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How do emotions affect giving? Examining the effects of textual and facial emotions in charitable crowdfunding

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Abstract

Drawing on emotional contagion theory and language-mediated association theory, this study develops a research model to examine how textual and facial emotions affect charitable crowdfunding performance. We use computer-aided techniques to extract and measure specific textual and facial emotions in pitches. The proposed model is tested via regression analysis with a sample of 1372 campaigns collected from the largest charitable crowdfunding platform in China—Tencent Gongyi. Moreover, we conducted a fuzzy-set qualitative comparative analysis to examine the complementarity of textual and facial emotions, which supplements the regression analysis results. Our findings show that both textual and facial emotions can impact funding outcomes. However, the effects of specific emotions vary: some (e.g., textual sadness and facial anger) are positive, some (e.g., textual anger and facial fear) are negative, and others (e.g., textual fear, textual disgust, and facial sadness) are insignificant. Moreover, facial emotions complement textual emotions in their effects on funding outcomes. This research outlines a framework to offer a more detailed and comprehensive understanding of emotions in charitable crowdfunding. It also contributes to existing research by revealing the vital but complex role of emotions in the persuasive process of prosocial behaviors and by uncovering the different cognitive mechanisms underlying the impacts of textual and facial emotions.

Keywords: Charitable crowdfunding, Facial emotion, Textual emotion, Emotional contagion theory, Language-mediated association theory, Configuration theory

Introduction

Charitable crowdfunding, also known as donation-based crowdfunding, has become an increasingly popular method for charitable fundraising (Ba et al. 2020; Xiao and Yue 2021). For those who need funds to solve life difficulties, it is an effective means of acquiring external investment from crowds via an online platform (Ba et al. 2021). By facilitating donations without the constraints of time and space, online crowdfunding handles more transactions in terms of both volume and amount between initiators (people who request funds) and backers (people who give money) (Liu et al. 2018). The Donor-Advised Fund (2021) indicates that Americans gave \$471.44 billion in 2020, with individuals as the largest source of charitable donations (\$324.10 billion). According to

the latest report from the China Charity Federation, the funds raised by China's top 20 charitable crowdfunding platforms reached \$1.29 billion in 2020 (China Charity Donation Report 2021). Although charitable crowdfunding reduces the cost of donations and allows more backers to enter the market (Geva et al. 2019), numerous projects have failed to achieve their fundraising targets. Moreover, in many developing countries, charitable crowdfunding is still in its infancy. When operating platforms, managers encounter various difficult issues that affect fundraising. Therefore, both project initiators and managers need more insightful knowledge to break through the funding performance bottleneck (Lee and Park 2020).

Improving crowdfunding performance is probably the most important concern of scholars in the field of charitable crowdfunding (Lee and Park 2020; Sewaid et al. 2021). In charitable crowdfunding, online pitches are the major funding solicitation method used to convey key information to potential backers about both the initiators and their projects (Allison et al. 2015). Backers generally depend exclusively on pitches to form opinions and assess fundraising (Lin and Boh 2021), overcome information asymmetry (Geva et al. 2019; Sewaid et al. 2021), and make decisions. Recognizing online pitches' central role (Martens et al. 2007; Lee et al. 2019), ample literature explores how pitches impact funding performance (e.g., Ba et al. 2022; Wu et al. 2022; Ge et al. 2022). These studies examine how funding performance is impacted by the signals (e.g., length of text and use of photos) conveyed by pitches (e.g., Kamatham et al. 2021; Ba et al. 2021), language styles and tone of narratives (e.g., Chen et al. 2022; Wu et al. 2022; Ge et al. 2022), or the issue-relevant factors that reflect key fundraising attributes, such as initiators' characteristics (Ba et al. 2022), readability (Kamatham et al. 2021), transparency (Mejia et al. 2019), and appeals for donations (Wu et al. 2022). These message contents are critical factors (Chen et al. 2009) that directly reflect the initiator and project reliability (Liu et al. 2018; Ba et al. 2022) and reveal the crowdfunding project's focus characteristics (Lu et al. 2022).

The prior literature provides a wealth of insights into improving crowdfunding performance but does not fully cover all factors that may affect crowdfunding performance. In charitable crowdfunding, emotional expressions in crowdfunding pitches have been suggested to be a key and effective factor in evoking donation behavior (Kamatham et al. 2021). On the one hand, charitable crowdfunding backers generally do not seek financial incentives in return; thus, charitable giving should be understood as a prosocial behavior that is largely driven by intrinsic factors (Allison et al. 2015; Li et al. 2020). Emotional appeals can evoke unpaid help from potential consumers by stimulating their empathic response (i.e., a form of intrinsic factor) (De Waal 2008; Kemp et al. 2013; Nakagawa and Kosaka 2022). On the other hand, charitable crowdfunding backers are typically ordinary people who generally lack the knowledge and expertise to evaluate a project's viability or authenticity (Li et al. 2021); instead, they are easily influenced by emotions (Raab et al. 2020). In summary, emotional appeals are a critical factor for evoking prosocial behavior in backers and improving crowdfunding performance (Kemp et al. 2013; Homer 2021; Zhao et al. 2022). Given the central role of pitches and importance of emotions for charitable crowdfunding, recent studies examine the effects of emotions in narratives (e.g., Kamatham et al. 2021; Chen et al. 2022) or pictures (e.g., Lee and Park 2020). This literature suggests the importance of emotions in garnering charitable funding, but has

produced inconsistent results (Baron 2008). For example, while negative textual emotions are found to produce favorable outcomes in some studies (e.g., Kamatham et al. 2021), negative facial emotions are indicated to lead to negative outcomes in others (e.g., Lee and Park 2020). Given that textual and facial emotions might have different impacts on crowdfunding performance and that they might complement each other by facilitating backers' cognitive processing (Riaz et al. 2018), an integrated research model needs to be developed to systematically explore their roles in charitable crowdfunding. Recent literature has begun to examine the effects of multi-modal emotions (i.e., textual and facial emotions) in charitable crowdfunding (e.g., Rhue and Robert 2018; Zhao et al. 2022), offering a more comprehensive understanding of emotions.

However, the existing emotion research still has some limitations. First, most of the multi-modal emotion studies treat textual and facial emotions differently (e.g., Davis et al. 2021). More specifically, while textual emotions are typically categorized as positive and negative, facial emotions are generally classified into specific emotions like happiness, sadness, and anger. This difference makes it difficult to compare the impacts of textual and facial emotions. Second, some scholars suggest that neither negative (e.g., sadness, anger, and disgust) nor positive emotions (e.g., happiness, pride, and enthusiasm) play a uniformly beneficial or detrimental role in the fundraising process (Tiedens 2001; Baron 2008). Examining the effects of emotions at a general level may confound the roles of specific emotions. Therefore, for charitable crowdfunding, the effects of specific textual emotions should be examined. Third, research mainly focuses on facial sadness and happiness (e.g., Rhue and Robert 2018; Zhao et al. 2022), while rarely examining the impacts of other facial emotions; however, these might also be important and deserve careful exploration (Ekman and Friesen 2003). Therefore, the effects of both textual and facial emotions on charitable crowdfunding performance should be examined in a more integrated and fine-grained way. Finally, studies typically employ variance-based methods to analyze the net effects of emotion-related variables on crowdfunding performance. Multiple regression analysis (MRA), a variance-based method, can effectively test the statistical significance of relationships between independent and dependent variables, but it cannot be used to analyze the combined effects of independent variables.

To fill these research gaps, we draw upon language-mediated association theory (LMAT) (Hoffman 2002) and emotional contagion theory (ECT) (Hatfield et al. 1994) to propose an integrative research model for examining the effects of specific textual and facial emotions. We exploit a sample of 1372 projects that completed fundraising on Tencent Gongyi, the largest charitable crowdfunding platform in China, for our analyses. We used AI techniques to extract emotional scores from the narratives and pictures of pitches and developed measures for our emotional constructs. Finally, we employed regression models to test our model and conducted a fuzzy-set qualitative comparative analysis (FsQCA) to examine the complementarity between text and facial emotions.

This study makes several contributions to the literature. First, examining specific textual and facial emotions in an integrative model provides a more detailed and comprehensive understanding of emotions in charitable crowdfunding and, thus, complements research on crowdfunding (e.g., Rhue and Robert 2018; Lee and Park 2020; Zhao et al. 2022) and charitable donations (e.g., Small and Verrochi 2009; Fisher and Ma 2014). Second, drawing on ECT and LMAT, this study clarified the underlying mechanisms

through which potential backers perceive textual and facial emotions. It then contributes to existing emotion studies (e.g., Lee and Park 2020; Zhao et al. 2022) by providing a comprehensive theoretical framework for understanding emotions. Third, in addition to using MRA to examine the net effects of textual and facial emotions, this study also utilizes FsQCA to examine the combined effects of emotion-related variables on crowdfunding performance. Applying FsQCA not only partially corroborates the regression analysis results but also reveals complementary relationships between textual and facial emotions. Consequently, the hybrid research method that combines MRA and FsQCA provides more profound insights into the role emotions play in crowdfunding performance. Finally, our novel findings on emotions uphold the need to examine multiple types of signals within a comprehensive framework (Lee and Park 2020). This research contributes a framework that uses multiple computer-aided analytical methods (Short et al. 2010; Lu et al. 2022) to investigate how signals in multiple channels impact online businesses.

