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Not what you expected to see? Obesity stereotypes, expectancy violations, and angel investment decisions

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ABSTRACT

This article investigates the impact of obesity stereotypes on angel investment decisions. Drawing from the stereotype literature and expectancy violation theory, we propose that angel investors tend to evaluate founders with obesity worse because they perceive them as high in warmth but low in competence (and competence matters more for angel investors' evaluations). However, we also suggest that founders with obesity who violate low-competence stereotypes through high-competence displays can offset negative obesity stereotypes without affecting positive ones, leading to overall higher evaluations. The results from two field studies show that angel investors penalize founders with obesity but that the effect is ameliorated for those presenting high-tech ventures. A follow-up experiment using AI-generated, photorealistic manipulations of founders' body types identifies perceived competence and warmth as mechanisms that explain the effects. Collectively, these findings contribute to the literature streams on appearance in entrepreneurial finance, stereotypes and their violations, and entrepreneurial research methods.

1. Executive summary

This paper explores how obesity stereotypes influence angel investment decisions. Individuals with obesity are often penalized in society due to stereotypes portraying them as lacking competence, willpower, and self-discipline. Yet, although 41 % of U.S. adults are obese and these stereotypes likely affect investor evaluations, their role in entrepreneurial finance remains largely unexplored. We therefore ask: *Does the obesity penalty exist in venture pitches? If so, can it be overcome?*

Drawing from the stereotype literature and expectancy violation theory, we propose that obesity leads to lower investor evaluations, mediated by two competing stereotypes, i.e., low competence and high warmth, with competence being more important for angel investors than warmth. However, we theorize that low-competence stereotypes of founders with obesity are overruled when they pitch high-tech ventures. Combining (updated) venture-driven competence assessments with (existing) obesity-driven warmth stereotypes can therefore lead to *better* evaluations for founders with obesity than for those without obesity. We find support for our

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hypotheses in two field studies and one experiment. Study 1 analyzes 636 televised pitches on *Shark Tank*; Study 2 replicates the results with 263 pitches at *TechCrunch Disrupt's Startup Battlefield* pitch competition; Study 3 is a randomized experiment with 449 investors.

Our paper makes four contributions. First, it extends research on physical appearance and stereotypes in entrepreneurial finance by examining obesity, a largely unstudied factor. Second, it contributes to obesity research by identifying perceived competence and warmth as competing mechanisms through which obesity stereotypes influence judgments. Third, it advances the theoretical discourse on stereotypes and their violations by demonstrating that founders with obesity who present high-tech ventures can mitigate competence penalties while retaining warmth advantages, leading to a net positive effect. Finally, our methodological innovation—using AI-generated photorealistic images to manipulate BMI—offers a novel approach to studying physical appearance in entrepreneurship, answering recent calls to integrate AI into this domain of research.

2. Introduction

Obesity[2] is one of the most significant health problems of the twenty-first century, affecting over 41 % of adults in the United States (Stierman et al., 2021). Individuals with obesity often face negative stereotypes about their personalities, preferences, or abilities (see Johnson and Schminke, 2020; Puhl and Heuer, 2009, for reviews). For example, people with obesity are often believed to lack competence, willpower, and self-discipline, which harms their job prospects (Agerström and Rooth, 2011; Pingitore et al., 1994) and performance evaluations (Bento et al., 2012; King et al., 2016). These stereotypes may be particularly influential in entrepreneurial finance, where the scarcity of information often forces investors to rely on surface-level characteristics, such as founders' physical appearance, when making their decisions (e.g., Huang et al., 2023; Schreiber et al., 2024).

However, obesity stereotypes differ from other stereotyped characteristics of founders' physical appearance that have been studied in the context of entrepreneurial finance. Whereas facial attractiveness (e.g., Colombo et al., 2022; Schreiber et al., 2024) and skin color (e.g., Gornall and Strebulaev, 2024; Younkin and Kuppuswamy, 2018) are perceived as largely beyond the individual's control, obesity is perceived to be at least partially within an individual's direct control (e.g., Crandall, 1994; Vartanian, 2010). This moral aspect of obesity stereotypes likely leads to more intense affective reactions and stronger evaluative responses (Weiner, 1995; Weiner et al., 1988). Yet, despite the prevalence of obesity and its potential effects on evaluations, its role in entrepreneurial finance remains largely unexplored.

We address this gap by drawing from the stereotype literature (see Anglin et al., 2022, for an overview) and expectancy violation theory (Burgoon and Jones, 1976; Jussim et al., 1987) to examine how obesity stereotypes affect angel investors' evaluations. We first outline why obesity is associated with generally lower investor evaluations (even though no evidence indicates that ventures founded by entrepreneurs with obesity are of lower quality).[3] We argue that obesity stereotypes materialize as perceptions of *low competence* and *high warmth* (Fiske et al., 2002), and that competence is more important for angel investors' decisions than warmth (Svetek, 2022), which leads us to expect an overall obesity penalty. We then draw from the assimilation account of expectancy violations (Prentice and Carranza, 2003; Schaumberg and Flynn, 2017) to propose that presenting high-tech ventures—a high-competence display—can serve as a means for founders with obesity to mitigate low-competence stereotypes while maintaining high warmth perceptions, thus leading to higher overall evaluations (e.g., Prentice and Carranza, 2003; Schaumberg and Flynn, 2017).

We tested our theoretical predictions across three studies. First, we conducted a pilot study analyzing 636 televised pitches made on *Shark Tank* (Study 1). Our findings show that obesity is negatively related to angel investors' evaluations but that this relationship is moderated (ameliorated) in the context of high-tech ventures. To validate these findings, we collected data from 263 pitches at TechCrunch Disrupt's Startup Battlefield pitch competition (Study 2) and found comparable results. We then conducted an experiment with 449 investors (Study 3) to rule out alternative explanations by isolating the mechanisms with a randomized two-by-two experimental design in which investors evaluated entrepreneurs (with obesity or without obesity) presenting two kinds of ventures (high tech or low tech). Collectively, our studies suggest that entrepreneurs with obesity tend to receive lower evaluations, that this effect is mediated by perceptions of lower competence and higher warmth, and that expectancy violations can mitigate the low-competence stereotype enough for the high-warmth effect to become dominant and produce overall higher evaluations for founders with obesity. Finally, we conducted three semi-structured interviews with angel investors that confirmed the face validity of our findings and captured practitioners' thoughts about the mechanisms at play (see Appendix 1 for details).

Our study makes four contributions. First, we introduce obesity as a novel stereotype in venture funding and show that it triggers competence-based biases that result from moral judgments about obesity, thereby adding to research on appearance-based factors in early stage venture finance (e.g., Colombo et al., 2022; Schreiber et al., 2024). Second, we contribute to the broader obesity literature by showing that obesity leads to competing mechanisms (i.e., perceptions of low competence and high warmth) and that the overall evaluation of people with obesity might be context dependent (e.g., in angel investing, where competence is more critical than

[2] *Obesity* describes a medical condition in which excess body fat has accumulated. In everyday language, the terms *overweight* and *obese* are often used interchangeably. Regardless of its conceptualization, the literature agrees that obesity is more accurately defined in terms of body fat than in terms of weight, and that it can be both visually perceived and physically experienced (Johnson and Schminke, 2020). We follow common practice and use the body mass index (BMI), which is a height-to-weight ratio that groups individuals into categories from underweight to morbidly obese. In line with the World Health Organization's (WHO, 2005) definition, we consider individuals with a BMI equal to or >25 as overweight and individuals with a BMI equal to or >30 as obese.

[3] While this research project focuses on perceptions and stereotypes, we also had the opportunity to measure firm performance, and found no significant differences between ventures started by individuals with obesity and those started by other individuals (see also the Appendix).

warmth, obesity results in an overall penalty). Third, we contribute to the theoretical discourse on stereotypes and their violations (e.g., Prentice and Carranza, 2003; Schaumberg and Flynn, 2017) by demonstrating that founders with obesity who present high-tech ventures can mitigate competence penalties while retaining warmth advantages, leading to a net positive effect. Fourth, we advance entrepreneurial research methods by using artificial intelligence (AI) to predict BMI from images and to create photorealistic manipulations in experimental designs (Matthews et al., 2024). This addresses limitations of previous research, improves measurement accuracy, and aligns with calls for more rigorous approaches to studying appearance-based biases (Grimes et al., 2023) as well as the use of AI in entrepreneurship research (e.g., Lévesque et al., 2022; Obschonka et al., 2024).

3. Theoretical background and hypotheses

3.1. Stereotypes and decision making

Stereotypes are "beliefs about the characteristics, attributes, and behaviors of members of certain groups" (Hilton and Von Hippel, 1996, p. 240). They help individuals navigate uncertain environments by providing simplified information when it is difficult to obtain or process more relevant details (Fiske and Taylor, 1991; Hamilton and Trolier, 1986). However, stereotypes can *over*simplify the complex nature of individuals, leading to biases in decision making (Jussim et al., 1987; Nelson and Miller, 1995). For example, angel investors influenced by the stereotype that men are more tech savvy might be more inclined to invest in a high-tech venture presented by a male founder, skipping comprehensive evaluations of the strengths and weaknesses of entrepreneurs and their ventures (Seigner et al., 2024).

Stereotype-based decision making is particularly relevant under conditions of uncertainty, such as angel investments, where investors typically invest in companies with no track record, well before products or services reach the market (Wesemann Lekkas et al., 2025). Here, stereotypes influence investment decisions across various contexts, including bank financing (Eddleston et al., 2016), venture capital (Malmström et al., 2017), or crowdfunding (Anglin et al., 2018; Seigner et al., 2024). In these situations, judgments are often formed based on stereotypes related to surface-level characteristics, such as attractiveness, gender, race, or age. This has led researchers to conclude that, stereotypically, entrepreneurship is a "men's world" (Gupta et al., 2009, p. 399) or a "young person's game" (Levesque and Minniti, 2006, p. 177).

However, not all stereotypes are created equal (Hamilton and Trolier, 1986). While some stem from inherent characteristics, such as facial features, race, or gender, others—like those regarding obesity or tattoos—assume that the focal characteristics are the result of individual choices. The cognitive processes underlying these stereotypes differ: non-malleable traits, such as facial features or race, are not attributed to personal decisions (Major and O'Brien, 2005). For example, evaluators do not view ethnic group membership as reflecting a lack of self-control. In other words, stereotypes associated with ethnic group membership are not perceived as an individual's fault. However, malleable traits and their associated stereotypes are believed to be within an individual's control (Johnson and Schminke, 2020; Weiner, 1995). For characteristics that are perceived as the result of agentic choices—such as obesity or tattoos—evaluative and emotional reactions intensify (Crandall, 1994; Kincaid et al., 2022; Puhl and Brownell, 2003). In such situations, stereotypes can even elicit moral judgment and blame (Corrigan et al., 2003; King et al., 2005) because observers believe individuals deliberately choose to be a member of these categories.

Most studies in entrepreneurial finance have focused on stereotypes related to non-malleable characteristics like gender (e.g., Balachandra et al., 2019; Malmström et al., 2017) or race (e.g., Gornall and Strebulaev, 2024; Younkin and Kuppuswamy, 2018). Recently, the attention paid to stereotypes about malleable characteristics has increased (e.g., Anglin et al., 2023; Chandler et al., 2024). For example, a growing body of work explores social stigmas and moral biases associated with political (Chandler et al., 2024) or religious expressions (Anglin et al., 2023; Jones et al., 2024) in funding pitches. Yet, research on obesity—one of the most important factors surrounding a person's appearance and one that is seen as malleable—remains limited in entrepreneurial finance. This lack of understanding of how physical appearance affects venture pitch evaluations represents a major research gap (Kalvapalle et al., 2024).

3.2. Obesity stereotypes and angels' investment decisions

Obesity is often subject to intense moral judgments in which people with obesity are "seen as lazy, sloppy, lacking in self-discipline, lacking in self-confidence […] and unintelligent" (Vartanian and Silverstein, 2013, p. 319). When evaluating others, observers compare their stereotypical beliefs to the characteristics and behaviors deemed appropriate in each situation. Incongruence between stereotyped characteristics and expected norms and behaviors results in evaluative penalties (Eagly and Karau, 2002; Rudman and Glick, 2001). For example, Levine and Schweitzer (2015) found that experiment participants predicted less success for contestants with obesity on the quiz show *Jeopardy!*, even though obesity and performance on the show were not correlated. This belief was rooted in the stereotype that quiz-show winners have above-average competence, which does not conform to the low-competence stereotype of people with obesity. Similarly, people with obesity receive worse evaluations in employment contexts (Johnson and Schminke, 2020), healthcare (Phelan et al., 2015), education (Puhl and Brownell, 2013), and political elections (Roehling et al., 2014).

