimental test in the literature to show that women being evaluated for leadership positions or promotions benefit more than men from close ties.

Having a tie that can vouch for the entrepreneur may increase VC confidence in an entrepreneur's ability and potential, mitigating the level of uncertainty in the funding decision at hand. Moreover, in the high-tech entrepreneurial context where women's capabilities may already be influenced by gendered assumptions, the kind of familiarity bred in networks may reduce gender bias to women entrepreneurs who may otherwise seem less suitable than men with similar characteristics (Flynn and Anderson n.d.). While both men and women may benefit from social capital, we expect that *having a social tie to the venture capitalist is more important for evaluations of women entrepreneurs than for evaluations of men entrepreneurs.*

## **DATA AND METHODS**

To summarize, we explore how gender affects evaluations of the entrepreneur and evaluations of the venture, and hypothesize that evaluations arise from interactions of gender with technical background and social ties. To assess these hypotheses, we use an experimental design as aided by exploratory qualitative research on the venture capital process. We describe the experimental approach of this study below.

### **Study Overview**

We interviewed and conducted focus groups with Silicon Valley entrepreneurs and venture capitalists in 2006 to understand the VC funding process. These conversations focused on the process by which evaluative decisions are made about prospective entrepreneurs, informing the experimental manipulation and the questions that constituted participant's evaluations of the entrepreneur and venture. The VCs we spoke with indicated strict parameters in their investment strategies; they screen many business proposals and invest in very few companies each year (about 10 out of 1,000 proposals). Further, initial investments in portfolio companies range from approximately \$500,000 to \$15 million (Zacharakis and Meyer 2000). To test our hypotheses, we employed a vignette design in which study participants evaluated an executive summary of a business plan for a mobile communications platform. Participants were randomly assigned to one of four conditions in which we crossed the entrepreneur's sex (male or female as indicated by the entrepreneur's name – David or Amy) with his or her technical

background (history major with no software engineering work experience or computer science major with some software engineering experience).<sup>1</sup> The executive summary was identical across all four conditions. After reading the executive summary, participants evaluated the entrepreneur and the venture on a number of measures, and were asked questions about the influence of having social ties to the entrepreneur on their decision-making.

## **Participants**

Participants were male Masters of Business (MBA) students recruited from the Stanford Graduate School of Business Entrepreneur Club to complete an online survey.<sup>2</sup> MBA clubs of this sort are a highly competitive group; more than just representing students who display interest in a particular topic, they serve as venues for targeted training and for sharing industry-specific knowledge. All of the participants, by virtue of their membership, had received training in the process of obtaining VC funding and access to Silicon Valley VC networks, and additionally, about half of our sample indicated direct personal experience with VC funding. The members also displayed comparable backgrounds to VCs in the high-tech arena. A 2008 survey of VCs found that 86% are male, 36% earned technical degrees, 28% began their careers as entrepreneurs, and 42% graduated from Harvard, Stanford, University of Pennsylvania, Duke, and MIT (NVCA 2008). The mean age of participants was 29 years. Fifty-four percent had undergraduate degrees in science or engineering, 45% had experience seeking venture capital, and 14% had worked in a VC firm.

Club members were first randomly assigned to one of our four conditions and recruited through an email disbursed by the president of the club. They were offered up to \$15 and an opportunity to win a \$250 gift card in exchange for their participation. Our final sample has 114 males with a cell size per condition of 43 in the male tech, 18 in the male non-tech, 29 in the female tech, and 24 in the female non-tech conditions.

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<sup>1</sup> Hereafter, male or female “tech” refers to a male or female computer science major, respectively, while male or female “non-tech” refers to a male or female history major, respectively.

<sup>2</sup> We were unable to recruit enough female entrepreneur club members to reach an adequate sample size to statistically control for this group, but hope that future research examines differences in women’s and men’s decision-making. Nonetheless, our sample is fairly reflective of the notable gender imbalance in the VC industry. While the NVCA (2008) reports that 86% of VCs are men, this number underestimates the proportion of men who make funding decisions since managing directors and general partners, who are almost all men, make the funding decisions.