Theoretical background and literature review

Theoretical background

Although studying the multi-modal emotions in crowdfunding has become a trend, little research considers the mechanisms through which potential backers perceive and process different types of emotions or the differences in those mechanisms. To address this gap, this section introduces two cognitive mechanisms that underlie textual and facial emotion perceptions.

Textual and facial emotions are two types of emotions that are usually expressed in pitches. Textual emotions are transmitted to backers through emotional words in crowdfunding narratives (Uparna and Bingham 2022). They are a particular type of verbal cue that refers to the meaning of the message displayed by the project's textual description (Bonaccio et al. 2016). Facial emotions are exhibited by the facial expressions of campaign-related parties, usually the beneficiaries. Facial emotions are nonverbal cues, which refer to a range of subtle non-spoken or nonwritten signals, such as facial expressions and body postures (Bonaccio et al. 2016). The social psychology literature (Van den Broek 2010; Bonaccio et al. 2016; Li et al. 2021) suggests that people process verbal and nonverbal cues in different ways. While nonverbal cues are processed through the lower-order cognitive pathway, verbal cues normally require a high level of cognitive effort and are processed via the higher-order cognitive pathway. Picture perception is faster, more passive, and requires less effort than text perception (Feng et al. 2021). In emotion studies, facial emotions are found to affect people through the emotional contagion process (as a lower-order cognitive pathway) (Hatfield et al. 1994), whereas textual emotions have impacts via the language-mediated association process (as a higher-order cognitive pathway) (Hoffman 2002; Lishner et al. 2008). We elaborate these two emotion cognitive mechanisms by drawing upon two theories: ECT and LMAT.

ECT suggests that a person's facial expressions of emotions can have a contagion effect on the observer's emotional state (Hatfield et al. 1994). Emotional contagion is described as the automatic and rapid transfer of emotional states between people. During interpersonal communication, people tend to automatically stay in line with or imitate others' facial expressions (Prochazkova and Kret 2017; Wood et al. 2016; Wróbel and Imbir

2019). According to ECT, the contagion process comprises three stages: mimicry, feedback, and contagion (Hatfield et al. 1994). During the mimicry stage, observers unconsciously and automatically mimic and synchronize their nonverbal behavior with that of another person. During the feedback stage, unconscious neural feedback mimicking activates the observers’ emotional systems, partially triggering the associated emotional state in themselves to infer the expressed emotions (Prochazkova and Kret 2017). During the contagion stage, the emotion of others captured by the observers evokes an emotional state that matches the imitated expression. As a result, the observers reach a state of emotional empathy with the emotional expressers. How facial emotions impact funding performance should be associated with the process of emotional contagion (e.g., Raab et al. 2020). ECT can thus serve as a suitable theoretical perspective for understanding the effects of facial emotions in charitable crowdfunding. Figure 1 depicts the process by which facial emotions in crowdfunding pitches influence potential backers’ decisions.

LMAT suggests that written or oral descriptions of another’s situation can make an information receiver think of a comparable situation where the receiver would have a similar reaction (Hoffman 2002; Lishner et al. 2008). Thinking about the situation will arouse corresponding emotional experiences in the receiver (Hoffman 2002). Processing textual information, however, requires the information receiver to have the appropriate knowledge to capture the intended meaning of the text and the ability to incorporate the textual information into that background knowledge (Van den Broek 2010). Extracting emotions from the narratives of crowdfunding pitches is thus a language-mediated association process that requires more cognitive effort and ability from potential backers (Barsade and Gibson 2007; Lin and Boh 2021). LMAT can thus be an appropriate theory to aid in understanding how textual emotions impact funding performance. Figure 2 depicts the process by which textual emotions in crowdfunding pitches influence potential backers’ decisions.

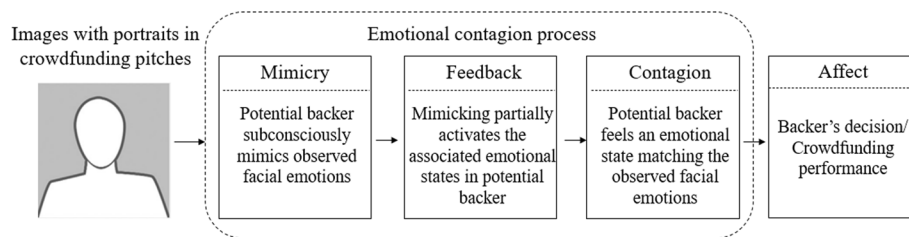


Fig. 1 Flow chart of mechanism of ECT

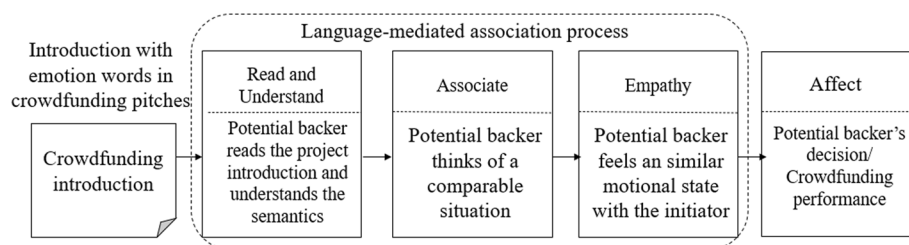


Fig. 2 Flow chart of mechanism of LMAT

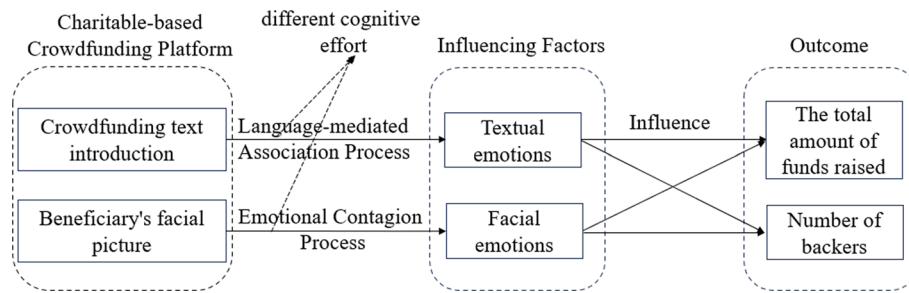


Fig. 3 Research framework

As depicted in Figs. 1 and 2, facial and textual emotions influence potential backers' decision-making in different ways. Some scholars have argued that people perceive textual and facial emotions through different neural systems, indicating that the processes through which people perceive textual and facial emotions are not conflicting (Feng et al. 2021). This also suggests that textual and facial emotions do not function independently. Existing research has revealed that when information is delivered through different channels (e.g., text and images), different forms of information can complement each other (Riaz et al. 2018). Therefore, it is interesting and necessary to employ a comprehensive research model to simultaneously investigate the roles of textual and facial emotions in charitable crowdfunding. ECT and LMAT together could offer a comprehensive analysis of emotions in charitable crowdfunding. Therefore, drawing on ECT and LMAT, this study constructs a research framework to highlight the diverse cognitive pathways through which potential backers perceive textual and facial emotions in crowdfunding pitches (see Fig. 3).

Charitable crowdfunding

Charitable crowdfunding is a type of crowdfunding in which backers do not receive any material returns, only spiritual wealth (Deng et al. 2022). Enabled by Internet technologies, it has become an increasingly popular way to solve livelihood issues such as healthcare and education (Bagheri et al. 2019; Ba et al. 2022). It is also viewed as an effective substitute for conventional charitable giving (Xiao and Yue 2021). Many charitable crowdfunding platforms have emerged worldwide, such as JustGiving, GlobalGiving, and DonorsChoose. An increasing number of individuals and nonprofit organizations use such platforms to launch charitable projects (Zhao et al. 2022).

The rapid growth of charitable crowdfunding has drawn increasing academic attention. A review of existing studies reveals two primary research streams. One stream focuses on backers' behaviors, investigating how backers' motivations and perceptions determine their backing decisions (e.g., Bagheri et al. 2019; Chen et al. 2021). Charitable crowdfunding usually follows the donation model (Ba et al. 2020), where backers rarely seek monetary returns (Ba et al. 2022). Therefore, most existing research views backers' participation as prosocial or charitable behavior (Nakagawa and Kosaka 2022), focusing on prosocial or intrinsic motivations such as altruism and empathy (Bagheri et al. 2019; Zhang et al. 2020; Chen et al. 2021), and their impacts on backing decisions. For instance, Bagheri et al. (2019) find that donors are primarily motivated by several intrinsic-individual factors (e.g., beliefs and values) to participate in charitable crowdfunding.