When raising funds from angel investors, founders pitching their ideas are compared to the stereotype of a successful entrepreneur. Popular perceptions of successful founders depict them as self-reliant, hardworking, confident, and generally competent (e.g., Gupta et al., 2014; Verheul et al., 2005). Given the widespread and enduring nature of these perceptions, angel investors assessing early stage founders likely seek traits that align with these expectations (Anglin et al., 2022). However, these expectations stand in stark contrast to common obesity stereotypes, which include a lack of self-discipline, self-confidence, and general competence (see Johnson and Schminke, 2020; Puhl and Heuer, 2009, for reviews). Therefore, we propose that founders with obesity are penalized because they do not fit the stereotype of a successful entrepreneur. Our interviewees echoed this sentiment. For example, one investor stated: "If I saw

an obese person, I would probably wonder if they had the discipline and resilience required to navigate the startup world. This is not necessarily fair, but first impressions matter." Another investor reasoned: "It does not have to be true, but when someone is obese, I ask myself whether they care about their health. Building a startup is a marathon that requires huge amounts of perseverance from founders. An obese founder does not come across as [fitting] the 'archetype' in this regard." Given these arguments, we hypothesize:

H1. Founder obesity is associated with lower angel investor evaluations.

4. Mediating mechanisms

Building on the obesity literature and the stereotype content model (Fiske et al., 2002), we propose that founders' obesity influences investors' evaluations through two main mechanisms— perceived competence and warmth, which are the "two universal dimensions of human social cognition" (Fiske et al., 2007, p. 77). While competence describes perceptions related to ability, including skill, intelligence, and efficacy, warmth captures perceptions related to friendliness, sincerity, and trustworthiness (Cuddy et al., 2011; Fiske et al., 2002).

4.1. Stereotypical competence judgments, obesity, and funding

People with obesity are often stereotyped as incompetent (e.g., Crandall, 1994; Puhl and Brownell, 2003; Yu et al., 2010) because they are assumed to be personally responsible for their condition and should know better (e.g., Crandall, 1994; Quinn and Crocker, 1999; Vartanian, 2010). In other words, they are believed to lack the discipline, motivation, and self-control needed to reduce their body weight. Although obesity is not correlated with intelligence (see Yu et al., 2010 for a meta-analysis), the low-competence stereotype is strong enough for individuals with obesity to receive poorer evaluations in various contexts. For example, Levine and Schweitzer (2015) found that perceived competence mediates the effect between obesity and expected quiz show performance. Similarly, politicians with obesity are rated lower in leadership ability (Bresnahan et al., 2016; Re et al., 2012) and are less likely to be elected (Roehling et al., 2014).

Perceived competence also affects venture evaluations. Studies have identified perceptions of competence as a critical factor in fundraising (Huang et al., 2013; Lee and Huang, 2018) because competence is crucial for transforming early stage prototypes into final products (Oo et al., 2022), recognizing new opportunities, and generating growth (e.g., Lans et al., 2008; Sternberg, 2004). All of this highlights the central role of perceived competence in angels' investment decisions (Svetek, 2022).

Based on these arguments, we propose that (a) angel investors view founders with obesity as less competent and that (b) this lower perceived competence negatively affects angel investors' evaluations. As such, we expect perceived competence to mediate the obesity-investment relationship. We hypothesize:

H2a. Founder obesity is associated with lower perceived competence of the entrepreneur.

H2b. The perceived competence of the entrepreneur mediates the relationship between founder obesity and angel investor evaluations.

4.2. Stereotypical warmth judgments, obesity, and funding

Like perceived competence, we expect perceived warmth to be a mediating mechanism that explains the relationship between founders' obesity and investors' evaluations. Warmth is associated with an orientation towards supporting others, including helpful and conciliatory behavior (Fiske et al., 2002). In the context of obesity stereotypes, research suggests that people with obesity are perceived as warmer than non-obese people (e.g., Bryksina et al., 2021; Tiggemann and Rothblum, 1988; Vartanian and Silverstein, 2013). Sociocultural figures like Santa Claus perpetuate the perceived warmth of people with obesity. One prevalent explanation is that observers attribute greater emotional expressiveness to people with obesity, leading to higher judgments of warmth (Bryksina et al., 2021).

Perceptions of warmth can also influence angel investors' decisions. Factors such as investor's fondness for the entrepreneur (Huang, 2018; Mason et al., 2017) and the entrepreneur's willingness to accept feedback (Ciuchta et al., 2018) influence the likelihood of investment. As the interests of founders and angel investors do not always align (Van Osnabrugge, 2000), angel investors are especially attentive to indications that a founder can be trusted (e.g., Bammens and Collewaert, 2014; Svetek, 2022). This makes trust in founders a central selection criterion of investment proposals (Maxwell and Lévesque, 2014; Wesemann Lekkas et al., 2025). We therefore expect perceived warmth to reassure investors that the founders feel a sense of obligation to deliver on their promises and that they will continue to cultivate the relationship after the investment, for example, by providing regular updates on the venture's development. Given these arguments, we propose that:

H3a. Founder obesity is associated with higher perceived warmth of the entrepreneur.

H3b. The perceived warmth of the entrepreneur mediates the relationship between founder obesity and angel investor evaluations.

4.3. Prioritization of competence over warmth in angel investing

Previous research on social judgments indicates that perceived warmth is generally more important in decision making than perceived competence (Abele and Bruckmüller, 2011; Wojciszke and Abele, 2008). However, when competence is particularly relevant

to the perceiver's goals, perceived warmth may be the lesser force. For example, in the context of angel investing, the entrepreneur's competence determines whether an investor can ultimately exit the venture and generate a payout (Wennberg et al., 2010). This makes the founders' competence crucial for angel investors' goal achievement (Ko and McKelvie, 2018; Svetek, 2022). Indeed, most entrepreneur-level selection criteria identified in prior research (e.g., Baum and Silverman, 2004; Ko and McKelvie, 2018) emphasize competence-related factors, such as formal education, entrepreneurial experience, market knowledge, and preparedness, as well as competence-enhancing traits like persistence, commitment, and resilience. Warmth-related traits (e.g., coachability, likability, trustworthiness) account for only a small proportion of these criteria (Svetek, 2022). This suggests that angel investors respond more to stereotyped traits related to founders' competence than to warmth. In support of this idea, Svetek (2022) found that angel investors prioritize competence over cooperativeness, a concept similar to warmth.

While competence is likely prioritized, warmth remains important in angel investing. The long-term nature of investor-entrepreneur relationships makes rapport and cooperation crucial (Bammens and Collewaert, 2014; Huang, 2018). However, given that angel investors rely on founders to exploit business opportunities, we propose that perceptions of founders' competence have a greater influence on angel investors' initial decision making than perceptions of founders' warmth. This reasoning is in line with insights from our interviews, where one investor stated that: "I would rather back a founder who is brilliant but rough around the edges than someone who is super likable but seems out of their depth. Don't get me wrong—you need to have the right amount of respect for each other. However, the founders you invest in do not necessarily have to become your close friends; they need to execute on their ideas." Therefore, we hypothesize:

H4. The relationship between perceived competence and angel investor evaluations is stronger than the relationship between perceived warmth and angel investor evaluations.

5. Obesity and expectancy violations

We have established that obesity stereotypes lead investors to perceive founders with obesity as lower in competence but higher in warmth than non-obese founders. As competence is more important than warmth for angel investors, this creates an overall evaluation penalty for founders with obesity. However, what happens when founders with obesity violate low-competence stereotypes by presenting high-tech ventures? To answer this question, we draw from the assimilation account of expectancy violations (Prentice and Carranza, 2003; Schaumberg and Flynn, 2017) to argue that violating investors' expectations by presenting high-tech ventures will improve the overall evaluation of founders with obesity through the removal of negative stereotypes and retention of positive stereotypes (Prentice and Carranza, 2003).

First, when founders with obesity present high-tech ventures, angel investors are likely to update their low-competence perceptions. Presentations of high-tech ventures (e.g., ventures in biotechnology or quantum computing) provide a credible display of competence. High-tech ventures are often based on complex intellectual property, which requires founders to invest time and resources in research and development before pitching their ideas to potential investors (Block et al., 2014). Furthermore, the successful launch of high-tech ventures often involves securing patents (Hoenig and Henkel, 2015), trademarks (Zhou et al., 2016), or government grants (Islam et al., 2018), all of which provide valuable information about the founder's expertise and capabilities.

The assimilation account of expectancy violations (Prentice and Carranza, 2003; Schaumberg and Flynn, 2017) suggests that when evaluating another individual, people tend to assimilate their observations into their stereotypes (Olson et al., 1996). This is particularly true under conditions of uncertainty, where there is little credible information (Jussim, 1991; Kunda and Thagard, 1996). When such information emerges, it typically plays a disproportionate role in forming the updated stereotype and the relevance of initial stereotypes diminishes (Jussim et al., 1987; Prentice and Carranza, 2003). For example, Jussim et al. (1987) found that, for racial minorities, displays of unexpected positive traits significantly improve perceptions of their competence, hirability, and likability. Similarly, women who are perceived as innovative—a trait display that goes against initial gender stereotypes—are viewed as significantly more promotable (Post et al., 2009).

Second, when founders with obesity present high-tech ventures, investors not only update their initial stereotypes but also add them to a set of other perceived traits that together form their overall evaluation (Prentice and Carranza, 2003). Therefore, founders with obesity who present high-tech ventures are likely perceived as (equally) competent (due to updated competence perceptions) *and* warm (due to existing warmth stereotypes), a highly sought-after combination among angel investors (Svetek, 2022).

This aligns with research showing that expectancy violations can result in the parallel existence of "positive stereotypical qualities [through] group membership, and positive counterstereotypical qualities [through] idiosyncratic expression of these traits" (Schaumberg and Flynn, 2017: 1862). As a result, we propose founders with obesity presenting high-tech ventures to receive *more* positive evaluations than their non-obese counterparts, who are perceived as competent but not warm. This argument was confirmed by our interviewees: one investor noted that founders with obesity "pitching a deep-tech startup would immediately elevate my perception. To me, it would signal they have the intellectual horsepower to pull it off. This would override any of my stereotypes." Therefore, we hypothesize:

H5a. The relationship between founder obesity and perceived competence is less negative for founders who present high-tech ventures.

H5b. Founders with obesity who present high-tech ventures receive better overall evaluations than non-obese founders presenting high-tech ventures.

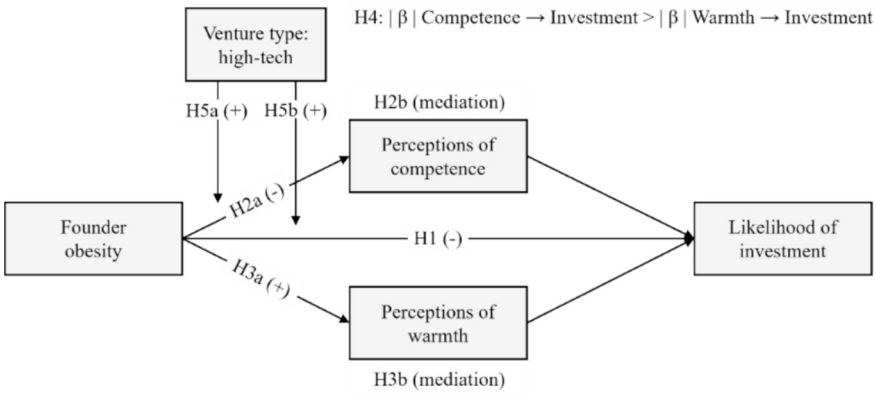

Fig. 1. Overview of hypotheses and research model.

6. Overview of studies

Fig. 1 provides an overview of our hypotheses and research model. We tested our hypotheses with three studies. In Study 1, we conducted a pilot investigation using data from 636 pitches made on *Shark Tank* to examine our predictions that investors penalize founders with obesity and that this relationship is moderated by venture type, resulting in more positive evaluations for founders with obesity presenting high-tech ventures. To establish external validity and replicate our findings, we analyzed 263 pitches from TechCrunch Disrupt's Startup Battlefield pitch competition (Study 2). In Study 3, we used data from a randomized experiment with 449 participants to investigate competence and warmth as theoretical mechanisms and test our moderated mediation hypotheses.

7. Study 1: Pilot study

Our first study used archival field data from the television show *Shark Tank* (2009–2019; https://abc.com/shows/shark-tank) to assess the effect of obesity on funding decisions (H1) and the moderating role of venture type (H5b) in the context of founders' pitches to angel investors.