## Procedure

We sent an introductory email to all members of the Entrepreneur Club inviting them to participate in a study about decision-making processes behind recognizing talent. Participants were told the researchers had collected business plans reviewed by at least one Silicon Valley VC firm and some of the business plans secured venture funding, and a few had become successful companies. Participants were asked to evaluate one business plan by reading an executive summary of the plan and completing an online questionnaire. Participants were informed that they would receive 3 times the pay (\$15 instead of \$5) if their evaluation matched that of top Silicon Valley VCs. In reality, all participants read the same business plan and were paid the same amount. This deception was important for reducing the tendency of participants to appear non-sexist and give artificially high evaluations of the female entrepreneur.<sup>3</sup> Since the incentive motivates participants to behave like real VCs, we are not measuring participants' personal beliefs as much as approximating how they would behave if they were a VC calculating real financial risks. Research has shown that people take into account how others would behave when determining their own course of action and that the social validity of others' beliefs influences their own willingness to act according to status beliefs (Berger, Ridgeway, and Zelditch, 2002; Seachrist and Sangor, 2001). Thus, by financially motivating participants to evaluate the entrepreneurs as they think top VCs would, we better approximate how VCs would behave.

The executive summary was taken from an actual mobile communications start-up company that had recently secured \$6 million in VC investments after \$1 million in angel investment. By presenting participants with information about a recently funded venture (though participants were not informed that it had received the funding), we placed them in a position of evaluating a company that had many of the characteristics of a promising company. The executive summary provided unambiguous information that the entrepreneur and the venture were promising, but given high competition for funding, we still expected considerable variation in evaluations of the founder and his/her company. The company name and entrepreneur biography were changed to insure that participants did not recognize the company. The business

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<sup>3</sup> Pilot tests with and without the increased pay incentive provided evidence of social desirability effects; when participants had a stake in the outcome, evaluations of the female versus male entrepreneurs were less positive.

summary included information on the technology, competition, marketing approach, and entrepreneur. The two-page summary also included on the first page the name and educational background of the entrepreneur, the founding date, funding history, total amount sought, and the three-year revenue forecast.<sup>4</sup> In all conditions, the entrepreneur was described as having a Bachelor's degree from the University of Michigan, an MBA from University of California-Berkeley, and a few years of industry experience. Because the high-tech industry tends to provide different job tracks to those with technical degrees versus those without technical degrees (Simard et al., 2008), the entrepreneurs with technical degrees were described as having experience in software engineering and product management, in addition to marketing and sales expertise (described in all conditions).

## **Dependent Measures**

### *Evaluation of the Venture*

To measure evaluations about the *venture's* potential for success, we asked participants, on a 6-point scale, "how unique is the company's product?", "how interested would you be in buying the company's product?", and "how likely would you be to schedule a meeting with the company's founder to learn more about the venture?". We constructed a composite "optimism for the venture" scale of the combined question set by averaging these items ( $\alpha=.70$ ). We also measured the amount participants would invest by asking, "The founder has asked you to be the lead investor. If you agree to be the lead investor, you have the option of investing a majority or a smaller proportion of the total amount being sought. What percentage of the \$6M would you choose to invest?" Investment amount choices ranged on an 11-point scale between 0-100 percent.

### *Evaluation of the Entrepreneur*

We measured evaluations of the *entrepreneur* by focusing on the assumed level of personal authority and leadership capability of the entrepreneur. We assess these impressions with semantic differential scales used in previous status construction experiments (see, for example, Ridgeway et al. 2009). These items are 7-point scales for pairs of words that

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<sup>4</sup> We consulted with venture capitalists and entrepreneurs to make sure that the funding information was believable and indicative of a promising venture.

encompass three dimensions of VCs' impressions of the entrepreneur: (1) status/leadership potential: *powerful/powerless, high status/low status, leader/follower*; (2) competence: *competent/incompetent, knowledgeable/unknowledgeable, capable/incapable*; (3) sociability: *considerate/inconsiderate, pleasant/unpleasant, likable/unlikable, cooperative/uncooperative*.<sup>5</sup> We constructed composite measures of each dimension by averaging these items (status  $\alpha=.60$ ; competence  $\alpha=.63$ ; sociability  $\alpha=.79$ ).<sup>6</sup> Based on our interviews, we also included two industry-specific evaluations of the entrepreneur by asking, "How much confidence do you have in the entrepreneur's ability to manage this start-up's founding team?" and "How much does the founder seem to understand about how to penetrate the market?". Both were measured on a 6-point scale with higher scores indicating a better evaluation of the entrepreneur.