Li et al. (2018) suggest that donors' giving behaviors are significantly affected by their perceptions about a project and the initiator, such as a sense of trust and experience expectation.

The second stream manifests in a noticeable trend toward initiators and crowdfunding pitches, exploring how initiators' characteristics and the information conveyed by pitches impact funding outcomes (Ba et al. 2021, 2022; Wu et al. 2022). Early studies consider the information asymmetry problem and examine the impact of informational factors, for example, target money, duration, number of pictures, and length of description, on funding performance (Xiao et al. 2021; Chen et al. 2021; Ba et al. 2022). Recent studies explore the role of issue-relevant factors or the content of pitches, such as self-presentation (Wang et al. 2019), transparency (Mejia et al. 2019), trustworthiness (Li et al. 2018; Zhang et al. 2020), and rational appeal (Majumdar and Bose 2018; Wu et al. 2022). More recent studies examine the impacts of emotions presented in pitches (e.g., Kamatham et al. 2021; Chen et al. 2021; Wu et al. 2022). These studies disclose the various impacts of emotions on funding performance, suggesting the importance of an emotional perspective for donation-based crowdfunding. Combining these two research streams and building upon the ECT and LMAT, this study examines how both textual and facial emotions promote backers' prosocial behaviors. In the next section, we review the literature that explores emotions in crowdfunding.

Emotions in crowdfunding

Emotion is an affective state arising from appraising or evaluating an event (Bagozzi et al. 1999; Côté 2005). Emotion can affect people's attitudes, other cognitive processes, and subsequent behaviors (Bagozzi et al. 1999; Lerner et al. 2015; Van Kleef et al. 2015). In interpersonal communications, people take emotional expressions from external sources as key information when forming their own emotions (Van Kleef et al. 2015). Therefore, emotional expressions are helpful in triggering emotional responses and creating emotional ties between strangers (McAllister 1995; Pengnate and Riggins 2020; Wu et al. 2022). In crowdfunding, emotions in pitches can also imply key information about the initiators, such as attitudes, feelings, and mental states (Takagi and Terada 2021; Yuan et al. 2021). Because backers are generally novices who have limited information and expertise with which to form judgments, they tend to rely on peripheral clues like emotions. Moreover, emotions are found to be particularly helpful in evoking intrinsic motivation for prosocial behaviors (De Waal 2008; Kemp et al. 2013). In charitable crowdfunding, backers' donation behaviors are thus more likely to be impacted by emotional factors (Kemp et al. 2013). Emotional appeals (i.e., emotional content intentionally added into crowdfunding pitches) are then an effective tool for convincing backers to render their support, particularly in charitable crowdfunding (Merchant et al. 2010; Kemp et al. 2013; Wu et al. 2022). Consequently, initiators can appeal to backers' emotions to seek their support (Li et al. 2017; Fisher et al. 2021).

How emotions affect crowdfunding outcomes has attracted substantial interest from scholars, particularly in recent years. Table 1 summarizes the recently published crowdfunding studies on emotions and shows that the literature exhibits two significant trends. One trend largely focuses on emotions conveyed through the texts of pitches, examining how emotional words or sentiment strength presented in crowdfunding

Table 1 Recent studies on emotion in crowdfunding

Authors	Crowdfunding type	Data source (data scale)	Tool	Emotion category		Main findings
				Textual emotions	Facial emotions	
Kamatham et al. (2021)	Charitable Crowdfunding	DonorsChoose (168,675)	Emotional word dictionary	✓		Projects with longer introductions and greater positive sentiment are more likely to succeed
Chen et al. (2021)	Charitable crowdfunding	Qingsongchou (754)	LIWC	✓		The article does not find significant effects of sentiment polarity on crowdfunding performance
Wu et al. (2022)	Charitable Crowdfunding	Qingsongchou (1645)	LIWC	✓		The article does not find significant effects of positive and negative emotions on crowdfunding performance
Uparna and Bingham (2022)	Commercial Crowdfunding	Prosper (30,518)	Harvard IV-4	✓		Projects that include more negative emotion words are more likely to be funded
Lee and Park (2020)	Charitable Crowdfunding	Crowdpic (148)	Deep learning techniques		✓	Happy facial emotion has a significant negative effect on crowdfunding performance
Davis et al. (2021)	Commercial Crowdfunding	Kiva (43,210)	Emotient FACET algorithm		✓	The impact of facial emotions on crowdfunding performance is influenced by gender stereotypes
Yoo et al. (2022)	Commercial Crowdfunding	Kiva (142,580)	Deep learning techniques		✓	A smiling face mitigates the negative effect of overhead aversion, whereas a sad face amplifies it
Rhue and Robert (2018)	Charitable Crowdfunding	Gofundme (32,000)	Deep learning techniques	✓	✓	The same emotion—happiness or joy—leads to different fundraising outcome when they are presented in different forms

Table 1 (continued)

Authors	Crowdfunding type	Data source (data scale)	Tool	Emotion category		Main findings
				Textual emotions	Facial emotions	
Zhao et al. (2022)	Charitable Crowdfunding	Unknown (1781)	Deep learning techniques and TextBlob	✓	✓	Sad textual emotion has a discouraging effect on backers. However, there is no significant relationship between facial emotions and crowdfunding performance
This study	Charitable Crowdfunding	Tencent Gongyi (1372)	Deep learning techniques	✓	✓	Some emotions (i.e., textual sadness, facial happiness, and facial anger) have positive effects, while some (i.e., textual anger and facial fear) pose negative effects

narratives impact funding outcomes (e.g., Pengnate and Riggins 2020; Kamatham et al. 2021; Uparna and Bingham 2022). For example, Uparna and Bingham (2022) investigate the effect of negatively worded pitches on funding speed, finding that the presence of negative emotions can accelerate fundraising success. Pengnate and Riggins (2020) explore the impacts of sentiment scores and five basic emotions in project narratives, suggesting that negative emotions are more likely to lead to funding success. Kamatham et al. (2021) explore the role of sentiment strength in project descriptions, revealing that descriptions with more positive or fewer negative words are less likely to succeed.

Another trend concentrates on emotions signaled through photos, examining the effects of facial emotions using different facial emotion analytical tools (e.g., Davis et al. 2021; Yoo et al. 2022, 2023). For instance, Lee and Park (2020) employ deep learning models to explore the impacts of seven facial emotions (e.g., happiness, sadness, fear, and anger) on funding decisions. Building on expectancy violation theory and gender stereotype studies, Davis et al. (2021) point out that entrepreneurs can signal “missing” agentic or communal characteristics via gender-counter stereotypical facial expressions of emotion. Yoo et al. (2022) investigate the moderating effects of two facial emotional expressions (i.e., happiness and sadness) on the negative effect of overhead costs on crowdfunding performance.

While the literature verifies the significant role of emotions in soliciting funding, it reports mixed results on some emotions (refer to Table 1). This suggests that how emotions take effect should be carefully examined in a specific context. Realizing the potential effects of multi-modal emotions in crowdfunding, some scholars are examining the role of textual and facial emotions; however, they all focus on the net effects of textual

and facial emotions. Thus, it remains unclear how textual and facial emotions interact and jointly influence backers' donations. This study fills this knowledge gap by examining these two types of emotions in one comprehensive model and using a FsQCA to examine the complementarity of textual and facial emotions. The effects of facial emotions have been previously studied, primarily from specific emotions, but the roles of textual emotions have rarely been explored from specific emotions. Different types of emotions do not play uniformly favorable or detrimental roles in the fundraising process (Tiedens 2001; Baron 2008). To better study the roles of emotions and compare the differences between the two types, we also divide textual emotions into several specific types of emotions. To uncover how textual and facial emotions impact funding outcomes, we rely on LMAT and ECT for theoretical development.

Proposition development

Since there is little research examining the effects of specific textual and facial emotions, we remain unclear about how specific emotions affect crowdfunding performance. Therefore, we propose exploratory research propositions in this study without explicitly stating the directions of the independent variables (Pengnate and Riggins 2020), an approach that is not uncommon in the emotion literature (e.g., Mejia et al. 2019; Pengnate and Riggins 2020; Lee and Park 2020).