7.1. Data and sample

On *Shark Tank*, early stage founders present their businesses to "sharks"—a group of well-established angel investors (Blaseg and Hornuf, 2023). After the pitch, the investors ask questions, offer comments, and decide whether they want to invest. If any of the investors expresses an interest, further discussions take place, which may include questions about past sales, and negotiations on the financing details and the terms of the investment offer. Although investors are paid to participate in the show (Huang et al., 2023), they invest their own money in the entrepreneurs' businesses (Huang et al., 2023; Sanchez-Ruiz et al., 2021).

The fact that *Shark Tank* provides a great amount of information makes it a popular context for angel-investment research (e.g., Blaseg and Hornuf, 2023; Huang et al., 2023; Sanchez-Ruiz et al., 2025, 2021). It also provides a compelling setting to test our theory, because (1) it entails live interactions between angel investors and entrepreneurs, (2) it allows us to observe investors' decisions right after the entrepreneurs' pitches, and (3) it offers sufficient information on each transaction (see Huang et al., 2023; Liao et al., 2023 for similar arguments).

We collected data on all episodes that were available for purchase at the time of this study. Following Huang et al. (2023), we then took standardized video stills (i.e., screenshots of a frontal pose) of the lead entrepreneur (i.e., the entrepreneur initiating the pitch) at the beginning of each presentation. We used these pictures to feed machine-learning algorithms designed to predict each founder's BMI (see Appendix 2 for technical details). We then supplemented this data with information from three main sources. First, we coded several entrepreneur and venture characteristics based on the video recordings. Second, we followed Huang et al. (2023) and searched founders' LinkedIn profiles and the *Shark Tank* website to collect additional information. For 135 of the 857 pitches, the required background data was unavailable. In addition, for 86 pitches, the video images were insufficient for the BMI-prediction algorithm (e.g., because the entrepreneur was not visible in a frontal pose or wore a costume that hid their face). This resulted in a final sample of 636 pitches. *t*-tests did not reveal any meaningful differences between our initial sample and the final *Shark Tank* sample with respect to firm size (i.e., total sales) or entrepreneurs' gender. The average BMI for founders in our final sample was 28.19 (SD: 4.14; 25th percentile: 25.29, 75th percentile 30.87). Of our 636 observations, 146 founders had a BMI of <25 and 200 had a BMI equal to or >30. The overall distribution was comparable with that of the overall US population (see Fig. 2).

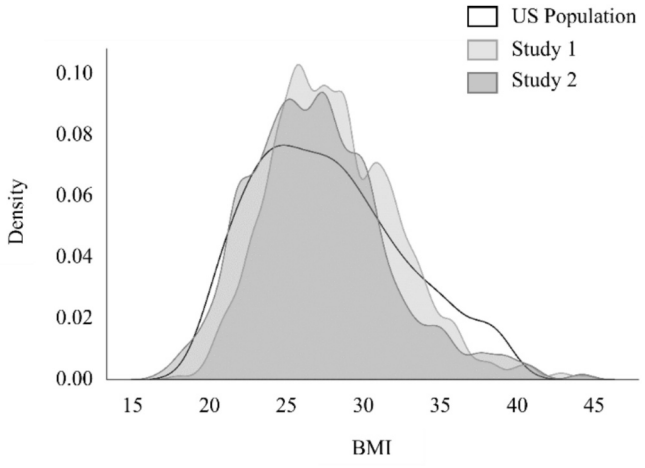

Fig. 2. Distribution of BMI across samples compared with the US population.

7.2. Measures

7.2.1. Dependent variable

Our dependent variable is a dummy variable that takes a value of 1 if the venture received an investment and 0 otherwise (Huang et al., 2023).

7.2.2. Independent variables

Our independent variables are entrepreneurs' *BMI* and *venture type*. BMI is a continuous measure that expresses a height-to-weight ratio. It is the dominant measure for studying obesity across different fields (e.g., Agerström and Rooth, 2011; Cowart and Brady, 2014; Judge and Cable, 2011) and categorizes individuals into the following groups (WHO, 2005): underweight (BMI $<$ 18.5), normal weight (18.5 $\leq$ BMI $<$ 25.0), overweight (25.0 $\leq$ BMI $<$ 30.0), and obese (BMI $\geq$ 30.0). Assessing entrepreneurs' BMI during pitches using traditional methods is challenging, as doing so requires asking them to reveal their weight and height on the day of the pitch. Given the invasive nature of these questions, previous studies have found workarounds using facial features. For instance, the cheek-to-jaw-width ratio is strongly correlated with BMI (e.g., Coetzee et al., 2010, 2009). Building on recent advancements in AI showing that algorithms can produce scalable, valid, and highly reliable predictions of BMI from facial images (e.g., Gadekallu et al., 2021; Jiang et al., 2019), we used the *face-to-bmi* algorithm (Zheng, 2023) to predict founders' BMI from facial pictures. The precision of this algorithm is in line with the one of other proprietary algorithms reported in previous research (e.g., Sidhpura et al., 2022).

For *venture type*, we categorized a venture as *high tech* (coded 1) if its value creation was driven by "technology-centric […] value chain activities" (Uzuegbunam et al., 2019, p. 675), such as intellectual property, software, patents, or copyrights. All other ventures were considered *low tech* (coded 0). Two researchers independently classified the ventures based on the pitch content and venture description. All disagreements were settled through discussions. We calculated Cohen's Kappa, which compares the percentage of agreement with the expected percentage of agreement on a scale from 0 to 1 (Cohen, 1960). Cohen's Kappa for our measure was 0.84, which the literature classifies as "almost perfect" (Kvålseth, 1989; Landis and Koch, 1977). In the context of *Shark Tank*—an environment that focuses on audience-oriented products (Sanchez-Ruiz et al., 2021)—examples of high-tech ventures included a cryptocurrency investment app and content-filtering software designed to prevent cyberbullying.

7.2.3. Control variables

We included several controls for environment- and entrepreneur-related factors known to influence investors' decisions. First, to capture time effects of the *Shark Tank* show (e.g., the largest deals being aired towards the end of each season), we controlled for *episode* and *season* (Liao et al., 2023; Sanchez-Ruiz et al., 2021).

Second, we included several entrepreneur characteristics that might distort how investors perceived founders' appearances and that might be related to funding success (e.g., Colombo et al., 2022; Graham et al., 2017). Specifically, we controlled for the entrepreneur's *gender*, *age*, *race*, *facial attractiveness*, and *dress formality*. We analyzed the lead entrepreneurs' facial images using the AI application *deepface* (Serengil and Ozpinar, 2020, 2021) to capture *race* and *age*. *Race* represents the predicted probability of being white and *age* captures the predicted age in years at the time of the pitch. We coded *gender* as 1 for female entrepreneurs and 0 for male entrepreneurs. To ensure that the effects of BMI on investors' evaluations were not an artifact of *facial attractiveness*, which has been shown to elicit evaluative responses among angel investors (e.g., Huang et al., 2023; Schreiber et al., 2024), we used a machine-learning algorithm to predict facial attractiveness. Specifically, we used the *AttractiveNet* algorithm, which was trained based on the *SCUT-FBP-5500* dataset for "facial beauty prediction" (Liang et al., 2018), to assess facial attractiveness. Finally, we controlled for the founder's *dress formality*, which has been shown to significantly affect social evaluations (see Chang and Cortina, 2024 for a review). Two researchers independently coded dress formality using a three-item scale (i.e., casual, business casual, formal). We classified individuals as casually

dressed when they wore, for example, a plain t-shirt or sweatshirt, jeans, and sneakers. The business-casual condition contained entrepreneurs wearing, for instance, white or blue dress shirts and dark pants. The formal condition contained male founders in suits, and female founders in suits or other formal outfits. Any differences were settled through discussions. Interrater agreement was substantial (Cohen's Kappa = 0.76).

7.3. Model specification

As our dependent variable (investment decision) is dichotomous, we analyzed the data using logistic regression. To assess the results of our moderation, we followed best-practice recommendations (Busenbark et al., 2022; Hoetker, 2007) and calculated marginal probabilities for each coefficient of interest using the *margins* command in Stata 15. To assess whether the marginal probabilities differed significantly across various levels of the moderator, we followed previous research (e.g., Kammerlander et al., 2015; Yang et al., 2020) and performed a contrast analysis using the *contrast* command in Stata 15. This allowed us to assess whether any differences in the marginal probabilities across groups of interest (e.g., investment probabilities for founders with obesity presenting high-tech ventures versus non-obese founders presenting high-tech ventures) are significant (Casella and Berger, 2024).

7.4. Results

We standardized all continuous variables. The average VIF was 1.12, which is well below the recommended threshold of 5 (O'Brien, 2007), indicating no multicollinearity concerns. Our descriptive statistics and correlations are reported in Table 1.

7.4.1. Hypothesis testing

Table 2 reports the logistic regression results. H1 proposes that founders' obesity is negatively related to angel investors' evaluations. Model 2 in Table 2 indicates that BMI has a significant negative effect ($\beta = -0.417$, $p < 0.001$) on the probability of investment. A likelihood ratio test shows that the addition of BMI in Model 2 significantly improves the model's fit relative to Model 1 (LR χ^2 =18.16, $p < 0.001$). Also, the marginal effect analysis (holding all other variables constant) suggests that founders in the tenth percentile of BMI (non-obese) have a 67.2 % probability of receiving an investment. In contrast, founders in the ninetieth percentile of BMI (obese) have a significantly lower probability of receiving an investment (43.8 %). Together, these results support H1.

Next, we test H5b, which predicts that venture type moderates the obesity-investment relationship, such that founders with obesity presenting high-tech ventures receive more positive evaluations than non-obese founders presenting high-tech ventures. Model 3 in Table 2 includes the interaction between BMI and venture type. The likelihood ratio test shows that adding the interaction term enhances the model's overall fit (LR $\chi^2 = 14.18$, $p = 0.001$). As the significance and direction of an interaction in a logistic regression should not be determined solely from the sign or the *p*-value of its coefficient (for details, see Hoetker, 2007), we performed a marginal effects analysis as well as a visual analysis of the effects (see also Yang et al., 2020).

The marginal probabilities are reported in Table 3. For high-tech ventures, the probability of founders with obesity (90th percentile of BMI) receiving an investment is 74.8 %, compared to 31.9 % for non-obese founders (10th percentile of BMI). To determine whether these groups are statistically different, we conducted a contrast analysis, as shown in Table 3. The results show that the difference in the likelihood of an investment for high-tech ventures presented by founders with obesity (versus non-obese founders) is significant at the 1 % level (contrast of marginal probabilities: 0.429, $p = 0.014$). To illustrate this effect, we plotted the marginal probabilities for founders with and without obesity (10th versus 90th percentile of BMI) presenting low-tech and high-tech ventures in Fig. 3. The figure clearly supports the conclusion that founders with obesity presenting high-tech ventures receive better overall evaluations than non-obese founders presenting high-tech ventures. Overall, these results support H5b.

7.4.2. Robustness tests

We carried out several robustness tests. First, we tested whether the results held without any controls. BMI's significant negative effect on the likelihood of investment remained significant ($\beta = -0.104$, $p < 0.001$). Similarly, the predicted marginal probabilities for founders with obesity presenting high-tech ventures was significantly higher than for non-obese founders presenting high-tech ventures (contrast of marginal probabilities: 0.432, $p = 0.008$).

Second, we examined whether our findings were caused by the *face-to-bmi* algorithm (Zheng, 2023) by testing an alternative approach. As the cheek-to-jaw-width ratio is highly correlated with body mass (e.g., Coetzee et al., 2010; Wen and Guo, 2013), we followed Wen and Guo (2013) and obtained this ratio from facial landmarks using the *OpenFace* algorithm (Amos et al., 2016; see Appendix 3 for details). A higher ratio indicates a narrower jaw relative to the cheekbones, which correlates with lower body mass, and vice versa. We inverted the measure to aid interpretation in line with our theory. Higher cheek-to-jaw-width ratios have a significant negative effect on the likelihood of investment ($\beta = -0.353$, $p = 0.004$), whereas the contrast of marginal probabilities for founders with versus without obesity in high tech is marginally significant (contrast of marginal probabilities: 0.346, $p = 0.067$).

Third, we tested our models with an obesity dummy (1 if BMI $\geq$ 30) instead of the continuous measure. The results support our hypotheses in that obesity has a negative effect on the likelihood of investment ($\beta = -0.419$, $p = 0.048$) and the contrast for founders with versus without obesity in high-tech ventures is statistically significant (contrast of marginal probabilities: 0.277, $p = 0.024$).

Table 1
Descriptive statistics (Study 1).