### *Influence of Contacts*

We consider how the presence of valuable social ties influences assessments of both the entrepreneur and the proposed venture. To measure the effect of social ties on VCs' impressions of the *entrepreneur*, respondents were asked to respond to the following on a 6-point scale: "We are interested in whether the ability to recognize talent is influenced by others' opinions. How much would having a trusted colleague who can vouch for the entrepreneur influence your decision-making?" To measure the effect of social capital on evaluations of the *venture*, we asked respondents on a 6-point scale "What if rather than receiving the business summary directly from the founder, you received it and a strong endorsement from your trusted colleague who had been the founder's college roommate? Under these circumstances, how likely would you be to schedule a meeting with the founder to learn more about the company?" The means from this measure are compared to those from the earlier question measuring likelihood to schedule a meeting (without mention of the contact).

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<sup>5</sup> Ridgeway et al. (2009) refers to the "sociability" scale as a measure of considerateness. This measure is theoretically and empirically associated with status; high-status actors tend to be more instrumental and agentic, while low-status actors tend to be more expressive and communal (Berger, Ridgeway and Zelditch 2002). The interdependent relationship between a VC and an entrepreneur may make an affable personality uniquely attractive.

<sup>6</sup> Additional factor and correlation analyses reveal that the data are unidimensional and that the items are positively correlated with each other. Confirmatory factor analyses in Ridgeway et al. (1998) showed that combining status and competence is more parsimonious, but that separating the two dimensions offers a better fit. From a theoretical perspective, since leadership is particularly relevant for a founder's performance and gender stereotypes hold women to be ill-suited for leadership, it was important in this study that we examine the status/leadership dimension separate from competence.

After collecting data on all measures, we asked participants to provide information on various demographic characteristics, including their age, race/ethnicity, college major, experience seeking venture capital, and experience working as a VC. We also included questions designed to confirm that subjects read and recalled the sex and technical background of the entrepreneur.

### **Analytic Approach**

We present mean differences across conditions in the tables and text below. We used the statistical software package, SPSS, to conduct all analyses. To account for the unbalanced design (the unequal cell sizes across conditions), we estimated Type III sum of squares ANOVAs<sup>7</sup>. All significance tests were conducted using 2 (sex of entrepreneur) x 2 (technical background of entrepreneur) ANOVA in which F statistics and significance levels of main effects were calculated while controlling for the other main and interaction effects. To analyze the effect of a social contact on the evaluation of the venture, we employed a 2 (sex of entrepreneur) x 2 (technical background) x 2 (social contact or not) mixed model ANOVA. Where we find significant interaction effects, we conducted simple effects tests to evaluate the significant differences in marginal means (unweighted means that assign no additional weight to cell sizes with larger Ns) across the four conditions. So as not to over-state the meaning behind non-significant findings, we also present effect sizes using Cohen's *d* where appropriate. Effect sizes provide an additional way to assess the magnitude of the condition effects, and can be interpreted according to Cohen's (1988) standards (.2 for small, .5 for moderate, and .8 for large effects). In analyses not presented here, we also estimated OLS regression models to examine the main and interaction effects of sex and technical background while controlling for participant's entrepreneurial experience, college major, VC experience, and age. Since unequal cell sizes can cause collinearity, we also examined variance inflation factors from the regression models and found no evidence of multicollinearity (VIFs < 5). Results from the regression models do not differ substantively from those presented here, and tables are available upon request.

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<sup>7</sup> There is some debate among statisticians about whether unbalanced ANOVAs should be based on Type II or Type III sums of squares (Langsrud 2003). We analyzed the data using both Types II and III and found results to be the same.