Textual emotions and crowdfunding performance

Emotional appeal is a key and effective factor for inducing prosocial behavior (De Waal 2008; Kemp et al. 2013; Homer 2021). Narratives are often used as an important channel for conveying emotions. According to LMAT, backers can recognize textual emotions that shape their empathic responses as they navigate project narratives (Hoffman 2002). Textual emotions can generate emotional ties to bring initiators closer to their backers, thus effectively convincing backers to render their support (McAllister 1995; Merchant et al. 2010; Kemp et al. 2013). As a peripheral factor, textual emotions can also reflect initiators' characteristics, increasing the project's attractiveness and credibility (Jiang et al. 2020; Takagi and Terada 2021; Yuan et al. 2021). Two primary aspects are used to examine the effects of textual emotions: sentiment polarity (i.e., the text's overall sentimental orientation as well as its strength) (e.g., Kamatham et al. 2021; Chen et al. 2021) and the frequency of negative emotional words (e.g., Majumdar and Bose 2018; Wu et al. 2022). These studies demonstrate the role of textual emotions in improving crowdfunding performance. However, emotional expression creates complex social impressions where neither negative (e.g., sadness, anger, and disgust) nor positive emotions (e.g., happiness, pride, and enthusiasm) play uniformly beneficial or detrimental roles in the fundraising process (Tiedens 2001; Baron 2008). For instance, although anger and depression are both negative, they motivate the recipient to react to the sender in very different ways; this is because they indicate different intentions and qualities when expressed and activate different cognitive reactions within the recipient (Celik et al. 2016). Each emotion has unique features: signal, physiology, and antecedent events (Ekman 1992). Therefore, it is valuable to further explore the role of each emotion in crowdfunding without considering only sentiment polarity or a general concept of negative emotions. To better understand how textual emotions work in charitable crowdfunding, we use previous

studies to classify textual emotions into five basic emotions: sadness, anger, fear, disgust, and happiness (Johnson-Laird and Oatley 1989).

To better influence backers' emotional states, a crowdfunding narrative is generally designed to take backers through different emotional stages by starting with a story crafted to deliberately trigger negative emotions (Merchant et al. 2010). People always express sadness when they are in the stages of loss and long-term adverse behavior (Ekman 1992; Garg and Lerner 2013). Expressing sadness can evoke a feeling of warm glow and sympathy and thus can encourage backers to donate (Andreoni 1990; Celik et al. 2016). People often use an angry tone to narrate when a negative evaluation results in (or is caused by) injustice or when discussing the severity of the trouble being addressed (Celik et al. 2016). Expressing anger signals one's traits related to overcoming a problem, such as strength, power, and competence, which are valued by potential backers and in turn increase their interest and admiration (Alsos and Ljunggren 2017; Fisher et al. 2021). Anger in narratives may thus encourage backers to provide financial support. People always express fear when there is a threat in the environment or when the state of affairs is perceived as unpredictable and uncontrollable (Lerner and Keltner 2001; Foo 2011). Fear motivates people to develop group cohesion and engage in group and collective activities (Griskevicius et al. 2009). Therefore, expressing fear may encourage backers to cooperate with initiators to overcome a common threat. People always express disgust when they are faced with physical or moral impurity (e.g., spoiled foods and dirty environments) (Ottaviani et al. 2013). Disgust drives people to get rid of what is disgusting (Ekman and Friesen 2003). Some scholars have suggested that expressing disgust can encourage potential backers to donate when the charitable appeal emphasizes the relevance to self (Chan and Septianto 2022). In addition to negative emotions impacting crowdfunding performance, positive emotions have also been found to impact funding. Initiators often display happiness when emphasizing the positive impact a donation will have (Faseur and Geuens 2010). Because of the benefits of giving to the recipient, contributing to such projects might give potential backers a sense of pride and accomplishment (Kemp et al. 2013). Moreover, some literature indicates that those who experience happy moods tend to be more altruistic and philanthropic (Lyubomirsky et al. 2005). Therefore, displaying happiness is also helpful for attracting potential backers to donate. Considering the impact of each textual emotion, we make the following proposition:

P1 Textual emotions displayed in charitable crowdfunding pitches have significant impacts on crowdfunding performance.

Facial emotions and crowdfunding performance

Nonverbal cues also play a significant role in conveying information and forming impressions in crowdfunding campaigns. They may exhibit initiators' traits (e.g., friendliness, likability, and attractiveness) and thus increase the projects' credibility and promote backers' prosocial behavior (Bonaccio et al. 2016; Li et al. 2021; Li and Yin 2022). Facial expressions of beneficiaries, as a kind of nonverbal cue, are often used in crowdfunding to attract potential backers to participate (Lee and Park 2020; Davis et al. 2021). According to ECT, potential backers can rapidly and automatically recognize various

emotions expressed through facial expressions in pictures and respond to them when they are browsing a project (Hatfield et al. 1994; Wood et al. 2016; Raab et al. 2020). Facial emotions can influence backers' emotional states and attempt to affect them in a way that is beneficial to the initiators, thus impacting their funding decisions (Russell et al. 2003; Huang and Pearce 2015; Raab et al. 2020). Therefore, selectively displaying recipients' facial emotional expressions is considered an effective way to elicit potential backers' participation (Lee and Park 2020).

The effects of facial emotions are examined in the literature (e.g., Davis et al. 2021; Yoo et al. 2022, 2023). Some scholars suggest that sad facial expressions rather than positive emotions can promote fundraising in the context of charity (Small and Verrochi 2009; Lee and Park 2020). However, other scholars suggest that happy facial expressions promote fundraising (Li and Yin 2022). Therefore, the influence of happy facial expressions on donation decisions remains ambiguous and deserves further investigation. Moreover, existing research primarily focuses on facial sadness and happiness; thus, it remains unclear how other types of facial emotions affect funding performance. To fill this research gap, this study examines the effects on crowdfunding performance of six basic facial emotions (i.e., happiness, sadness, anger, fear, disgust, and surprise) suggested by Ekman and Friesen (2003). Sad facial emotions are often expressed when the recipient is trapped in a problematic situation and wants to solicit help to achieve a goal (Warnick et al. 2021). Sad facial emotions may arouse warmth and promote perceptions that the recipient is in urgent need of help (Tiedens 2001; Davis et al. 2021). Sadness motivates individuals to repair their emotional distress by taking action, such as charitable giving (Garg and Lerner 2013; Li and Yin 2022). Therefore, displaying sad facial emotions helps evoke sympathy and prosocial behaviors in backers (Small and Verrochi 2009). A smile (i.e., a sign of facial expressions of happiness) can give impressions of the initiators' friendliness, optimism, and likability, which will lead to a positive evaluation by backers (Li et al. 2021). Moreover, initiators often show a smiling face to highlight the benefits of donations for initiators (Faseur and Geuens 2010; Li and Yin 2022). Because people are more likely to help those with good character and the positive outcomes of helping give them a greater sense of accomplishment and pride (Chen et al. 2009; Kemp et al. 2013), displaying happy facial emotions can promote backers' engagement. Facial expressions of anger are often used when discussing the severity of the problems people face, and they also indicate the characteristics of the initiators involved in overcoming problems, such as ambition, self-confidence, and determination (Van Kleef et al. 2010; Hareli and Hess 2010). Because potential backers are more likely to provide financial support to those who express confidence in the objectives that can be achieved (Anglin et al. 2018), expressions of anger may prove appealing to potential backers. Facial expressions of fear, surprise, and disgust reflect, to varying degrees, perceptions of potential threats (Lerner and Keltner 2001; Allred and Amos 2018; Davis et al. 2021). The literature suggests that these facial emotional expressions can also help encourage potential donors to participate, but their underlying mechanisms differ. While disgust facial emotions arouse prosocial behavior by evoking strong empathy in backers (Allred and Amos 2018), the other two expressions stimulate backers' self-protection systems and thus motivate them to engage in cooperative behavior, such as joining with initiators, to avoid or overcome the common threat (Griskevicius et al. 2009). In addition to the six basic emotions,

neutral facial expressions are equally common but are often ignored. Some scholars have suggested that neutral facial expressions convey as much important information as positive or negative facial expressions do (Carrera-Levillain and Fernandez-Dols 1994; Albohn and Adams 2021). However, to date, no one has studied the role of neutral facial emotion in charitable crowdfunding, and the effect of neutral expressions on backers' decisions is unknown. We thus consider the role of neutral expressions in this study. Accordingly, we propose the following proposition:

P2 Facial emotions in charitable crowdfunding pitches have significant impacts on crowdfunding performance.

We then put forward a model that examines the effects of textual and facial emotions on crowdfunding performance, as depicted in Fig. 4. The research model also considers the controlling effects of a few variables that are suggested in the literature to significantly affect crowdfunding performance, such as the duration of a project (i.e., *Duration*), the number of words in the project description (*Text Length*), the number of photos in the project pitches (i.e., *Number of pictures*), and the number of project updates (i.e., *Number of updates*) (e.g., Mollick 2014).