		Mean	SD	Min.	Max.	1	2	3	4	5	6	7	8
1	Investment	0.560	0.497	0.000	1.000	1.000							
2	BMI	28.190	4.141	17.937	44.526	−0.205	1.000						
3	Venture type	0.105	0.307	0.000	1.000	−0.026	0.031	1.000					
4	Gender	0.321	0.467	0.000	1.000	0.134	−0.341	−0.104	1.000				
5	Age	32.305	5.143	21.000	52.000	−0.032	0.250	−0.054	0.064	1.000			
6	Race	55.268	31.918	0.000	100.000	0.030	0.016	0.025	0.054	0.175	1.000		
7	Facial attractiveness	3.171	1.079	1.136	4.718	0.037	−0.027	0.076	−0.051	−0.005	0.058	1.000	
8	Dress formality	1.796	0.761	1.000	3.000	−0.068	0.023	0.025	0.242	0.031	−0.030	−0.035	1.000

Note: 636 observations. Unstandardized values. All values larger than |0.10| are significant at the 5 % level.

Table 2
Logistic regression results (Study 1).

	Model 1			Model 2			Model 3		
Variables	β	S.E.	OR	β	S.E.	OR	β	S.E.	OR
BMI				−0.417	0.100***	0.659	−0.515	0.106***	0.597
Venture type							−0.094	0.286	0.910
BMI x venture type							1.248	0.350***	3.483
Gender	0.743	0.194***	2.102	0.421	0.209*	1.523	0.417	0.212*	1.517
Age	−0.109	0.089	0.897	0.004	0.094	1.004	−0.013	0.095	0.987
Race	0.060	0.086	1.062	0.066	0.087	1.068	0.076	0.088	1.079
Facial attractiveness	0.091	0.085	1.095	0.078	0.086	1.081	0.060	0.087	1.061
Dress formality	−0.162	0.120	0.850	−0.097	0.123	0.908	−0.098	0.124	0.907
Season/Episode	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant	−0.372	0.546	0.689	−0.420	0.562	0.657	−0.364	0.576	0.695
Log-likelihood		−410.145			−401.063			−393.971	
LR χ^2					18.16***			14.18***	
Δ McFadden pseudo-R^2					0.021			0.016	
McFadden pseudo-R^2		0.060			0.081			0.097	
Observations		636			636			636	

Notes: Unstandardized regression coefficients are shown. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$. OR = Odds ratio.

Table 3
Marginal effect and contrast analysis (Study 1).

Quantile of BMI	Value of BMI	Probability of investment[a]	Venture type		Contrast groups (quantile)	Contrast	95 % CI	
			High tech	Low tech				
5th	22.12	0.695	0.277	0.737	High tech: BMI (5) vs. BMI (95)	0.532**	0.146	0.918
10th	23.23	**0.672**	**0.319**	0.709	High tech: BMI (10) vs. BMI (90)	**0.429****	0.087	0.771
25th	25.29	0.628	0.403	0.653	High tech: BMI (25) vs. BMI (75)	0.243*	0.030	0.457
50th	27.69	0.575	0.510	0.582				
75th	30.87	0.501	0.647	0.483	Low tech: BMI (5) vs. BMI (95)	−0.396***	−0.540	−0.252
90th	33.58	**0.438**	**0.748**	0.400	Low tech: BMI (10) vs. BMI (90)	−0.309***	−0.427	−0.192
95th	35.58	0.393	0.809	0.341	Low tech: BMI (25) vs. BMI (75)	−0.170***	−0.237	−0.103

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$. Numbers from the text are in bold.
[a] Calculated at the mean for all variables except BMI.

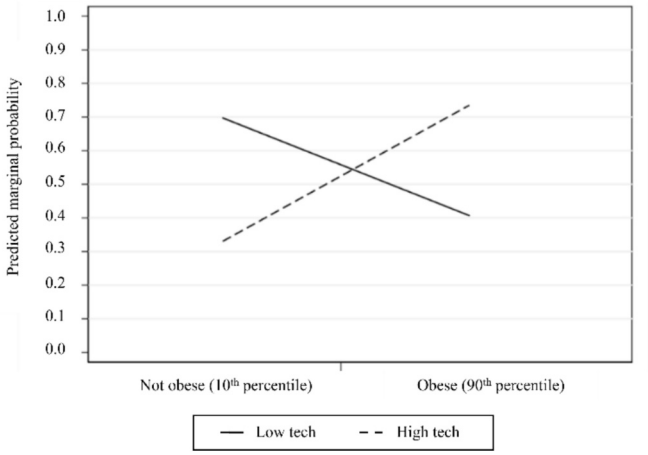

Fig. 3. Investment probability by obesity and venture type (Study 1).

7.4.3. Discussion

Our findings from Study 1 support our hypothesis that angel investors penalize founders with obesity (H1). In addition, the results show that this relationship is moderated for founders with obesity presenting high-tech ventures, such that these founders receive overall better evaluations than non-obese founders presenting high-tech ventures (H5b). As we controlled for other appearance-influencing factors, including age, race, gender, facial attractiveness, and dress formality, our results support the notion that obesity stereotypes matter for angel investors' evaluations, over and above other visible characteristics. However, due to the entertainment-oriented format of *Shark Tank*, alternative explanations related to unobserved differences in the process of selecting

entrepreneurs and ventures for the show cannot be entirely ruled out. We therefore replicated our results with data from a real-life pitch context. Appendix 4 shows detailed results, descriptives, and regression tables for Study 2.

8. Study 2: Replication

To validate the findings from Study 1, we tested our model using data from TechCrunch's Startup Battlefield pitch competition (https://techcrunch.com/startup-battlefield) from 2011 to 2023. We obtained all available, unedited video recordings from TechCrunch's YouTube account and used the same method as in Study 1 to enrich our data. This resulted in a final sample of 263 pitch presentations. The average BMI of entrepreneurs in this sample was 27.08 (SD: 4.54).

Our dependent variable is a binary measure that takes a value of 1 if the venture was the winner of an individual competition and 0 otherwise (Huang et al., 2023). Consistent with Study 1, we controlled for founder characteristics (i.e., gender, age, race, facial attractiveness, and dress formality) and setting-specific factors (i.e., conference year and location). The results show that the founder's BMI has a negative and significant effect on selection ($\beta = -0.870$, $p = 0.001$). More specifically, non-obese founders (10th percentile of BMI) have a 31.2 % probability of being selected as the winner, compared to 4.5 % for founders with obesity (90th percentile of BMI). Together, these results provide additional support for H1. The data also shows that the probability of founders with obesity (90th percentile of BMI) presenting high-tech ventures being selected as winner is 66.5 %, compared to 11.8 % for non-obese founders (10th percentile BMI; contrast of marginal probabilities: 0.547, $p = 0.039$). These results provide additional support for H5b.

These findings further support the idea that angel investors penalize founders with obesity, and that venture type moderates the relationship between obesity and angel investors' evaluations. Moreover, the pitch-competition context increases the generalizability of our findings to more typical startup pitches. However, we still cannot completely rule out alternative explanations stemming from systematic, unobserved differences in ventures founded by individuals with and without obesity (Clarke et al., 2019; Lee and Huang, 2018). Therefore, we used generative AI to manipulate founders' body weight (normal weight versus obese) in a randomized experiment.

9. Study 3: Experimental study

Our third study involved an experimental test that used generative AI to experimentally manipulate founders' body weight (*normal weight* versus *obese*) to explore the underlying mechanisms of obesity stereotypes and exclude alternative explanations. We pre-registered this experiment on *aspredicted.org* (https://aspredicted.org/cxhp-y4n6.pdf).

9.1. Data and methods

9.1.1. Design and procedure

Participants first read a written pitch and saw a picture of the entrepreneur. They then completed a questionnaire, providing their opinion about the investment opportunity. We employed a two-by-two experimental design. First, we included two body-weight conditions for the entrepreneur (*normal weight* and *obese*). To mitigate ethical concerns and maximize the isolation of our stimuli, we used synthetic images created by the generative AI software platform *PhotoAI* (https://photoai.com). This platform enabled us to adjust specific attributes, especially BMI, in photorealistic AI models while keeping other factors, such as posture, facial expression, and clothing, constant. We asked the software to generate an image of a male person at the age of 30 with a normal weight ($18.5 \leq$ BMI < 25.0). We used this picture as a seed to then prompt the AI to create a variation of this picture in which the person's body weight was obese ($30.0 \leq$ BMI). All other aspects were kept constant. We ran the two resulting pictures through the algorithms used in Studies 1 and 2, and found that the predicted BMI of our AI-generated, normal-weight entrepreneur was 22.8 (i.e., roughly the middle of the "normal weight" range of BMI set by the WHO). Similarly, the BMI of the entrepreneur with obesity was 34.9 (i.e., in the "obesity class 1" range set by the WHO). The fact that our BMI classification algorithm correctly classified the experimental stimuli provides additional validation for both the measurement algorithm and the image-generation process. The pictures are shown in Fig. 4.

Fig. 4. Obesity manipulation (Study 3).

The founders' pictures were randomly matched to the venture pitches to create an expectancy violation. We first generated a series of written pitches using OpenAI's ChatGPT 4o. We showed a short list of pre-selected business summaries to five field experts experienced in evaluating venture pitches (two entrepreneurship professors and three business angels) and asked them to rank the ideas according to how suitable they seemed for this research project. Their rankings allowed us to pick the final two pitches. Each pitch summary consisted of 220 words, and included information on the industry, the customer problem, the product and/or service, the target market, and competitive advantage. Their structures and formats were identical. The first was a *neutral* (or *low-tech*) condition in which the entrepreneur's venture required no technological knowledge, as it revolved around a subscription service for mailed boxes that contain curated household items. In the *high-tech* condition, the entrepreneur presented a venture for autonomous cargo airplanes that used state-of-the-art machine-learning technologies. The pitch made it clear that significant technological skill was required to realize or even start this venture.

9.1.2. Participants

We recruited participants with investment experience via *Prolific* (e.g., Liao et al., 2023; Zunino et al., 2022). We restricted participants to those with equity-investment experience to ensure high conceptual familiarity with the presentation of venture ideas. Moreover, we required participants to have at least five submissions and at least a 95 % approval rate on the *Prolific* platform. We invited 600 individuals from the US to take part in the survey. We excluded 79 individuals who stated they did not have relevant investment experience after all, 24 individuals who failed our attention checks, and 48 individuals who were not fluent English speakers. This resulted in a final sample of 449 respondents.

9.2. Measures

9.2.1. Dependent variable

Studies 1 and 2 used a straightforward binary measure of whether the venture received an investment (*Shark Tank*) or won the pitch competition (*Startup Battlefield*). In this study, we followed Murnieks et al. (2011) and used a three-item measure designed to capture the likelihood that the participant would evaluate the proposed opportunity positively and would make an investment (*likelihood of investment*). The coefficient alpha reliability estimate was 0.90. Detailed measure items are shown in Appendix 5.

9.2.2. Obesity

We experimentally manipulated BMI (*obesity manipulation*) by showing participants pictures of the same founder with normal weight (coded 0) and obesity (coded 1).

9.2.3. Venture type

We experimentally manipulated *venture type* by showing participants two venture ideas—one neutral (coded 0) and one high tech (coded 1).

9.2.4. Perceived competence

We asked participants to rate the founder's *competence* by assessing how "competent," "intelligent," and "competitive" they perceived them to be using a scale from 1 ("very low") to 5 ("very high"). These items were developed by Fiske et al. (2002), and have been validated in previous studies (e.g., Aaker, 1997; Judd et al., 2005). We averaged the responses to create a compound measure ($\alpha = 0.92$).

9.2.5. Perceived warmth

We asked participants to rate the founder's perceived *warmth* by indicating the extent to which they considered them to be "warm," "compassionate," and "kind" on a scale from 1 ("very low") to 5 ("very high"). Like our competence scale, these items were originally developed by Fiske et al. (2002) and have been verified in multiple studies (e.g., Judd et al., 2005; Lee and Huang, 2018). We averaged the responses to a composite measure ($\alpha = 0.91$).

9.2.6. Control variables

We controlled for the most important angel-investor demographics: *investor age* and *investor gender* (Antretter et al., 2020b; Maula et al., 2005; Wesemann and Antretter, 2023b). Our experiment also allowed us to capture the effect of body homophily (i.e., investors with obesity supporting founders with obesity, and investors without obesity supporting founders without obesity). Thus, we included a dummy variable (*investor obesity*) that took a value of 1 if the self-reported BMI of the investor was considered "obese ($30.0 \leq$ BMI)" and 0 otherwise. Lastly, we followed previous research (e.g., McKenny et al., 2024; Tacke et al., 2023) and controlled for *social desirability* using the 10-item scale from Strahan and Gerbasi (1972).