## RESULTS

### Bias and Manipulation Checks Analyses

Before testing our hypotheses, we examine whether there were any substantively meaningful biases introduced by the experimental design. Since we randomly assigned participants to conditions before recruitment<sup>8</sup>, we introduced the possibility that the entrepreneur's sex or technical experience unique to each condition could influence participants' willingness to complete the survey after they had viewed the business plan. To examine whether the attrition rate was comparable across conditions, we conducted a chi-square test and found that among those who followed the link to the study, 80% of the participants assigned to the male tech condition completed the survey compared to 51% in the male non-tech condition, 68% in the female tech condition, and 70% in the female non-tech condition ( $p < .01$ ). We suspect that because the cover story promised three times the pay to participants whose evaluations matched that of top VCs, the response rate was biased toward the condition in which uncertainty was minimized. Since a man with a technical degree represents the prototypical entrepreneur, participants in this condition may have been more confident than participants in other conditions about matching the evaluations of top VCs. If our interpretation is correct, this suggests that all else equal, men with technical backgrounds may have an advantage over women and non-tech men in getting attention "over the transom." There may be a layer of gender bias even prior to evaluating the entrepreneur's dossier and business plan.

To examine whether the non-random attrition rate led to substantively different participant samples, we compared participants' age, race/ethnicity, college major, entrepreneurial experience, and VC experience across conditions. The only difference we found was that there were significantly fewer participants with entrepreneurial experience in the female non-technical condition compared with other conditions. To account for any potential bias related to the participants' entrepreneurial experience, all analyses were also conducted using 2 (gender) x 2 (technical background) ANCOVA with entrepreneurial experience as a covariate. Because there

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<sup>8</sup> While randomly assigning participants to conditions after recruitment would have led to more equal cell sizes, difficulty gaining access to the sample, and the small size of the sample from which we recruited made it imperative that we maximize the number of willing subjects by recruiting and offering the link to the survey-experiment in one email.



were no substantive differences between ANCOVA and ANOVA results (they yielded similar F-values and significance levels), we report the more parsimonious ANOVA results.

To insure that participants recalled the sex and technical background of the entrepreneur, we analyzed our manipulation check questions for errors. Of the 146 participants who completed the questionnaire, we eliminated 32 participants who incorrectly recalled the entrepreneur's tech background or sex. To investigate whether the manipulation errors were non-random, we estimated binary logit models in which we regressed the likelihood of making an error on demographic characteristics, controlling for the condition that participants were assigned. We found no significant demographic predictors except that Asian participants were more likely to fail the manipulation check than others. Due to no significant differences in the proportion of Asian participants across conditions, the interpretation of results remains the same. Though it is possible we have failed to measure *all* sources of bias in the sample, our preliminary analyses give us confidence in the study results.

## **Variation in Technical Background and Gender**

### *Evaluations of the Venture*

Tables 1 and 2 report means of 2 (sex) x 2 (technical background) between-subjects ANOVAs on the variables measuring evaluations of the venture and of the entrepreneur, respectively. Consistent with prior evidence showing that uncertainty (and thus, the influence of gender) is lower in evaluations of the venture, we find a main effect of technical background, and neither significant main effect of sex nor significant interaction effect between sex and technical background on rated optimism for the venture or percentage equity participants were willing to invest in the venture. Participants in both male and female tech conditions evaluated the venture more favorably ( $P < .05$ ) and comparisons of effect sizes show that the technical degree effect is considerably larger for females (Cohen's  $d = .73$ ) than it is for males (Cohen's  $d = .38$ ). This suggests that even though evaluation of the venture does not differ by the sex of the entrepreneur, the credibility gains afforded by technical experience may be larger for women than men. As for investment percentage – perhaps the best measure of decision-making – mean investment amounts are significantly higher in the tech than in the non-tech conditions (female Cohen's  $d = .51$ , male Cohen's  $d = .45$ ;  $p < .05$ ). They are also higher in the male than in the female conditions, though this is not significant and small in effect size (tech and non-tech Cohen's

$d=.26$ ; n.s.). Overall, these results show that in the less uncertain context of evaluating the venture, the entrepreneur's training and experience affect evaluations more than the entrepreneur's sex.<sup>9</sup> We discuss the implications, in tandem with the results for the evaluations of the entrepreneur, in more detail below.