Complementarity of textual and facial emotions and configuration theory

Textual and facial emotions are the two most common types of emotional appeals used by project initiators; some scholars suggest that these two forms of emotions simultaneously influence crowdfunding performance (Davis et al. 2021; Chen et al. 2023). To gain a more comprehensive understanding of the role of emotions in charitable crowdfunding, some literature examines the effects of multi-modal emotions in charitable crowdfunding. However, these studies primarily use variance-based methods (e.g., regression analysis) to identify the net effects of multi-modal emotions on performance;

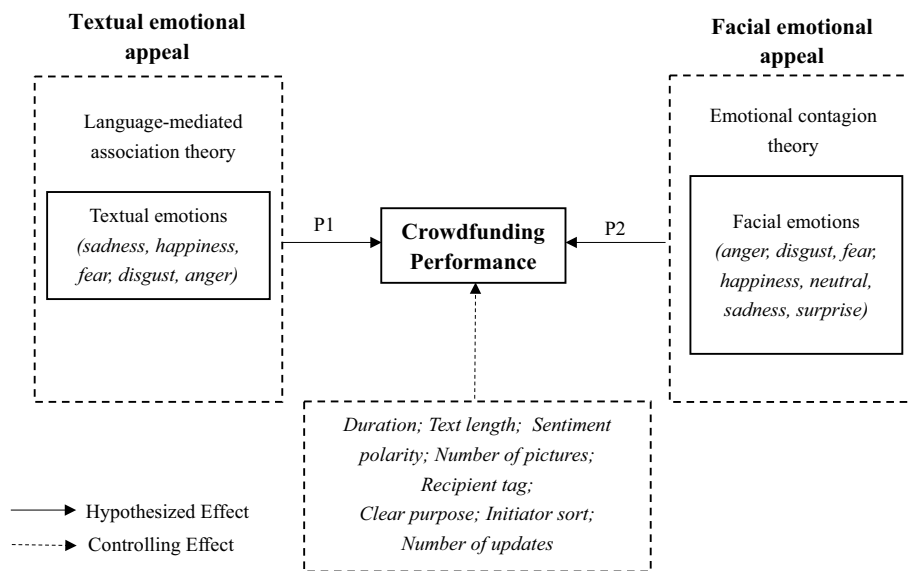


Fig. 4 Research model

these methods fail to capture their joint influence on crowdfunding performance or the complex relationships between these two categories of emotions. Compared to variance-based methods, configuration analysis, which is based on set theory, can uncover complex causal relationships between variables and specific results (Aw et al. 2022; Pappas and Woodside 2021). Thus, configuration analysis of our data will help reveal how textual and facial emotions function together to affect crowdfunding performance and will supplement the regression analysis results.

Existing research suggests that when information is delivered through different channels (e.g., text and images), different forms of information presentation can complement each other, facilitating the audience's cognitive processing (Riaz et al. 2018). Therefore, scholars are extremely interested in the complementarity of textual and facial emotions and have begun investigating how they complement each other in crowdfunding. Existing research finds that consistency between textual and facial emotions helps mitigate the failure of charitable crowdfunding projects in America (Zhao et al. 2022). However, this conclusion may not apply to charity crowdfunding in China. Americans are likely to experience specific feelings, typically look to reconcile inconsistencies, and are more disturbed by discrepancies (Fang et al. 2018). Therefore, they expect the emotions that are spread through different channels to be consistent. In contrast, Chinese tend to experience multiple different emotions concurrently and are less troubled by apparent contradictions in their own thoughts and emotions, as well as in those of others (Hideg and Van Kleef 2017). By combining both modalities, initiators can then express varied emotions to potential backers. Furthermore, scholars argue that people perceive textual and facial emotions through different neural systems (Feng et al. 2021). Some emotions may not be as readily visible through text but can be effectively communicated through facial expressions, and vice versa. Therefore, it is reasonable that people expect to experience various emotions in charitable crowdfunding. To summarize, we believe that textual and facial emotions can complement each other to lead backers through a wider range of emotional stages, eliciting a higher intensity of sympathy and encouraging them to make donations (Merchant et al. 2010). In this case, textual and facial emotions can be combined in various configurations to predict a high level of crowdfunding performance (refer to Fig. 5). Based on this reasoning, we make the following proposition:

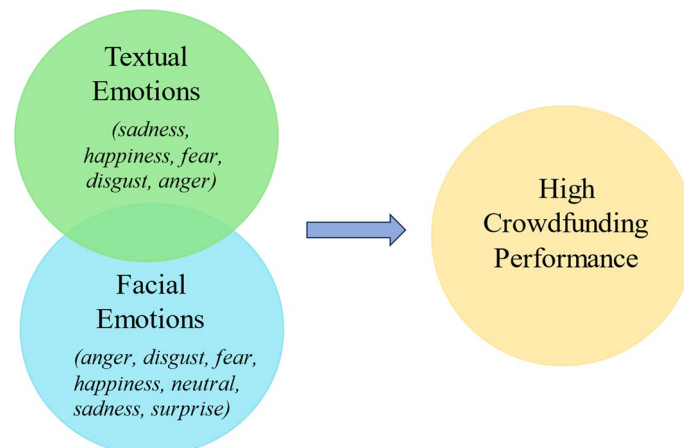


Fig. 5 Configurational model

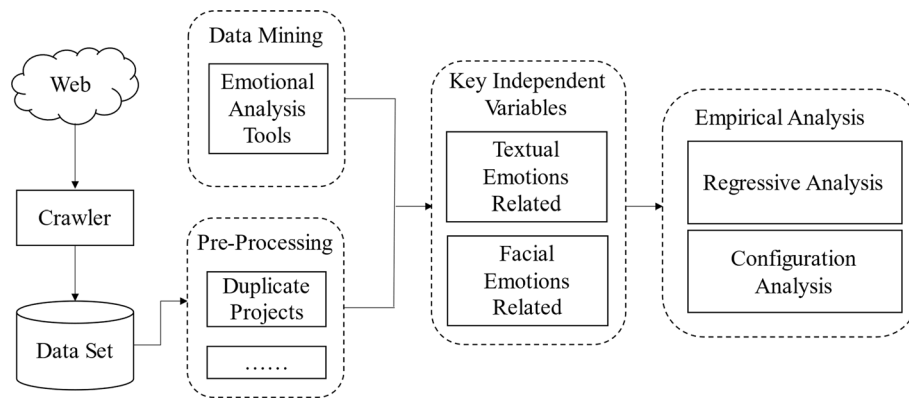


Fig. 6 Technology roadmap

P3 In the configuration pathways that lead to high crowdfunding performance, textual and facial emotions co-occur, indicating the interdependent and complementary relationship between them in their effect on crowdfunding performance.

Methods

Technology roadmap

The technology roadmap, shown in Fig. 6, has four parts: (1) data collection, (2) data preprocessing, (3) data mining, and (4) testing propositions through empirical analysis.

Data

We selected Tencent Gongyi—one of the largest online charitable crowdfunding platforms in China—as our data source. Tencent Gongyi adopts the “keep-it-all” model (i.e., the initiators receive funds regardless of whether the campaign reaches its targeted pledge goal or not) for its campaigns (Cumming et al. 2020). As of August 2021, this platform has received total donations of \$2.382 billion from 535 million backers. Initiators or designated agencies create pitches for donations by offering campaign elements, including the title, purpose, duration, text descriptions, pictures, and optional target amount. The pitches are then displayed to potential backers who determine whether to donate by relying solely on the information in these pitches. The collected contributions are sent to the initiators through a third-party organization after the fundraising is completed.

A Python-based web crawler was created to scrape the “live” projects from the website. Data crawling was conducted between July 2020 and August 2021. We captured all live projects and their details within this period, including the (1) title, (2) start and end dates, (3) project initiators, (4) amount of donations received, (5) number of backers, (6) project description, (7) project pictures, and (8) number of project updates. Figure 7 offers a screenshot of a pitch and its information.

We then performed some preprocessing on our data. We removed projects with any one of the following characteristics: (1) duplicate project, (2) missing project description or number of backers, (3) project photos do not include portraits, (3)



Fig. 7 A screenshot of a charitable crowdfunding pitch

the donation destination is abroad, and (4) does not portray human beings, such as animal protection. After the data preprocessing, our sample included 1,372 projects.

Independent variables

Textual emotion-related variables

We used IBM Watson Natural Language Understanding (NLU) to analyze textual emotions in pitches. Available on the IBM cloud, NLU includes a set of text analytics features that can be used to extract meanings and sentiments from unstructured data. The deep-learning model derives scores of sentiment polarity and textual emotions from a text. Moreover, while the most commonly used dictionary-based method measures emotions just by using emotional words in isolation (Liu 2012), NLU calculates sentiment scores based on how words compose the meaning of longer phrases (Socher et al. 2013). The dictionary-based method thus fails to capture the order of words and their semantic relationships and might lose important information, resulting in less accurate sentiment prediction (Liu 2012). NLU, however, can capture more detailed and contextual information in texts and, thus, is more accurate in measuring textual emotions than the dictionary-based method (Li et al. 2022).

We created a programming script to send the collected texts to the IBM cloud and extracted emotion scores from the returned file for each project, including scores of sentiment polarity and the five textual emotions suggested by Johnson-Laird and Oatley (1989). Scores of sentiment polarity range from -1 to 1, and scores of textual emotions range from 0 to 1. We then take the extracted emotion scores as measures for our textual emotion-related variables.