9.3. Results

9.3.1. Analysis approach

We tested our parallel (moderated) mediation model using the *lavaan* package (Rosseel, 2012) in R. Compared to single mediation models, parallel mediation models "allow a variable's effect to be transmitted to another through multiple mechanisms simultaneously" (Hayes, 2017: 147). Furthermore, in parallel mediation models, a specific indirect effect (e.g., the effect through perceptions of competence) is estimated controlling for the other parallel mediators specified in the model. As such, by fitting a parallel mediation model, we were able to account for the correlation between competence and warmth (Hayes, 2017). As we hypothesize that our two mediators point in opposite directions, our models can be referred to as inconsistent or competitive mediation (MacKinnon et al., 2007, 2000; Zhao et al., 2010).

9.3.2. Manipulation checks

To ensure the validity of our results, we included two manipulation checks at the end of the survey to avoid priming participants. Specifically, we asked respondents to rate the body types of the entrepreneurs on a six-point Likert scale from the WHO (underweight to obesity category 3). The participants rated the normal-weight entrepreneur ($mean_{normal\ weight} = 2.162$; SD: 0.693) as significantly thinner than the entrepreneur with obesity ($mean_{obese} = 3.746$; SD: 0.858; $p < 0.001$). The manipulations of venture type were also successful—participants rated the technology focus (on a 1–5 Likert scale) of the high-tech venture as significantly higher than that of other ventures ($mean_{low\ tech} = 2.667$; SD: 1.059; $mean_{high\ tech} = 4.251$; SD: 0.733; $p < 0.001$). Table 4 presents the descriptive statistics.

9.3.3. Hypothesis testing

Table 5 reports the regression models for the individual stages of the mediation. Table 6 contains the moderated mediation results. H2a proposes that obesity is associated with lower perceptions of competence. As indicated in Table 5, the coefficient of obesity in Model 1 is negative and significant ($\beta = -0.125$, $p = 0.043$), providing support for H2a. Perceived competence is also positively related to investment ($\beta = 0.453$, $p < 0.001$), and the indirect effect is negative and significant ($ab = -0.057$, $p = 0.049$). Together, this supports H2b.

H3a proposes a positive relationship between obesity and perceptions of warmth, suggesting that founders with obesity are perceived as warmer. The coefficient of obesity in Model 2 is positive and significant ($\beta = 0.299$, $p < 0.001$), supporting H3a. Perceived warmth is positively related to investment ($\beta = 0.320$, $p < 0.001$), and the indirect effect of warmth is positive and significant ($ab = 0.096$, $p < 0.001$). These results support H3b. This pattern of results suggests that warmth acts as an inconsistent mediator (MacKinnon et al., 2000). When multiple mediators' indirect effects are opposite in sign, as is the case here, "the overall relation […] may actually be zero, yet there are two opposing mediational processes" (MacKinnon et al., 2007, p. 602).

H4 proposes that the influence of competence on investors' evaluations is stronger than the influence of warmth. When we compare the effects in Model 3, we find that competence (perceived competence → investment) has a stronger absolute effect ($\beta = |0.453|$, $p < 0.001$) than warmth (perceived warmth → investment; $\beta = |0.320|$, $p < 0.001$). The difference between the effects is statistically significant ($|\beta_{comp}| - |\beta_{warm}| = 0.133$, $p = 0.037$). Together, these findings support H4.

Before presenting the test of our moderated mediation hypotheses, it is worth noting that our sample compositions differ across studies. In our experiment, 50 % of ventures were high tech and 50 % of those high-tech founders were in the obese category (i.e., 25 % high-tech founders with obesity). This differs from the field samples, where individuals with obesity in high tech were much rarer (e.g., 4.1 % in Study 1). We theorized (and found in both field samples) that entrepreneurs with obesity excel when launching high-tech ventures. This suggests that the increase in the share of the overperforming "obese in high-tech" subgroup in the experiment would increase the overall investment average for individuals with obesity in Study 3 and that the negative direct effect of obesity on investment might disappear. We therefore focus our analysis on the parallel (moderated) mediation model to test the pathway-switching mechanism of competence and warmth in the presence (absence) of high-tech ventures.

Specifically, H5a proposes that venture type moderates the first stage of our mediation (obesity → competence). Model 1 in Table 6 shows that the impact of the interaction effect between obesity and venture type on competence is positive and significant ($\beta = 0.266$, $p = 0.030$). To examine the conditional indirect effects, we followed previous research (e.g., Johnson et al., 2018) and computed the index of moderated mediation (IMM; Hayes, 2015), which determines whether a moderator significantly influences the indirect relationship between an independent and a dependent variable. We derived our confidence intervals using 5000 bootstrap iterations. The index of moderated mediation was significant ($IMM = 0.112$, $p = 0.038$), supporting H5a. This effect is also shown in Fig. 5, where founders with obesity presenting high-tech ventures are perceived as the most competent, while those with obesity presenting low-tech ventures are perceived as the least competent.

H5b proposes that founders with obesity who present high-tech ventures will receive better evaluations than non-obese founders who present high-tech ventures. Our results show that in high-tech contexts, the previously negative competence pathway is no longer significant (indirect effect: $\beta = 0.003$, $p = 0.941$), suggesting that venture type itself becomes the primary competence signal, thereby reducing the salience of obesity-driven competence perceptions. Consequently, the reduction in the salience of the competence pathway allows the warmth pathway to dominate, leading to a significant positive total indirect effect in the high-tech group ($\beta = 0.111$, $p = 0.040$). This aligns with the logic of inconsistent mediation, where venture type shifts the balance between the competence and warmth pathways, providing additional support for H5b.

Table 4
Descriptive statistics (Study 3).

		Mean	SD	Min.	Max.	1	2	3	4	5	6	7	8	9
1	Likelihood of invest.	3.203	0.958	1.000	5.000	1.000								
2	Competence	3.827	0.675	1.667	5.000	0.461	1.000							
3	Warmth	3.537	0.744	1.000	5.000	0.471	0.450	1.000						
4	Obesity manipulation	0.506	0.501	0.000	1.000	0.060	−0.102	0.196	1.000					
5	Venture type	0.512	0.500	0.000	1.000	0.081	0.038	−0.170	−0.020	1.000				
6	Investor age	38.274	11.207	21.000	79.000	−0.208	0.010	−0.148	−0.028	0.034	1.000			
7	Investor gender	0.621	0.486	0.000	1.000	−0.021	−0.032	−0.033	−0.028	−0.045	−0.100	1.000		
8	Investor obesity	0.138	0.345	0.000	1.000	−0.031	0.026	−0.090	−0.017	0.094	0.069	−0.047	1.000	
9	Social desirability	0.025	0.259	−0.500	0.500	0.323	0.207	0.280	−0.038	−0.091	−0.128	−0.019	−0.143	1.000

Note: 449 observations. Unstandardized values. All values larger than |0.09| are significant at the $p < 0.05$ level.

Table 5
Parallel mediation results (Study 3).

	Model 1			Model 2			Model 3		
	DV = Competence			DV = Warmth			DV = Investment		
Variables	Coeff.	S.E.	95 % CI	Coeff.	S.E.	95 % CI	Coeff.	S.E.	95 % CI
Investor age	0.002	0.003	[−0.004 0.007]	−0.007	0.003*	[−0.013 −0.001]	−0.013	0.004***	[−0.020 −0.006]
Investor gender	−0.035	0.064	[−0.160 0.089]	−0.053	0.068	[−0.187 0.080]	−0.024	0.078	[−0.176 0.128]
Investor obesity	0.102	0.091	[−0.077 0.280]	−0.091	0.096	[−0.278 0.097]	0.051	0.109	[−0.163 0.265]
Social desirability	0.558	0.115***	[0.332 0.784]	0.766	0.129***	[0.514 1.018]	0.634	0.150***	[0.340 0.927]
IV → Mediator									
Obesity manipulation	−0.125	0.062*	[−0.246 −0.004]	0.299	0.065***	[0.172 0.426]			
Mediator → DV									
Competence							0.453	0.055***	[0.345 0.562]
Warmth							0.320	0.051***	[0.221 0.419]
IV → DV									
Obesity manipulation							0.088	0.074	[−0.056 0.233]
R^2		0.056			0.135			0.309	

Note: $N = 449$. Obesity manipulation/Investor obesity: 1 = Obese, 0 = Non-obese. All coefficients are unstandardized. Results based on 5000 bias-corrected bootstrap samples. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$.

Table 6
Path analysis and parallel moderated mediation results (Study 3).

	Model 1			Model 2			Model 3		
	DV: Competence			DV: Warmth			DV: Investment		
Variables	Coeff.	S.E.	95 % CI	Coeff.	S.E.	95 % CI	Coeff.	S.E.	95 % CI
Investor age	0.002	0.003	[−0.004 0.007]	−0.007	0.003*	[−0.013 −0.001]	−0.013	0.003***	[−0.020 −0.006]
Investor gender	−0.022	0.064	[−0.147 0.103]	−0.053	0.067	[−0.185 0.079]	−0.010	0.077	[−0.161 0.141]
Investor obesity	0.087	0.091	[−0.091 0.266]	−0.091	0.093	[−0.273 0.091]	0.027	0.112	[−0.192 0.246]
Social desirability	0.567	0.115***	[0.342 0.793]	0.766	0.127***	[0.518 1.015]	0.660	0.146***	[0.374 0.947]
Venture type	−0.067	0.083	[−0.230 0.096]				0.246	0.104*	[0.043 0.449]
IV → Mediator									
Obesity manipulation	−0.260	0.081**	[−0.417 −0.102]	0.299	0.064***	[0.173 0.425]			
Conditional path									
Obesity x venture type	0.266	0.123*	[0.026 0.507]				0.039	0.145	[−0.245 0.323]
Mediator → DV									
Competence							0.422	0.055***	[0.314 0.529]
Warmth							0.361	0.049***	[0.265 0.458]
IV → DV									
Obesity manipulation							0.058	0.102	[−0.141 0.257]
R^2		0.068			0.135			0.333	

Note: $N = 466$. Obesity manipulation/Investor obesity: 1 = Obese, 0 = Non-obese. All coefficients are unstandardized. Results based on 5000 bias-corrected bootstrap samples. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$.

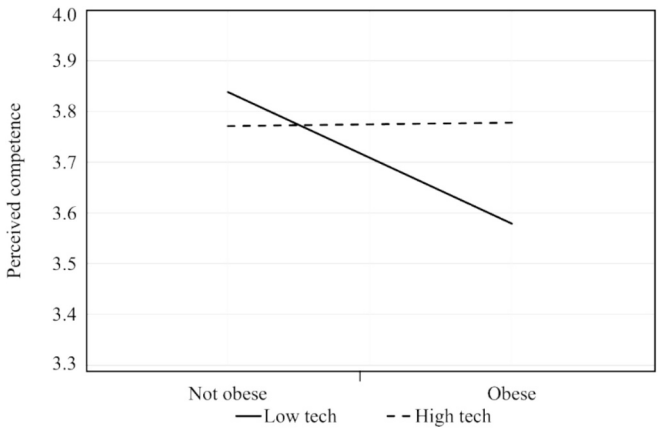

Fig. 5. Perceived competence by obesity and venture type (Study 3).

10. Discussion

The obesity penalty (e.g., Agerström and Rooth, 2011; Johnson and Schminke, 2020; Judge and Cable, 2011) is a well-known phenomenon that arises partially because of the widely held belief that people with obesity are less likely to possess the competence deemed necessary for success (e.g., Crandall, 1994; Puhl and Brownell, 2003; Yu et al., 2010). However, as this topic has not been studied in the context of entrepreneurial finance, we asked two critical questions: Does the obesity penalty exist in venture pitches? If so, can it be overcome?

We theorized that the obesity penalty exists in angel investments, but that founders with obesity presenting high-tech ventures can nullify low-competence stereotypes without disrupting their high-warmth perceptions, leading to higher overall evaluations. Our three studies support these predictions. A pilot study of entrepreneurs' evaluations in the television show *Shark Tank* (Study 1) revealed that angel investors penalize founders with obesity and that this effect is moderated by venture type. While founders with obesity were generally penalized, those presenting high-tech ventures were evaluated most positively. To enhance the external validity of these findings, we replicated our results using field data on 263 pitches made at TechCrunch's Startup Battlefield pitch competition (Study 2). The results were consistent. In a subsequent randomized experiment (Study 3), we explored the theoretical mechanisms explaining the link between obesity and investors' evaluations. More specifically, we manipulated founders' BMI using generative AI and found that perceptions of low competence and high warmth mediate the obesity-investment relationship. Moreover, violating negative competence perceptions by presenting high-tech ventures moderates the obesity-competence link. A post-hoc analysis showed that this change indeed results from expectancy violations (see Appendix 4).