[TABLES 1 AND 2 ABOUT HERE]

### *Evaluations of the Entrepreneur*

Prior research suggests that uncertainty is higher for evaluations of the entrepreneur as compared to evaluations of the venture – providing reason to explore whether gender bias plays a more prominent role in evaluations of the entrepreneur. We expected that the presence of a technical background reduces uncertainty such that gender bias would not influence evaluations of the technical entrepreneurs. However, when technical background is absent and prior performance information was more ambiguous, female non-technical entrepreneurs would be evaluated less favorably than male non-technical entrepreneurs. Thus, we hypothesized no significant main effects for the entrepreneur's technical background or sex, but a significant interaction between the two, i.e., the effect of gender varies by technical background.

Consistent with our hypothesis, the two-way interactions are significant for measures of status and ability to penetrate the market ( $p<.05$ ). Simple effects tests (Table 2) show no significant differences between male and female technical entrepreneurs, but show that the male non-tech entrepreneur received on average higher evaluations on both measures than the female non-tech entrepreneur (Cohen's  $d$ 's for status $=.55$ , for ability to penetrate the market $=.50$ ;  $p<.05$ ; one-tailed).<sup>10</sup> Meanwhile, there are no significant effects of the manipulations on rated competence (though there are small to moderate non-significant effects of technical background for both sexes) or the entrepreneur's ability to manage a team.

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<sup>9</sup> In analyses not reported in the paper, we examined whether participants' (gendered) evaluations of the entrepreneur might also influence their evaluation of the venture by estimating multiple regressions that included controls for the entrepreneur's sex along with participants' evaluations of the entrepreneur. While the two evaluative dimensions are correlated, there were no mediating effects. Still, future research could investigate the possibility of *indirect* effects of the venture/entrepreneur evaluative relationship. (i.e. gender may influence (simultaneously) evaluations of the entrepreneur, and indirectly through this, that of the venture as well).

<sup>10</sup> All reported significance tests are two-tailed except for simple effects tests of directional hypotheses, which are one-tailed.

Research on women business leaders suggests that women are generally seen as better at energizing and building a team, but less able at envisioning – at sensing opportunities, setting strategic directions, and inspiring constituents (Ibarra and Obodaru 2009). Thus, while women may be seen as capable and more communicative as managers, they are nonetheless seen as weaker leaders than men. Here as well, we did not find double standards with respect to women’s rated competence and team management ability. Instead, our results suggest the strongest double standards apply to non-technical women and men with respect to status and ability to penetrate the market – indicators of power, authority and “know-how.” Thus, the gender gap in venture capital (and likely other similar male-typed professional arenas) may be less driven by perceptions of qualified women as incompetent, and more rooted in biased perceptions about women’s *legitimacy as leaders*. These findings resonate with feminist theories of science and technology; in particularly strong masculine cultures like high-tech entrepreneurship, hegemonic forms of masculinity are strongly associated with technological prowess and power (Wajcman 2004; 2010). In situations where women lack documentation of some form of technical expertise (i.e. through a degree), it is possible that they are deemed less compatible in their ability to assume leadership roles in technological venues.

Of course, lower status ratings for non-tech women could reflect observations of women’s lower position in the gender status hierarchy, rather than an explicit belief that women are incapable of leadership. Still, such second-order biases (awareness of *most people’s* beliefs) have been shown to undermine performance evaluations in much the same way that first-order biases (explicit *personal* beliefs) do (Ridgeway 2011).