Fig. 8 An example of facial emotions analysis

Facial emotion-related variables

We used Face++, a new visual service platform that provides facial emotion recognition services, to recognize facial emotions in pictures. With a deep learning algorithm, Face++ can recognize human faces that are displayed in photos and classify them into seven facial emotions (i.e., happiness, neutral, surprise, sadness, disgust, anger, and fear) by calculating the confidence scores of various expressions. The scores are normalized to values between 0 and 100%. The facial emotion with the largest score is considered the key emotion presented by that face. Face++ can produce reliable and accurate facial emotion classification results and has been widely used in the literature for facial emotion analysis (e.g., Zhang et al. 2018). We measured a face's emotions using the confidence scores for the seven basic emotions. If the algorithm detected more than one face in a single image, we calculated the combined emotional score of the image by summing the scores of each face. We do this because more faces can display higher emotional expression strengths (Raab et al. 2020). Similarly, we add up the results of all images to obtain the overall result for each project.

We then created a Python script to send our images to the Emotion-Recognition API provided by Face++ and processed the returned results into a form that can be used for regression analysis. Figure 8 shows an example of facial emotion analysis provided by Face++. This picture depicts a face that expresses happiness with a large smile. The emotion scores of this face as calculated by Face++ are as follows: 100% for happiness and 0 for other emotions.

Dependent variable

Our dependent variable, crowdfunding performance, reflects the success of crowdfunding in different ways. Crowdfunding performance is multidimensional (Ahlers et al. 2015). Following prior work, we operationalized crowdfunding performance with two different variables (e.g., Ahlers et al. 2015; Lukkarinen et al. 2016). Our first variable, *funds raised*, captures the total amount of funds raised during the campaign. This measure is valuable for at least two reasons. First, there is no limit to the amount of funding that may be raised once a project is started, and Tencent Gongyi allows initiators to receive funds without achieving their goals (Anglin et al. 2018). Second, this variable

facilitates comparisons to extant charity fundraising research that uses funds raised as the dependent variable (e.g., Ahlers et al. 2015). Our second variable, *backers*, counts the number of backers who supported a project. The number of backers reflects the persuasive power and attractiveness level of a project presentation (Lukkarinen et al. 2016).

Control variables

We included several project-related control variables in our model that prior research has shown influences crowdfunding performance (Mollick 2014). *Duration* is operationalized as the natural log of one plus the project's duration. *Text length* is measured as the natural log of one plus the number of words in the project introduction. *The number of updates* is measured as the natural log of one plus the number of updates posted by the project initiator. *The number of pictures* is measured as the natural log of one plus the number of pictures used in the project introduction. *Initiator sort* is operationalized as a binary variable (Ba et al. 2022), where 1 indicates that the crowdfunding initiator is an organization and 0 indicates otherwise. *Clear purpose* is operationalized as a binary variable, where 1 indicates that a crowdfunding purpose is given and 0 indicates otherwise. *Recipient tag* is operationalized as a binary variable, where 1 indicates that the initiator labels the recipient with a tag that reflects the recipient's characteristics (e.g., children, old people) and 0 indicates otherwise. Sentiment polarity reflects the overall sentimental orientation (or direction) of the text (e.g., positive, negative, and neutral) as well as its strength; it is measured by NLU (Stieglitz and Dang-Xuan 2013). Table 2 illustrates the measures for all variables used in this study.

Estimation procedures

Model

We tested our propositions using multilevel modeling, which is a statistical approach widely used to analyze data in crowdfunding research (e.g., Anglin et al. 2018; Warnick et al. 2021). Crowdfunding scholars employ multilevel modeling to analyze the extent to which the independent variables explain the dependent variable (Raab et al. 2020). As such, we first added the control variables to the model in Eq. (1) (Models 1 and 5). Next, we added the textual emotion-related variables in Eq. (2) (Models 2 and 6) and facial emotion-related variables in Eq. (3) (Models 3 and 7), respectively. Finally, we added the facial emotion-related variables, which led to the full model in Eq. (4) (Models 4 and 8).

We tested our propositions with two different statistical techniques: multilevel ordinary least squares (OLS) regression modeling and multilevel negative binomial regression modeling. First, we used multilevel OLS regression modeling to estimate our models for funds raised. One of the dependent variables—*funds raised*—is right-skewed. To reduce the variable's skewness, we performed natural logarithmic transformations on this variable. Moreover, to guard against model misspecification due to heteroscedasticity, our models were fitted with robust standard errors. Second, we used multilevel negative binomial regression modeling to estimate our models for the dependent variable *backers*. The negative binomial regression model is a special form of the Poisson model, which allows the distribution of the dependent variable to be overdispersed (Venables and Ripley 2013). We employed this approach because the dependent variable *backers*

Table 2 Variable description

Variable type	Variable	Measures
Dependent Variable	Funds raised	$\text{Ln}(1 + \text{amount raised})$
Control Variable	Backers	Number of project backers
Control Variable	Duration	$\text{Ln}(1 + \text{the duration of the project})$
Control Variable	Text length	$\text{Ln}(1 + \text{the number of words of project introduction})$
	Number of updates	$\text{Ln}(1 + \text{the number of updates})$
	Number of pictures	$\text{Ln}(1 + \text{the number of pictures})$
	Clear purpose	1: Crowdfunding purpose is given 0: Otherwise
	Recipient tag	1: The initiator labels the recipient with a tag which reflects the individual's characteristics 0: Otherwise
Control Variable	Initiator sort	1: Crowdfunding initiator is an organization 0: Otherwise
	Sentiment polarity	Scores of sentiment polarity of crowdfunding description (between -1 and 1)
	T_sadness	Score of textual emotion of sadness (between 0 and 1)
	T_happiness	Score of textual emotion of happiness (between 0 and 1)
Independent Variable	T_fear	Score of textual emotion of fear (between 0 and 1)
	T_disgust	Score of textual emotion of disgust (between 0 and 1)
	T_anger	Score of textual emotion of anger (between 0 and 1)
	F_anger	$\text{Ln}(1 + \text{score of facial emotion of anger in pictures} * 100)$
	F_disgust	$\text{Ln}(1 + \text{score of facial emotion of disgust in pictures} * 100)$
	F_fear	$\text{Ln}(1 + \text{score of facial emotion of fear in pictures} * 100)$
	F_happiness	$\text{Ln}(1 + \text{score of facial emotion of happiness in pictures} * 100)$
	F_neutral	$\text{Ln}(1 + \text{score of facial emotion of neutral in pictures} * 100)$
	F_sadness	$\text{Ln}(1 + \text{score of facial emotion of sadness in pictures} * 100)$
	F_surprise	$\text{Ln}(1 + \text{score of facial emotion of surprise in pictures} * 100)$

is overdispersed count data, and the negative binomial regression model is suitable for processing such data (Lawless 1987). An alternative to this approach would be to use a natural logarithmic transformation on *backers* and estimate using an OLS model. However, the negative binomial regression model generated significantly better fit models than the alternative approach (Silva and Tenreiro 2006). Therefore, we used the negative binomial regression model to mitigate the influence of the overdispersion of the dependent variable.

The dependent variable for Models 1, 2, 3, and 4 is *funds raised*, while that of Models 5, 6, 7, and 8 is *backers*.

Model 1/5 (controls only model)

$$\begin{aligned}
 Y_i(\text{dependent variable}) = & \beta_0 + \beta_1 \text{Duration} + \beta_2 \text{Clear purpose} + \beta_3 \text{Initiator sort} \\
 & + \beta_4 \text{Recipient tag} + \beta_5 \text{number of updates} \\
 & + \beta_6 \text{number of pictures} + \beta_7 \text{Text length} \\
 & + \beta_8 \text{Sentiment polarity} + \varepsilon.
 \end{aligned}
 \tag{1}$$

Model 2/6 (textual emotions added)

$$\begin{aligned}
Y_i(\text{dependent variable}) = & \beta_0 + \beta_1 \text{Duration} + \beta_2 \text{Clear purpose} + \beta_3 \text{Initiator sort} \\
& + \beta_4 \text{Recipient tag} + \beta_5 \text{number of updates} \\
& + \beta_6 \text{number of pictures} + \beta_7 \text{Text length} \\
& + \beta_8 \text{Sentiment polarity} + \beta_9 T_sadness + \beta_{10} T_happiness \\
& + \beta_{11} T_fear + \beta_{12} T_disgust + \beta_{13} T_anger + \varepsilon.
\end{aligned} \tag{2}$$

Model 3/7 (facial emotions added)

$$\begin{aligned}
Y_i(\text{dependent variable}) = & \beta_0 + \beta_1 \text{Duration} + \beta_2 \text{Clear purpose} + \beta_3 \text{Initiator sort} \\
& + \beta_4 \text{Recipient tag} + \beta_5 \text{number of updates} \\
& + \beta_6 \text{number of pictures} + \beta_7 \text{Text length} \\
& + \beta_8 \text{Sentiment polarity} + \beta_{14} F_anger + \beta_{15} F_disgust \\
& + \beta_{16} F_fear + \beta_{17} F_happiness + \beta_{18} F_neutral + \beta_{19} F_sadness \\
& + \beta_{20} F_surprise + \varepsilon.
\end{aligned} \tag{3}$$