10.1. Theoretical contributions

Our paper makes several theoretical contributions. First, we extend the literature on the role of founders' physical appearance in venture funding (e.g., Colombo et al., 2022; Huang et al., 2023; Schreiber et al., 2024). While body weight has been investigated to some extent in entrepreneurship (e.g., as a consequence of stress; Cardon and Patel, 2015), the associated stereotype and how it influences outcomes for entrepreneurs has not been examined. As such, our research adds to the growing body of work on how stereotypes shape investment decisions. Specifically, with obesity, we introduce a unique kind of appearance-based stereotype to this conversation that is rooted not only in aesthetics but also in moral judgment. Whereas most appearance-based traits (e.g., racial markers) are perceived as largely uncontrollable, obesity stereotypes elicit moral judgments because many people believe obesity is an individual's own fault. By showing that this moral judgment leads people to perceive founders with obesity as less competent, we add to recent studies exploring social stigma and moral biases in funding pitches, such as those exploring political (Chandler et al., 2024) or religious expressions (Anglin et al., 2023; Jones et al., 2024).

Second, we contribute to the literature on obesity (see Johnson and Schminke, 2020; Puhl and Heuer, 2009 for reviews). Our study addresses an important gap in this literature, where the lack of research into obesity's theoretical mechanisms and boundary conditions has been described as "one of the most glaring weaknesses" (Johnson and Schminke, 2020, p. 676). Our results provide new insights into the mechanisms that explain why obesity affects evaluations. In the absence of objective information about an entrepreneur's qualities, obesity may serve as an initial proxy for people's competence and warmth (Fiske et al., 2002). Our findings also suggest that these stereotypes are not uniformly negative. Instead, competence and warmth operate as distinct factors in obesity-related evaluations. Specifically, we show that competence perceptions drive negative evaluations in angel investing more than warmth drives positive evaluations, creating an overall obesity penalty. This aligns with recent findings that not all stereotypes operate through simple compensatory tradeoffs, and that the relative weights of competence and warmth are context dependent (Johnson et al., 2018; Svetek, 2022). Thus, our study suggests that the mechanisms that drive obesity stereotypes might depend on how much emphasis evaluators place on, for instance, competence relative to warmth or vice versa.

Third, our study contributes to the theoretical discourse on stereotypes and their violations (e.g., Prentice and Carranza, 2003; Schaumberg and Flynn, 2017). While the traditional stereotype literature predicts that incongruence with existing stereotypes is universally negative, recent theoretical advancements around expectancy violations provide a more nuanced view suggesting that whether a violation is rewarded or punished depends on the malleability of the stereotype (Pinquart et al., 2021 refers to this as the strength of the expectancy). Our results show that a malleable (or weakly held) stereotype, such as viewing people with obesity as less competent, can be nullified by unexpected displays. Specifically, we demonstrate that initial low-competence stereotypes are corrected when more credible information about a founder's competence emerges. While negative stereotypes (i.e., low competence) are nullified, positive stereotypes (i.e., high warmth) remain. This results in an overall positive assimilation effect for founders with obesity because they are then perceived as both competent *and* warm, a highly sought-after combination among angel investors (Svetek, 2022).

While previous research has often used stereotype violations to explain how unexpected behaviors can induce additional penalties (e.g., Chandler et al., 2024; Livingston et al., 2017; Seigner et al., 2022), little attention has been paid to how expectancy violations can create net positive effects. However, some prior studies suggest that stereotyped individuals who exceed low expectations can be perceived even more favorably than those who were never the subject of negative stereotypes in the first place (e.g., Bettencourt et al., 1997; Lanaj and Hollenbeck, 2015; Rosette and Tost, 2010). We extend this work to obesity stereotypes and show how these advantages can occur under conditions of uncertainty when unexpected competence displays disrupt competence-based penalties while allowing warmth advantages to persist (Fiske et al., 2002). Our work thereby also adds to the recent discourse on signal conflicts in venture finance (Bafera and Kleinert, 2023; Colombo, 2021). Obesity creates rivaling mechanisms, as competence and warmth act as competing pathways. By showing how investors combine these mechanisms in their evaluations, our study addresses calls for more

research on signal conflicts (Colombo, 2021) and how ventures can "leverage conflicting signals to their advantage" (Bafera and Kleinert, 2023: 2440).

Fourth, our study makes a methodological contribution, as we introduce new ways to study obesity in entrepreneurship and psychology research. Historically, options for studying obesity have been limited, challenging, and peppered with bias and measurement errors. These limitations apply to the ways in which BMI was measured (i.e., by asking participants "How much do you currently weigh?"; Judge and Cable, 2011) and to BMI manipulations in experimental designs (e.g., using pictures of an individual before and after losing weight). Building on recent technological advances, we illustrate how both challenges can be solved with AI. First, algorithms can now produce scalable, valid, and highly reliable predictions of BMI from images (e.g., Gadekallu et al., 2021; Jiang et al., 2019). Second, AI tools can create "variants" of the same person, thereby allowing us to isolate the role of obesity in experimental contexts. By holding all other visual effects constant (e.g., pose, clothing, hairstyle, facial expression), AI-generated manipulations avoid multiple confounds that previous research had to accept. As such, our study joins other recent articles (see Matthews et al., 2024, for the use of AI to manipulate founders' age) and responds to recent calls to use generative AI (e.g., Grimes et al., 2023) to "realistically transform the same founder, such that factors, including […] weight, are cleanly manipulated, thereby allowing new ways to understand their effects on investor judgments" (Matthews et al., 2024, p. 24).

10.2. Practical implications

Our study also has practical implications. We have demonstrated that obesity stereotypes are powerful mechanisms that shape angel investors' evaluations. To minimize the effect of stereotypes and violation effects, angel investors might assess written business information before meeting entrepreneurs. Moreover, investors could consider leveraging AI in investing, as recent studies have offered important insights into the debiasing potential of machine-learning algorithms in early-stage investing (e.g., Antretter et al., 2018, 2020a; Blohm et al., 2022). On the other hand, entrepreneurs should be aware of (obesity) stereotypes in investors' decision making and how they can leverage them to their advantage. Specifically, entrepreneurs should understand the potential to correct initial stereotypes as well as the additive nature of investors' perceptions. By displaying positive traits, like competence, that counteract negative (obesity) stereotypes while maintaining positive stereotypical traits like warmth, entrepreneurs with obesity may sway investors' evaluations in their favor.

10.3. Limitations and future research

We acknowledge several limitations that suggest avenues for future research. First, while contexts like *Shark Tank* have been described as suitable for observing "angel investors' decisions after hearing and discussing the entrepreneurs' actual pitches" (Huang et al., 2023, p. 162), these settings often require investors to make decisions on the spot (Clarke et al., 2019). However, previous studies have shown that angel investors interact with entrepreneurs beyond these pitches (e.g., Mitteness et al., 2012). As the influence of stereotypes is most pronounced when people are unfamiliar with each other (Harrison et al., 2002), we expect the impact of obesity on investments to decrease in contexts that allow for more in-depth interactions. Future research should therefore explore how the degree of interaction influences the effects of obesity on evaluations.

Second, we did not examine the potential negative effects at the lower end of the BMI spectrum. Some research suggests that evaluators assign positive traits to athletic physiques but negative traits to both underweight and obese physiques (Kirkpatrick and Sanders, 1978), indicating that the relationship between BMI and evaluations may be nonlinear. For example, Judge and Cable (2011) found a negative weight-income relationship for women and an inverted U-shaped weight-income relationship for men. Testing such a nonlinear hypothesis in our data using the *utest* command in Stata 15 (Lind and Mehlum, 2010) did not support a nonlinear interpretation (Study 1: $p = 0.151$; Study 2: $p = 0.486$). Nevertheless, we encourage future research to investigate whether negative stereotypes about underweight individuals play an equal role in social judgments of angel investors evaluating entrepreneurial ventures.

Third, our findings provide important insights into the relationship between obesity and evaluations, but we did not consider potential geographical or cultural differences (Deurenberg et al., 1998; Gallagher et al., 1996). Investors from the United States, where 41.64 % of the adult male population is obese, might assess a founder with obesity differently than an investor from the United Kingdom, where 26.94 % of adult men are obese.[4] Future research should explore how geographical or cultural differences affect the role of obesity stereotypes in venture financing (Wesemann and Antretter, 2023a). In addition, homophily may affect evaluations of founders with obesity. Based on the concept of activist-choice homophily (Greenberg and Mollick, 2017), we encourage scholars to explore how investors' BMI might influence obesity stereotypes in investment decisions.

Fourth, while BMI is widely used by social scientists and is highly correlated with excess body fat (e.g., Deurenberg et al., 1998; Gallagher et al., 1996), it does not distinguish between different components of body composition, such as muscle, bone, and fat (Burkhauser and Cawley, 2008; Gallagher et al., 1996). We encourage scholars to consider alternative measurements of body fat, such as total body fat, waist circumference, or waist-to-hip ratio. Moreover, when interpreting our results, readers should consider obesity as a measure of body fat rather than categorizing individuals as normal weight, overweight, or obese. This approach helps avoid oversimplification, and acknowledges that health and workplace issues can arise even at relatively low levels of excess body fat (e.g.,

[4] While our US participants evaluated the obese entrepreneurs' ventures as a 2.58 on a five-point scale of investment likelihood, UK participants evaluated them significantly lower (2.35; $t = 2.59$, $p = 0.005$), suggesting that cultural and/or geographical body standards influence people's prejudices towards obese founders.

BMI of 25; Kelly et al., 2015; Roehling et al., 2014) or at small deviations from the group mean (Judge and Cable, 2011).

11. Conclusion

Our study provides evidence for how obesity stereotypes influence angel investors' evaluations of entrepreneurial ventures. While we find that founders with obesity face stereotype-based penalties, we also show that positive high-competence displays can lead angel investors to reevaluate their stereotypes, leading to overall funding advantages for founders with obesity. For scholars, we demonstrate how body weight functions as an important stereotype that influences investors' evaluations in countervailing ways. For entrepreneurs, we create awareness of the importance of stereotype assimilation and its impact on investors' evaluations. We hope that this study encourages others to investigate obesity in entrepreneurship—a stigmatized yet important factor that deserves more scholarly attention.

CRediT authorship contribution statement

Torben Antretter: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Henrik Wesemann Lekkas:** Writing – review & editing, Writing – original draft, Project administration, Methodology. **Djordje Djokovic:** Validation, Methodology, Investigation, Formal analysis, Data curation. **Vangelis Souitaris:** Writing – review & editing, Conceptualization. **Joakim Wincent:** Writing – review & editing.

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Declaration of competing interest

The authors have no relevant competing interests to declare.

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Appendix 1: Interviews

We followed previous research (e.g., Souitaris et al., 2023; Vanacker et al., 2020) and supplemented our quantitative studies with a set of semi-structured interviews to capture practitioners' insights. We conducted three interviews with angel investors in February 2025. Two of the interviewees were male and one was female. All of them invested actively in pre-seed- or seed-stage ventures. The average number of investments per investor was 11 (also counting investments made in their roles as venture capitalists, where they also participated with their own money) and the average interview lasted 25 min. The angel investors explained their thought processes when evaluating entrepreneurial ventures, how they would react to founders' appearances in a hypothetical pitch situation, and how they reflected on stereotypes and their violations. In line with other studies that use practitioner insights to enrich theoretical arguments and test the face validity of empirical findings (e.g., Souitaris et al., 2023; Vanacker et al., 2020), we used our personal networks to identify the interviewees. The interviewees were guaranteed that their identity would remain confidential.

Appendix 2: Technical approach to predicting BMI from facial images

This appendix provides a detailed technical overview of our approach to predicting an individual's BMI using facial images. The model is based on the Face to BMI GitHub repository (Zheng, 2023) and achieves prediction accuracy similar to that of proprietary models published in recent machine-learning research (Sidhpura et al., 2022). We retrained and retested the model to ensure its accuracy was as reported.

2.1. Model architecture

We adapted the Vision Transformer (ViT), originally developed by Dosovitskiy et al. (2020) and pretrained on the extensive ImageNet dataset (Russakovsky et al., 2015), for BMI estimation from facial images. Unlike traditional convolutional neutral networks

(CNNs) that process images through incremental layers of filters to gradually extract features, the ViT approaches image analysis using a more holistic methodology that is more effective for the comprehensive understanding needed in BMI prediction.