As for sociability ratings, we find a main effect of technical background, with the non-technical entrepreneurs viewed as more affable than their technical counterparts (Cohen’s  $d$ ’s  $>.45$ ;  $p<.05$ ). These results may be reflective of the common “nerd” stereotype that associates technical expertise with a lack of social skills (Kendall 2011). It is noteworthy that the male non-technical entrepreneurs and female technical entrepreneurs were rated higher in status (Males: Cohen’s  $d=.68$ ,  $p<.05$ ; Females: Cohen’s  $d=.34$ , n.s.) and sociability than male technical entrepreneurs (Cohen’s  $d$ ’s  $>.45$ ,  $p<.05$ ). Given the emphasis on “standing out” in the high-tech entrepreneurial arena, it may be that they both benefit from being unique, counter-stereotypical, and not “what one would expect” – and as research shows, status-inconsistent information affects evaluations of people more than status-consistent information (Berger, Wagner and Zeldtich

1992). However, with respect to evaluations of the venture, participants indicated a willingness to invest more and rated higher the venture led by male technical entrepreneurs than those led by their non-technical counterparts. These results further highlight the importance of distinguishing between evaluations of workers and the work they produce when assessing the role of gender bias.

### **The Influence of Social Contacts**

We hypothesized that given the possible uncertainty-reducing effects of social capital, women entrepreneurs would gain more from social ties than men entrepreneurs, regardless of technical background, particularly with respect to evaluations of the entrepreneur (compared to evaluations of the venture). Results, reported respectively in Tables 1 and 2, show support for our predictions.

To assess the impact of social capital on evaluations of the *venture*, we compare across conditions within-subject means from two items: 1) the likelihood of scheduling a meeting with the entrepreneur to learn more about the venture and 2) the likelihood of scheduling such a meeting if a trusted colleague had sent an endorsement of the entrepreneur. Results from a 2 (sex) x 2 (technical background) x 2 (with or without a contact) mixed model ANOVA reveal that, in all conditions, having endorsement from a close contact significantly increased the likelihood of scheduling a meeting to discuss the venture - and the effect is quite large (Cohen's  $d$ 's  $> .80$ ,  $p < .01$ ). We also find that the benefit from a trusted contact's endorsement did not differ by the entrepreneur's sex or background.

As for evaluations of the *entrepreneur*, we conducted a 2 (sex) x 2 (technical degree) ANOVA on the measure of how influential a trusted colleague's support of the entrepreneur would be to the participant's decision-making with respect to recognizing entrepreneurial talent. We find a main effect of sex, with the presence of a contact being more important for women than men. The average level of importance participants assigned to having a close contact vouch for the entrepreneur was significantly higher in the female entrepreneur conditions than in male entrepreneur conditions (Cohen's  $d$  technical=.44, non-technical=.56;  $p < .05$ ). We find no significant main effect of technical degree or interaction effects. Thus, having a contact vouch for the entrepreneur appears equally useful for men and women when their ventures are evaluated, but a double standard operates when the entrepreneur is considered. Women may

benefit more from having close ties than men in terms of how they are perceived and evaluated by others in the entrepreneurial arena.

## **DISCUSSION**

This study considers how gendered double standards may be applied in venture capitalists' evaluations of business proposals. We sought to examine how gender may be important in a more or less "blind" context where little is known about the candidate and good ideas are popularly emphasized over personal qualities; we also sought to examine the complex ways in which gender influences the evaluative process by disentangling different evaluative dimensions (venture vs. entrepreneur). Our findings reveal that gender's relevance to the decision-making process varies, and the uncertainty of the evaluative context heightens gender's influence. Consistent with extant literature, gender exerts more influence on evaluations of the entrepreneur than on evaluations of the venture. In addition, in line with past research (e.g., Heilman et al. 2004), we found that the effects of gender on entrepreneur evaluations depend on the presence and absence of clear performance information – specifically, double standards disadvantage women without technical backgrounds. Moreover, we found that having a social tie to the evaluator impacts women's evaluations more than men's. While this suggests social capital confers greater rewards on women than men, this also suggests that women more so than men need certain indicators of potential – connections to key players, and also technical background in this context – to achieve legitimacy as entrepreneurial leaders and instill confidence in their evaluators about their abilities.