Model 4/8 (full models)

$$\begin{aligned}
Y_i(\text{dependent variable}) = & \beta_0 + \beta_1 \text{Duration} + \beta_2 \text{Clear purpose} + \beta_3 \text{Initiator sort} \\
& + \beta_4 \text{Recipient tag} + \beta_5 \text{number of updates} \\
& + \beta_6 \text{number of pictures} + \beta_7 \text{Text length} \\
& + \beta_8 \text{Sentiment polarity} + \beta_9 T_sadness + \beta_{10} T_happiness \\
& + \beta_{11} T_fear + \beta_{12} T_disgust + \beta_{13} T_anger + \beta_{14} F_anger \\
& + \beta_{15} F_disgust + \beta_{16} F_fear + \beta_{17} F_happiness + \beta_{18} F_neutral \\
& + \beta_{19} F_sadness + \beta_{20} F_surprise + \varepsilon.
\end{aligned} \tag{4}$$

Results

Table 3 provides the means, standard deviations, and minimum and maximum values for the variables, as well as the variance inflation factors (VIFs) in model 4. All VIFs are below the commonly recommended threshold of 10 (Neter et al. 1990). Table 4 provides correlation coefficients for the variables; all correlations among the variables are less than 0.70. Therefore, multicollinearity is not a concern. Table 5 reports the results of the OLS regression analysis, while Table 6 presents the results of the negative binomial regression analysis. Table 7 reports a summary of the impacts of the independent variables on the dependent variables. We calculate the variance inflation factors (VIFs) to check for multicollinearity between variables.

Proposition 1 proposes that textual emotions displayed in charitable crowdfunding pitches have significant impacts on crowdfunding performance. As expected, the

Table 3 Descriptive statistics

Variable	Mean	SD	Min	Max	VIF
Funds raised(ln)	11.268	1.517	6.238	15.320	–
Backers	9670.845	21,171.110	255	519,608	–
Duration(ln)	3.517	1.314	0.000	6.725	1.09
Clear purpose	0.920	0.272	0	1	1.11
Recipient tag	0.251	0.434	0	1	1.12
Initiator sort	0.795	0.404	0	1	1.08
Number of updates(ln)	1.545	0.852	0.000	4.500	1.06
Number of pictures(ln)	1.835	0.502	0.693	3.466	1.06
Text length(ln)	7.308	0.407	5.380	8.342	1.19
Sentiment polarity	0.195	0.469	– 0.782	0.956	1.50
T_sadness	0.458	0.176	0.049	0.723	1.30
T_happiness	0.569	0.087	0.100	0.749	1.22
T_fear	0.148	0.142	0.010	0.694	1.16
T_disgust	0.146	0.112	0.033	0.648	1.08
T_anger	0.114	0.062	0.027	0.594	1.13
F_anger	1.799	1.665	0.000	5.681	1.74
F_disgust	1.982	1.802	0.000	6.000	1.95
F_fear	1.692	1.645	0.000	6.042	1.79
F_happiness	3.603	2.278	0.000	7.800	1.92
F_neutral	4.209	2.126	0.000	7.649	2.34
F_sadness	3.247	2.072	0.000	6.745	2.15
F_surprise	2.185	1.812	0.000	6.277	2.02

The VIFs in Table 3 are reported for Model 4

coefficients of each of the textual sadness terms are significantly positive, indicating the emotions have a significantly positive effect on funding performance (*funds raised*, $\beta = 0.121$, $p < 0.001$; *backers*, $\beta = 0.891$, $p < 0.001$). In addition, each of the textual anger terms has a significantly negative coefficient, indicating that anger has a significantly negative effect on *funds raised* ($\beta = -0.078$, $p < 0.01$) and *backers* ($\beta = -2.981$, $p < 0.001$), which is consistent with the proposition. However, the other textual emotions, including happiness, fear, and disgust, have no significant impacts on funding performance. Therefore, we find support for P1 for the textual emotions of sadness and anger.

Proposition 2 proposed that facial emotions in charitable crowdfunding pitches have significant impacts on crowdfunding performance. As expected, the coefficients of each of the facial happiness terms are significantly positive, indicating that they have a significantly positive effect on funding performance (*funds raised*, $\beta = 0.096$, $p < 0.01$; *backers*, $\beta = 0.055$, $p < 0.01$). In addition, our results in Model 8 show a positive and significant impact of facial anger ($\beta = 0.107$, $p < 0.001$) and negative and significant impacts of facial fear (F_fear, $\beta = -0.072$, $p < 0.01$) and surprise (F_surprise, $\beta = -0.043$, $p < 0.05$) on *backers*. Other facial emotions, including disgust, neutral, and sadness, have no significant impacts on funding performance. Therefore, we find support for P2 with our results on the facial emotions of happiness, anger, fear, and surprise.

Table 4 Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
1.Funds raised (ln)	1																						
2.Backers	0.256***	1																					
3.Duration (ln)	0.106***	0.030	1																				
4.Clear purpose	0.040	0.038	0.016	1																			
5.Recipient tag	0.060**	-0.034	0.069**	0.171***	1																		
6.Initiator sort	-0.008	-0.015	0.075***	0.129***	0.148***	1																	
7. Number of updates(ln)	0.320***	0.083***	0.068**	0.012	-0.033	0.009	1																
8. Number of pictures(ln)	-0.014	0.027	-0.021	0.103***	-0.118***	0.001	0.036	1															
9:Text length(ln)	0.162***	-0.015	0.202***	0.140***	0.048*	-0.051*	0.187***	-0.007	1														
10. Sentiment polarity	-0.095***	-0.065***	0.092***	-0.014	-0.013	0.086***	-0.011	-0.033	0.059**	1													
11:T_sad-ness	0.127***	0.086***	-0.127***	0.045*	0.089***	-0.070***	-0.030	-0.032	-0.098***	-0.439***	1												
12:T_hap-piness	0.013	0.003	0.018	-0.034	0.024	-0.024	0.014	0.012	0.145***	0.333***	-0.185***	1											
13:T_fear	0.029	0.007	-0.064**	-0.046*	-0.018	-0.074***	-0.016	0.033	-0.063**	-0.330***	0.224***	-0.168***	1										
14:T_dis-gust	0.002	-0.014	-0.045*	0.047*	0.086***	0.066**	0.043	0.049	-0.100***	-0.140***	0.070***	-0.111***	0.082***	1									
15:T_anger	-0.064**	-0.050*	-0.035	-0.023	-0.012	-0.073***	0.025	0.002	-0.068**	-0.212***	0.089***	-0.230***	0.135***	0.182***	1								
16:F_anger	0.067**	0.038	0.025	-0.006	-0.014	0.022	0.035	-0.001	0.115***	0.070***	-0.052*	0.097***	-0.054**	-0.030	-0.057**	1							

Table 4 (continued)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
17.F_dis-	0.003	0.082***	0.015	-0.048*	-0.025	0.045*	0.019	0.132***	0.128***	-0.099***	0.114***	-0.073***	-0.036	-0.006	0.345***	1							
gust																							
18.F_fear	0.074***	-0.003	-0.003	-0.018	-0.011	-0.006	0.027	0.042	0.074***	0.044	-0.051*	0.036	-0.083***	-0.027	-0.031	0.275***	0.276***	1					
19.F_hap-	0.126***	0.023	0.096***	-0.022	-0.052*	0.010	0.090***	-0.007	0.157***	0.175***	-0.116***	0.169***	-0.121***	-0.042	-0.067**	0.339***	0.494***	0.312***	1				
piness																							
20.F_neu-	0.120***	-0.012	0.039	0.050*	-0.062**	-0.035	0.051*	-0.005	0.210***	0.095***	-0.077***	0.124***	-0.105***	-0.066**	-0.058**	0.453***	0.456***	0.312***	0.456***	1			
trai																							
21.F_sad-	0.139***	0.018	0.066**	0.055**	-0.022	-0.005	0.049*	0.003	0.166***	0.046*	-0.023	0.120***	-0.042	0.000	-0.074***	0.389***	0.394***	0.363***	0.467***	0.598***	1		
ness																							
22.F_sur-	0.110***	-0.003	0.070***	0.010	-0.032	-0.020	0.056**	-0.007	0.154***	0.053*	-0.041	0.111***	-0.059**	-0.066**	-0.084***	0.359***	0.320***	0.359***	0.400***	0.505***	0.411***	1	
prise																							

***p < 0.001; **p < 0.01; *p < 0.05

Table 5 The influence of textual and facial emotions on funds raised (n = 1372)