2.1.1. Preprocessing

Before being processed by the ViT, images are subjected to several preprocessing steps to standardize the data for analysis. These steps ensure that the dataset is uniform and suitable for processing by the ViT. First, all images are rotated to properly align the faces, ensuring that key facial features, such as eyes and mouth, are oriented consistently across all samples. After alignment, the images are cropped to center on the faces, removing unnecessary background elements that could interfere with the analysis. The cropped images are then resized to a uniform resolution of 224 × 224 pixels. This step is important for standardizing the input for the model, thereby allowing for consistent processing of visual data. In addition to resizing, image normalization is applied in which the pixel values are adjusted based on the mean and standard deviation of the ImageNet dataset. This helps scale the pixel values into a range that is more consistent and expected by the model.

2.1.2. Vision transformer

Following image preprocessing, the ViT segments each image into uniform patches of 16 × 16 pixels (see Figure) and each patch is encoded into a 1280-dimensional vector. This translates the spatial and color information of each patch into a data format that is used in subsequent processing steps.

The core of the ViT consists of transformer layers that utilize a mechanism known as multi-head self-attention. This allows the model to process all of the encoded patches simultaneously rather than sequentially. By doing so, the ViT can dynamically focus on different patches, weighing their importance based on the information they contain. This is crucial for recognizing and interpreting the complex patterns and contextual relationships that are important for accurate BMI estimation.

Finally, the feature-extraction stage calculates a series of vectors that represent the high-level features of the entire image. These vectors encapsulate the essential attributes of the facial images that are predictive of BMI, and draw from the rich and nuanced analysis provided by the preceding transformer layers. Fig. A provides an overview of the BMI Visual Transformer Model.

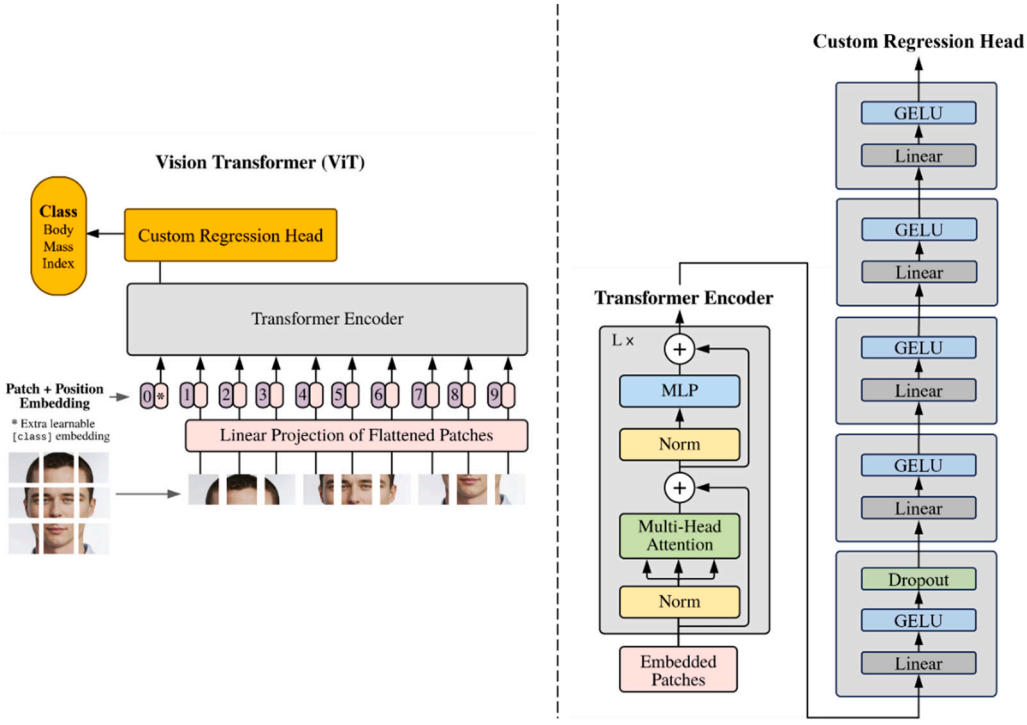

Fig. A. BMI visual transformer model.

2.1.3. Custom regression head

To adapt the ViT to predict BMI from facial images, we added a component known as the custom regression head to the model. This component is essential for transforming the complex feature representations extracted by the ViT into a practical output—the predicted BMI. The custom regression head progressively reduces the dimensionality of feature vectors through multiple layers (from 1280 to 640 to 320 to 160 to 80 to 1), with each step focused on retaining and refining critical attributes relevant for BMI prediction. The process culminates in a single scalar value that represents the estimated BMI. The Gaussian Error Linear Unit (GELU) activation function is used within the regression head to introduce nonlinearity. This function is important for modeling complex patterns in the data and allowing the system to understand nuanced relationships within the visual inputs that correlate with BMI. To ensure that the model generalizes well to new data and avoids overfitting, dropout is implemented within the regression head. Overfitting occurs when a model learns the training data too well, including the noise and fluctuations, which can lead to poor performance on unseen data. Dropout mitigates this risk by randomly disabling a portion of neurons during training, thereby promoting the development of a more robust and generalized model.

2.1.4. Training procedure

The training process utilized a dataset of 4206 images with variations in race, gender, and age along with corresponding BMI measurements. The images were sourced from the VisualBMI project. This dataset, a standard resource in BMI research, is derived from a Reddit forum where users post their images, heights, and weights (Sidhpura et al., 2022).

After the dataset was divided into three parts—60 % for training (2524 images), 20 % for validation (841 images), and 20 % for testing (841 images)—the data underwent comprehensive augmentation before the training began. Data augmentation is a crucial step that introduces variability into the training process, which helps prevent overfitting and improves the model's ability to generalize to new, unseen data. The augmentation techniques included randomly rotating the images by up to five degrees, flipping them horizontally with a 50 % probability, applying random distortions to simulate various deformations, adjusting the contrast with specified probabilities and factors, and altering the brightness, contrast, saturation, and hue of the images. These varied transformations exposed the model to a broad range of possible scenarios that it might encounter, thereby enhancing its predictive accuracy across diverse situations.

The training process then began by loading batches of these pre-augmented images and their corresponding BMI values. During the forward pass, the images were processed through the ViT and the custom regression head to generate BMI predictions, and the loss was calculated using the mean squared error (MSE), which quantifies the average squared difference between predicted and actual BMI values.

2.2. Evaluation

The model achieved a mean absolute error (MAE) of 3.02 on the out-of-sample dataset. This demonstrates accuracy comparable to the state-of-the-art research published by Sidhpura et al. (2022), where the MAE ranges from 2.68 to 5.03.

2.3. Comparison to previous approaches

Our approach of leveraging generative AI to create variants of the same person is superior to approaches used in previous research, which have often been riddled with bias and measurement errors. For example, Chatman et al. (2022) use photo stimuli of similar-looking people to test the roles of agency and warmth perceptions in men and women across ages. However, this approach introduces a variety of confounds that cannot be accurately controlled, including attire, hairstyle, pose, facial expression, attractiveness, and background. By using generative AI to create variants of the same person while holding all other variables constant, we can avoid these confounds and create a much cleaner experimental manipulation (see also Matthews et al., 2024).

Appendix 3: Robustness measurements of BMI estimated from facial images

As an alternative to our primary machine-learning-based BMI prediction model, we employed a method that uses identified points on the face to calculate several facial measurements. This approach utilizes OpenFace (Amos et al., 2016), a state-of-the-art machine-learning tool for facial landmark detection, to ensure accuracy and consistency in identifying key facial points. By incorporating these additional facial metrics, we enhance the robustness of our BMI prediction, providing a complementary technique that cross-validates and strengthens the overall reliability of the predictions. Before calculating various facial features, we ensured robust and accurate BMI prediction from facial images by first detecting and aligning faces ourselves. This involved detecting faces and eyes, normalizing them based on eye coordinates, and performing necessary transformations to align all face images.

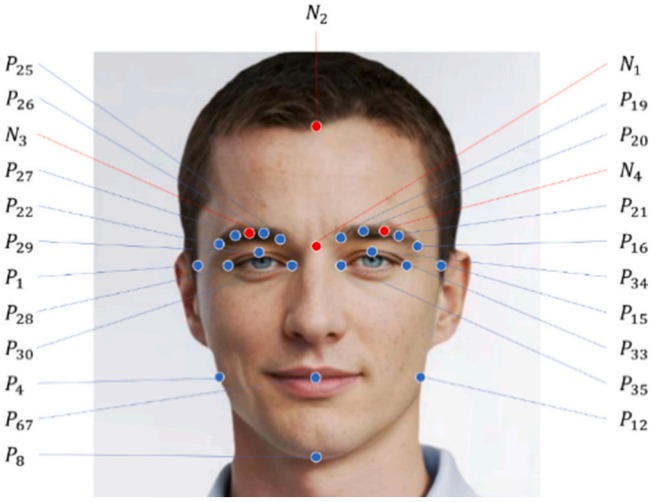

Fig. B. OpenFace facial landmarks used for estimation of facial features.

After this preprocessing, we passed the images to OpenFace for landmark extraction. These landmarks, which are shown in Fig. B, were then used to compute facial geometry and ratios, such as the cheek-to-jaw-width ratio (Wen and Guo, 2013). The cheek-to-jaw-width ratio is the ratio of the cheekbone width (distance between P_1 and P_{15}) to the jaw width (distance between P_4 and P_{12}; see Equation 1). This ratio provides insights into the overall shape and structure of the face. A higher ratio might indicate a narrower jaw relative to the cheekbones, which could correlate with lower body mass, and vice versa:

$$\mathrm{CJWR} = \frac{|P_1P_{15}|}{|P_4P_{12}|}.$$

Equation 1. Cheek to jaw width ratio (CJWR)

Appendix 4: Replication and additional analyses

4.1. Details on replication (Study 2)

4.1.1. Research setting

We conducted our replication study using data from TechCrunch Startup Battlefield pitch competitions. TechCrunch, an online media platform focused on technology and startups, hosts annual conferences around the globe. Each conference includes a Startup Battlefield pitch competition in which early stage entrepreneurs present their businesses to a group of judges (mostly angel investors and other successful entrepreneurs) on stage (Huang et al., 2023; Kanze et al., 2018). According to TechCrunch's website, startups having presented at their competitions—including firms like Dropbox, Fitbit, and Mint—have raised a total of USD 32 billion and achieved a total of 250 exits (as of January 2025). Each pitch lasts about 12 min, starting with approximately 6 min for the entrepreneur's uninterrupted presentation, followed by about 6 min for Q&A with the judges. The judges collectively decide on the competition's winners in private deliberations. Unlike *Shark Tank* investors, these judges do not invest their own money in the ventures (Huang et al., 2023). Instead, they decide the competition winners, who receive a USD 100,000 cash prize. The use of data from Startup Battlefield is in line with recent studies using pitch-competition data to investigate angel investors' funding decisions (Huang et al., 2023; Kanze et al., 2018).

4.1.2. Independent variables

Our independent variables are founders' *BMI* and *venture type*. We coded both variables as in Study 1. In the context of Startup Battlefield, where most products are technology related, an example of a business in the high-tech category is a company manufacturing safe, reliable, cost-effective, high-performance rocket engines, while an example of a business in the low-tech category

is a new coffee store franchise. Again, we constructed a dummy variable that took a value of 1 if the venture was high tech and 0 otherwise. The Cohen's Kappa for our venture-type measure was 0.82.

4.1.3. Control variables

Consistent with Study 1, we controlled for entrepreneurs' *gender*, *age*, *race*, *facial attractiveness*, and *dress formality* (Cohen's Kappa: 0.79). All variables were measured as in Study 1. Furthermore, to isolate the effects of individual conference artifacts (e.g., year, location), which may affect the funding environment and the quality of the ventures, we controlled for the *conference* by including dummies for each conference-year combination (e.g., Startup Battlefield Berlin 2023, Startup Battlefield London 2022; Huang et al., 2023).

4.1.4. Results

Table A shows the descriptive statistics. Table B reports the logistic regression results and Table C includes the marginal effects and contrast analysis. Fig. C shows the plot for the investment probability by obesity and venture type.

Table A
Descriptive statistics (Study 2).

		Mean	SD	Min.	Max.	1	2	3	4	5	6	7	8
1	Selection	0.209	0.408	0.000	1.000	1.000							
2	BMI	27.076	4.537	17.028	44.276	−0.242	1.000						
3	Venture type	0.171	0.377	0.000	1.000	0.139	−0.168	1.000					
4	Gender	0.141	0.348	0.000	1.000	0.088	−0.196	0.078	1.000				
5	Age	31.066	4.615	22.000	47.000	−0.013	0.101	0.003	0.196	1.000			
6	Race	40.669	30.061	0.000	100.000	−0.028	−0.023	−0.003	0.053	0.170	1.000		
7	Facial attractiveness	3.364	1.076	1.136	4.718	0.125	−0.123	0.036	−0.003	0.058	0.029	1.000	
8	Dress formality	1.707	0.695	1.000	3.000	−0.026	−0.054	−0.012	0.124	0.096	−0.059	0.057	1.000

Note: 263 observations. Unstandardized values. All values larger than |0.12| are significant at the $p < 0.05$ level.