Our findings suggest that gender bias in this evaluative context is subtle. We found gender to have small and mostly insignificant effects on evaluations of the ventures, as well as evaluations of entrepreneurs with technical backgrounds. However, when entrepreneurs did not have technical backgrounds, females were rated significantly lower than males on dimensions that relate most to leadership stature and ingenuity. Research shows that gender stereotypes describe women as less like leaders than men (Davis, Spencer and Steele 2005); further, women have to be seen as exceptional in their accomplishments if they are to be promoted to leadership positions (Lyness and Heilman 2006). Correspondingly, our findings suggest that when women lack evidence of outstanding or unusual accomplishments, they receive less favorable evaluations than men with equivalent backgrounds. This may be especially important in the

technoscience context, where the workplace rests on strong interactions between notions of masculinity and power (Wajcman 2004).

It is additionally interesting that women with technical backgrounds and men with non-technical backgrounds seem to have an advantage in status and sociability. We believe this pattern may indicate the benefits of non-conformity in settings where “standing out” is valued. In the case of high-tech entrepreneurship, whereas women with technical backgrounds undermine stereotypes, men with technical backgrounds conform to stereotypes that imply competence but perhaps a lack of sociability. Men without technical backgrounds, however, may be seen as socially savvy, and they also do not have to contend with the stereotype that they are not technically competent (for example, men without technical backgrounds are well-known in the high-tech entrepreneurial world, e.g., Steve Jobs of Apple, Michael Dell of Dell Computing, Reid Hoffman of LinkedIn). It may be that in certain settings where being unique and having the “X” factor is emphasized, gendered double standards serve to advantage those who violate stereotypes. Future studies should examine this hypothesis, and its implications for understandings of science and power, as well as how the direction of gender effects may vary by the specific values attached to evaluation criteria.

Studies indicate that qualities of the entrepreneur often outweigh qualities of the venture when VCs make investment decisions (see Franke et al. 2008). Though we found evidence that the venture may be evaluated relatively independently of the entrepreneur’s gender, gendered assessments of the entrepreneur likely remain an important factor in the overall decision-making process. Further, our findings may foreshadow the extent of gender’s impact on VCs’ later decisions in the entrepreneurial pipeline. While reputation, experience and contacts can help entrepreneurs gain access to venture capitalists, it is often the VC’s impression of the entrepreneur, drawn from face-to-face interactions, that ultimately determines the entrepreneur’s success (Baron and Markman 2000). As we found gendered double standards in evaluations based solely on business plans, we can expect gender to play a significant (and perhaps even larger) role in evaluations at later stages when entrepreneurs meet VCs and pitch their ventures. Further downstream in the process, VCs also make decisions about whether to replace the original founder with a new CEO or director (Wasserman 2003). Future research should examine the VC decision-making process in subsequent funding stages and beyond.

Insofar as our findings suggest barriers to venture capital among women entrepreneurs in the high-tech context, they also suggest practical implications for addressing gender disparities in venture capital funding. For one, given the advantages that technical background and social capital confer to women, encouraging technical education and expanding women's networks may improve women's success in garnering venture capital. At the same time, we caution that framing the outcome as a supply-side issue can obscure the complex ways in which gender delivers biasing effects. Given our findings, educating VCs about bias in decision-making is imperative. Furthermore, as entrepreneurial ties are often homophilic (Ruef, Aldrich and Carter 2003) and prior research has shown that VC firms with women partners are more likely to fund women-founded start-ups (Brush et al. 2006), increasing the proportion of women in the venture capital world may help women entrepreneurs build strategic connections. Additional research using a representative sample of women VCs can explore this relationship and address gender considerations on the demand side.

Though high-tech entrepreneurship is unique in its archetypal masculine culture, and may be a site where gendered cultural beliefs have a particularly strong effect on decision-making, our findings may also be applicable to evaluations in other workplaces where a distinctive combination of the candidate's "fit" and previous or proposed work are relevant to employment criteria (for example, faculty hiring at colleges and universities (Steinpreis, Anders & Ritzke, 1999). Similar processes may also be in effect in evaluations for promotion at the highest levels of organizations, where advancement requires more than just an established record, but also some combination of ambiguous (and often intangible) worker qualities believed to be predictive of success (the process of promotion to partnership in law firms or CEO of a company, for example). Additionally, our finding that social contacts yield greater rewards for women than for men in the VC context is an important expansion on the effects of social networks, and warrants study in different work environments and network arrangements.