Table B
Logistic regression results (Study 2).

	Model 1			Model 2			Model 3		
Variables	β	S.E.	OR	β	S.E.	OR	β	S.E.	OR
BMI				−0.870	0.254**	0.419	−1.328	0.323***	0.265
High tech							1.376	0.516**	3.958
BMI × High tech							2.418	0.664***	11.226
Gender	0.670	0.477	2.013	0.332	0.504	1.394	0.396	0.516	1.486
Age	−0.203	0.190	0.817	−0.071	0.206	0.932	−0.034	0.219	0.967
Race	−0.182	0.192	0.834	−0.221	0.199	0.801	−0.248	0.205	0.780
Facial attractiveness	0.358	0.187†	1.431	0.293	0.194	1.340	0.302	0.208	1.352
Dress formality	−0.297	0.258	0.743	−0.353	0.271	0.703	−0.370	0.289	0.691
Conference	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant	−2.292	0.832**	0.101	−2.128	0.881*	0.119	−2.498	0.954**	0.082
Log-likelihood		−112.665			−105.518			−97.240	
LR χ^2					14.29***			16.56***	
Δ McFadden pseudo-R^2					0.053			0.061	
McFadden pseudo-R^2		0.165			0.218			0.279	
Observations		263			263			263	

Notes: Unstandardized regression coefficients are shown. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$. OR = Odds ratio.

Table C
Marginal effect and contrast analysis (Study 2).

Quantile of BMI	Value of BMI	Probability of investment[a]	Venture type		Contrast groups (quantile)	Contrast	95 % CI	
			High tech	Low tech				
5th	20.87	0.350	0.098	0.428	High tech: BMI (5) vs. BMI (95)	0.676*	0.142	1.209
10th	21.70	0.312	0.118	0.368	High tech: BMI (10) vs. BMI (90)	0.547*	0.026	1.069
25th	23.78	0.228	0.182	0.238	High tech: BMI (25) vs. BMI (75)	0.316†	−0.038	0.671
50th	26.95	0.133	0.326	0.108				
75th	29.87	0.078	0.498	0.048	Low tech: BMI (5) vs. BMI (95)	−0.417***	−0.605	−0.228
90th	32.70	0.045	0.665	0.021	Low tech: BMI (10) vs. BMI (90)	−0.347***	−0.508	−0.186
95th	34.91	0.029	0.774	0.011	Low tech: BMI (25) vs. BMI (75)	−0.190***	−0.277	−0.103

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.10$.
[a] Calculated at the mean values of all variables except BMI.

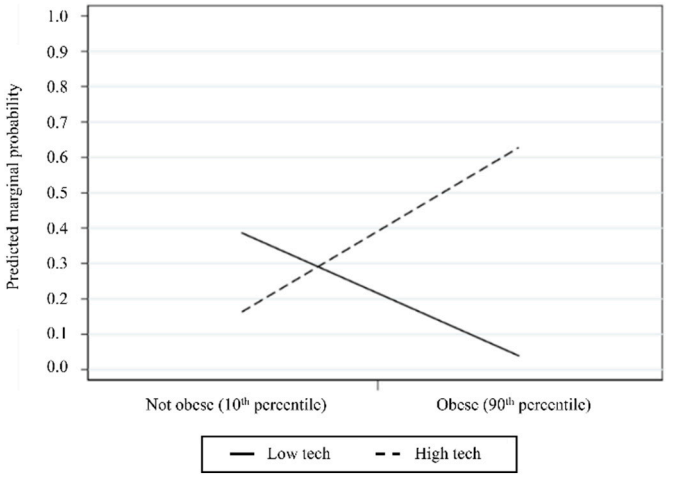

Fig. C. Investment probability by obesity and venture type (Study 2).

4.1.5. Robustness tests

We conducted the same robustness tests as in Study 1. First, we ran the models without controls (direct effect: $\beta = -0.161$, $p < 0.001$; moderation: contrast of marginal probabilities: 0.537, $p = 0.018$). Second, we used the cheek-to-jaw-width ratio as an alternative measure (direct effect: $\beta = -0.807$, $p = 0.004$; moderation: contrast of marginal probabilities: 0.419, $p = 0.034$). Third, we used an obesity dummy instead of a continuous measure (direct effect: $\beta = -2.587$, $p = 0.015$; contrast of marginal probabilities: 0.674, $p < 0.001$).

4.2. Investigating gender differences

We acknowledge the possibility that the effects of obesity stereotypes on evaluations may be more complex than our results suggest. For example, beauty standards are stricter for women than for men (Judge and Cable, 2011; Silverstein et al., 1986) and gender significantly influences angel investors' decisions (e.g., Becker-Blease and Sohl, 2007). We therefore also investigated how combinations of gender and venture type affect the obesity-funding relationship. We find support for a three-way interaction for founders with obesity presenting high-tech ventures. Fig. D plots these relationships for Study 1. These results suggest that both benefits and penalties for founders with obesity might be stronger for women than for men.

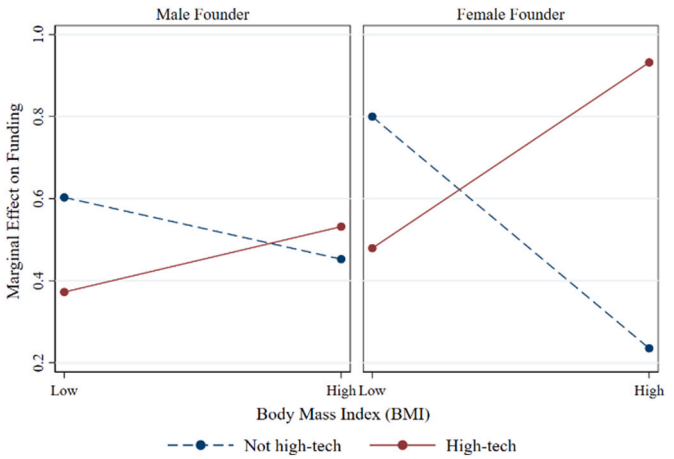

Fig. D. Moderating effect of venture type (high tech) and gender on obesity and funding.

4.3. Obesity and venture survival

Based on our findings, we wondered whether this effect has a rational foundation or is a self-fulfilling prophecy (i.e., lower levels of financial capital for founders with obesity lead to poorer performance and lower chances of survival; Marlow and Patton, 2005; Soto-Simeone et al., 2021). We therefore conducted a survival analysis for the ventures in both field studies. Survival is a widely accepted proxy for new venture success (see Soto-Simeone et al., 2020, for a review) and has been described as "the de facto measure of performance" for early stage ventures (Josefy et al., 2017, p. 778). As such, it has been used extensively as a performance measure in entrepreneurial finance research (e.g., Antretter et al., 2019, 2020a; Blohm et al., 2022).

To determine whether the ventures in our samples survived, we built on previous research (e.g., Blohm et al., 2022; Raz and Gloor, 2007), and searched the internet to determine whether they still had websites and, if so, whether those websites suggested that the companies were still active. We considered a venture inactive if its website returned an error, was blank, or displayed a notice stating that the business had closed. However, this search alone did not allow us to compare the survival spans of different ventures in our samples. Therefore, we used the internet-archiving tool Wayback Machine, which regularly stores versions of publicly accessible websites, to determine when each of the non-surviving ventures went out of business (for similar uses, see e.g., Funk, 2014; Wry et al., 2014).

We then created a dummy variable that took a value of 1 if the venture remained in business three years after its pitch and 0 otherwise (Hyytinen et al., 2015). We reran both field studies with an additional control for whether the entrepreneurs received an investment offer (Study 1) or won the pitch competition (Study 2). The results showed that our hypothesized effects disappeared. In other words, although BMI is negatively related to angel investors' investment decisions, it is not significantly related to survival (Study 1: $\beta = 0.004$, $p = 0.877$; Study 2: $\beta = -0.052$, $p = 0.236$). Also, we found no significant differences for founders with obesity presenting high-tech ventures (Study 1: $\beta = 0.002$, $p = 0.929$; Study 2: $\beta = -0.057$, $p = 0.222$) when it came to their ventures' probability of survival.

We also collected IPO and acquisition data on the ventures in Study 2 as an alternative measure of new venture success (see, e.g., Hochberg et al., 2007; Matusik and Fitza, 2012). We coded this data as a dummy variable (1 if the venture exited and 0 otherwise; mean: 0.236; SD: 0.425). Our analysis revealed that founder BMI is not related to long-term success (direct effect: $\beta = -0.047$, $p = 0.272$; interaction BMI x venture type, $\beta = 0.082$, $p = 0.533$). Overall, these results suggest that although founders with obesity receive less funding, they are no less successful, indicating that they can achieve as much with less financial support and that the bias against founders with obesity is irrational.

4.4. Direct measure of expectancy violation

We build on expectancy violation theory to suggest that positive expectancy violations can help mitigate, if not erase, negative obesity stereotypes. However, our model in Study 3 does not provide a direct measure of whether expectancy violations are indeed the underlying mechanisms explaining why presenting high-tech ventures benefits perceptions of the competence of founders with obesity. In this post-hoc analysis, we provide additional evidence for this theoretical assumption.

To empirically investigate the role of expectancy violation in founders with obesity presenting high-tech ventures, we followed Chandler et al. (2024) and used an adapted scale originally developed by Livingston et al. (2017) to capture expectancy violations about founders' body types. Sample items included "I was surprised to see the body type of the founder pitching this venture" and "in the pitch, the body type of the founder was unexpected to me." Detailed measure items are shown in Appendix 5. The coefficient alpha reliability estimate for the entire scale was 0.72. First, to provide additional support for our baseline assumption of a common belief that successful entrepreneurs are not expected to be obese, we asked participants in our experiment: "In your view, what is the most common body type for entrepreneurs?" Our participants indicated their expectations using the WHO scale described in the paper: 2.8 % said they expected a founder to be "underweight (BMI < 20)," 80.0 % said they expected a founder to be "normal weight ($20 \leq$ BMI < 25)," 16.5 % said they expected a founder to be "overweight ($25 \leq$ BMI < 30)," and only 0.7 % said they expected a founder to be "obese ($30.0 \leq$ BMI)." Thus, it seems that investors expected to see entrepreneurs without obesity.[5]

We tested a moderated mediation model in which expectancy violation mediated the obesity-competence relationship and venture type moderated the violation-competence stage. When controlling for the same variables as in Study 3, the results suggest that obesity is positively associated with our expectancy violation measure ($\beta = 0.128$, $p = 0.003$) and higher expectancy violations generally lead to lower competence assessments ($\beta = -0.168$, $p < 0.001$). The indirect effect of obesity on competence through expectancy violation is negative and significant ($\beta = -0.022$, $p = 0.035$), suggesting that expectancy violation mediates the obesity-competence relationship. Moreover, venture type moderates the relationship between expectancy violations and perceptions of competence ($\beta = -0.122$, $p = 0.050$), suggesting that expectancy violations by founders with obesity are less negative for those presenting high-tech ventures.

[5] To ensure that the results were not influenced by a priming effect through the questions regarding one's expectations for a pitch, we placed those questions at the end of the experiment, after recording all other measures of interest.

Appendix 5: Measures used in Study 3

Likelihood of investment: Murnieks et al. (2011).

1. What is the probability that you would invest in this opportunity?
2. If you were to invest in this opportunity, what is the likely amount you would invest?
3. Regardless of whether you would invest, how successful do you think this opportunity will be?

Expectancy violation: Livingston et al. (2017).

1. I was surprised to see the body type of the founder pitching this venture.
2. I did not expect to see this body type in a venture pitch situation.
3. I did not notice the body type of the founder in the pitch. (r)
4. In the pitch, the body type of the founder was unexpected to me.
5. The body type of the founder was what I expected it to be. (r)
6. The venture was presented as I expected it to be presented. (r)
7. The pitch was what I expected. (r)
8. The way the project was described did not live up to my expectations.

Social desirability: Strahan and Gerbasi (1972).

1. I am always willing to admit it when I make a mistake.
2. I always try to practice what I preach.
3. I never resent being asked to return a favor.
4. I have never been irked when people expressed ideas very different from my own.
5. I have never deliberately said something that hurt someone's feelings.
6. I like to gossip at times.
7. There have been occasions when I took advantage of someone.
8. I sometimes try to get even rather than forgive and forget.
9. At times, I have insisted on having things my own way.
10. There have been occasions when I felt like smashing things.

Data availability

Data will be made available on request.

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