In all, this research underscores the intricate ways in which gender remains involved in the venture capital decision-making process. This study also provides more clues to why science and engineering, particularly in the commercial and entrepreneurial arena, remain significantly gender imbalanced. If we assume that healthy and thriving economies are built, in part, on the development of innovations that require VC support, then we should attend to who is receiving funding for new entrepreneurial visions. Understanding how men and women become

differentially involved in entrepreneurship has implications for the quality and diversity of new companies and ventures on the market. Greater diversity among designers of science and technology leads to better knowledge and products (e.g., Jehn, Northcraft, and Neale 1999). If entrepreneurship is disproportionately stifled for women, this is detrimental not just for individual careers, but for the general economy as well.

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**Table 1. Condition Means (standard deviations) from 2X2 ANOVA on Evaluation of the Venture Variables.**

<b>Condition</b>	<b>Evaluation of the Venture</b>			
	<i>Percent to Invest</i>	<i>Optimism in Venture Scale</i>	<i>Schedule a meeting "over the transom"</i>	<i>Schedule a meeting with endorsement from close tie</i>
Female				
No technical background (N=24)	10.00 (16.94)	2.94 (.80)	3.83 (1.24)	5.08 (1.06)
Technical background (N=29)	18.62 (16.63)	3.57 (.92)	4.45 (1.15)	5.48 (.74)
Male				
No technical background (N=18)	14.44 (16.88)	3.04 (1.07)	3.67 (1.45)	4.94 (1.21)
Technical background (N=43)	24.19 (25.93)	3.44 (1.03)	4.07 (1.40)	5.07 (1.08)
<b>2x2 ANOVA F's (between-subject)</b>				
Sex	1.50	.11		1.91
Tech Background	5.05*	3.58*		3.78*
Sex*Tech Background <sup>1</sup>	.02	.33		.38
<b>Mixed Model 2x2x2 ANOVA F's (within-subject)</b>				
Social Contact ("over the transom" vs. with endorsement)				89.51**
Contact*Sex				.00
Contact*Tech Background				1.05
Contact*Sex*Tech Background				.02
<b>Variable Range</b>	0 to 100	1 to 6	1 to 6	1 to 6

\* p<.05 \*\* p<.01 (two-tailed)

**Table 2. Condition means (standard deviations) from 2X2 ANOVA on Evaluation of the Entrepreneur Variables.**

	Evaluation of the Entrepreneur					
	<i>Competence</i>	<i>Status</i>	<i>Sociability</i>	<i>Able to Manage a Team</i>	<i>Able to Penetrate the Market</i>	<i>Influence of contact vouching for the entrepreneur</i>
<b>Conditions</b>						
Female						
No technical background (N=24)	5.15 (.65)	4.49 (.66)	4.93 (.69)	3.63 (.97)	2.79 (1.21)	5.08 (.58)
Technical background (N=29)	5.46 (.90)	4.60 (.62)	4.63 (.67)	3.82 (.98)	3.45 (1.09)	5.10 (.72)
Male						
No technical background (N=18)	5.24 (.72)	4.85 (.63)	4.88 (.92)	3.67 (1.03)	3.44 (1.34)	4.56 (1.29)
Technical background (N=43)	5.43 (.89)	4.36 (.81)	4.38 (.69)	3.49 (1.08)	3.14 (1.34)	4.74 (.93)
<b>ANOVA F's</b>						
Sex	.04	.20*	1.10**	.52	.49	6.41*
Tech Background	2.39	1.90*	7.68**	.00	.51	.35
Sex*Tech Background <sup>1</sup>	.12	4.74*	.47**	.86	3.80*	.23
<b>Variable Range</b>	1 to 7	1 to 7	1 to 7	1 to 6	1 to 6	1 to 6

\* p<.05 \*\* p<.01 (two-tailed)

<sup>1</sup> Simple effects tests used for interpreting the interactions show significant marginal mean differences between female and male non-techs at p<.05 (one-tailed) for both status and market penetration variables. We also found significant mean differences between male techs and non-techs at p<.05 (two-tailed) for the status variable.