Variable	Model 1		Model 2		Model 3		Model 4	
	Coef	t value	Coef	t value	Coef	t value	Coef	t value
<i>OLS regression</i>								
Duration(ln)	0.072* (0.031)	2.73	0.084** (0.031)	3.16	0.078** (0.031)	2.94	0.087** (0.031)	3.29
Clear purpose	0.016 (0.129)	0.71	0.011 (0.129)	0.50	0.011 (0.127)	0.50	0.007 (0.129)	0.32
Recipient tag	0.053* (0.089)	2.09	0.041 (0.089)	1.61	0.062* (0.087)	2.49	0.048 (0.088)	1.90
Initiator sort	-0.012 (0.097)	-0.48	-0.009 (0.095)	-0.37	-0.012 (0.096)	-0.46	-0.009 (0.095)	-0.34
Number of updates (ln)	0.300*** (0.048)	11.06	0.305*** (0.048)	11.36	0.285*** (0.047)	10.71	0.291*** (0.047)	11.03
Number of pictures (ln)	-0.032 (0.061)	-1.27	-0.028 (0.060)	-1.13	-0.017 (0.068)	-0.70	-0.026 (0.060)	-1.04
Text length (ln)	0.091** (0.100)	3.37	0.092** (0.103)	3.33	0.060* (0.105)	2.14	0.065* (0.106)	2.27
Sentiment polarity	-0.102*** (0.084)	-3.94	-0.069* (0.096)	-2.34	-0.114*** (0.085)	-4.32	-0.076* (0.096)	-2.55
T_sadness			0.130*** (0.248)	4.51			0.121*** (0.247)	4.23
T_happiness			0.023 (0.522)	0.76			0.000 (0.508)	0.01
T_fear			0.011 (0.268)	0.43			0.013 (0.267)	0.52
T_disgust			-0.002 (0.338)	-0.09			-0.004 (0.334)	-0.17
T_anger			-0.085*** (0.566)	-3.65			-0.078** (0.557)	-3.39
F_anger					0.021 (0.030)	0.63	0.023 (0.030)	0.68
F_disgust					-0.046 (0.029)	-1.33	-0.032 (0.029)	-0.90
F_fear					-0.007 (0.029)	-0.22	-0.005 (0.029)	-0.15
F_happiness					0.103** (0.023)	2.99	0.096** (0.023)	2.82
F_neutral					0.065 (0.028)	1.65	0.063 (0.028)	1.62
F_sadness					0.013 (0.026)	0.36	0.003 (0.026)	0.08
F_surprise					0.037 (0.028)	1.08	0.029 (0.028)	0.87
_cons	7.765*** (0.724)	10.721	7.169*** (0.802)	8.94	8.121*** (0.74)	10.98	7.720*** (0.820)	9.42
Observations	1372		1372		1372		1372	
R-squared	0.133		0.154		0.159		0.177	
ΔR ²	-		0.021		0.026		0.044	
F value	25.63***		19.61***		17.13***		15.23***	

***p < 0.001; **p < 0.01; *p < 0.05

Robust standard errors are in parentheses

Robustness tests

We conducted a series of additional analyses to verify the robustness of our results. First, to test the robustness of textual emotion-related variables, we used alternative measures to retest textual emotions in crowdfunding pitches. In this step, the textual emotions were divided into four categories (i.e., positive, sadness, anxiety, and anger), and these emotions were labeled *T_pos*, *T_sadness*, *T_anxiety* and *T_anger*, respectively. The

Table 6 The influence of textual and facial emotions on backers (n = 1372)

Variable	Model 5		Model 6		Model 7		Model 8	
	Coef	z value	Coef	z value	Coef	z value	Coef	z value
<i>Negative binomial regression</i>								
Duration(ln)	0.073** (0.021)	3.45	0.068** (0.021)	3.29	0.058** (0.021)	2.73	0.056** (0.021)	2.66
Clear purpose	0.323*** (0.106)	3.02	0.182 (0.108)	1.68	0.398** (0.115)	3.47	0.283* (0.115)	2.47
Recipient tag	-0.189** (0.067)	-2.82	-0.222** (0.066)	-3.35	-0.185** (0.066)	-2.8	-0.222** (0.065)	-3.39
Initiator sort	-0.027 (0.070)	-0.38	-0.031 (0.071)	-0.43	-0.054 (0.07)	-0.76	-0.054 (0.071)	-0.76
Number of updates (ln)	0.219*** (0.035)	6.30	0.203*** (0.034)	5.93	0.216*** (0.034)	6.27	0.203*** (0.034)	5.98
Number of pictures (ln)	0.067 (0.047)	1.44	0.076 (0.046)	1.66	0.076 (0.053)	1.43	0.087 (0.052)	1.67
Text length (ln)	-0.188* (0.077)	-2.50	-0.180* (0.076)	-2.36	-0.254** (0.077)	-3.31	-0.218** (0.077)	-2.83
Sentiment polarity	-0.310*** (0.062)	-5.00	-0.280*** (0.075)	-3.74	-0.348*** (0.063)	-5.57	-0.307*** (0.074)	-4.13
T_sadness			0.894*** (0.190)	1.11			0.891*** (0.187)	4.76
T_happiness			-0.139 (0.212)	-0.65			0.184 (0.361)	0.51
T_fear			-0.176 (0.253)	-0.69			-0.161 (0.21)	-0.77
T_disgust			-3.049*** (0.455)	-6.71			-0.196 (0.253)	-0.77
T_anger			-0.280*** (0.075)	-3.74			-2.981*** (0.452)	-6.59
F_anger					0.106*** (0.02)	5.19	0.107*** (0.02)	5.33
F_disgust					-0.004 (0.02)	-0.20	-0.001 (0.02)	-0.04
F_fear					-0.073** (0.022)	-3.38	-0.072** (0.021)	-3.38
F_happiness					0.064*** (0.017)	3.86	0.055** (0.017)	3.33
F_neutral					0.006 (0.02)	0.29	0.004 (0.019)	0.23
F_sadness					-0.001 (0.019)	-0.07	-0.001 (0.019)	-0.07
F_surprise					-0.035 (0.022)	-1.58	-0.043* (0.022)	-2.00
_cons	9.631*** (0.543)	17.34	9.467*** (0.574)	16.48	9.852*** (0.542)	18.19	9.611*** (0.579)	16.59
Observations	1372	1372	1372	1372			1372	
Log likelihood	-13,907.483	-13,876.064	-13,882.339	-13,852.328			-13,852.319	
Pseudo R ²	0.004	0.006	0.005	0.008			0.008	
ΔR ²		0.002	0.001	0.004			0.002	

Standard errors are in parentheses

***p < 0.001; **p < 0.01; *p < 0.05

counts of the words for each emotion were measured by TextMind (Gao et al. 2013). TextMind was developed based on the Chinese version of Linguistic Inquiry and Word Count (LIWC) and is widely used to analyze language styles and text emotions (e.g., Luo

Table 7 Summary of the impacts of independent variables on dependent variables

Independent variable	Dependent variable	
	Funds raised	Backers
T_sadness	+++	+++
T_happiness		
T_fear		
T_disgust		
T_anger	--	---
F_anger		+++
F_disgust		
F_fear		--
F_happiness	++	++
F_neutral		
F_sadness		
F_surprise		-

+ Indicates that the independent variable has a significantly positive impact on the dependent variable. – Indicates that the independent variable has a significantly negative impact on the dependent variable. The number of + or – corresponds to the intensity of significance

et al. 2021; Jiang et al. 2022). As Models 9 and 10 show (see Table A-1 in “Appendix 1”), the estimation results are consistent with our prior results.

Second, to test the robustness of facial emotion-related variables, we used an alternative approach. This approach calculates the mean confidence score of all facial expressions per project rather than the total score for each facial emotion in the project. For instance, the confidence score of happy facial expressions in a project is 200% and there are three faces in the project; thus, the happy facial emotions score for this project is 200%/3. To reduce the skewness of the data, we convert them using natural logarithms (i.e., the final score of happy facial emotions = $\ln(200\%/3 * 100 + 1)$). As Models 11 and 12 show (see Table A-2 in “Appendix 1”), the results are in line with those in the main analysis.

Configuration analysis

We propose that textual and facial emotions can simultaneously influence charitable giving. Additionally, we suggest that textual and facial emotions can complement each other in improving crowdfunding performance. To further validate these viewpoints, we conducted FsQCA (Pappas and Woodside 2021) in addition to our regression analysis. FsQCA is a set analysis method that reveals complex causal relationships between multiple variables and specific results by analyzing the sufficiency and necessity of the conditions or combinations of conditions for an outcome (Ragin 2008). It emphasizes that the influences of variables on results are not independent and that a variable’s significance and function depend on its combination with other variables. Unlike variance-based methods, which identify the net effect between variables in a model, FsQCA focuses on investigating the complex causal relationship between a specific result and its antecedents (Pappas and Woodside 2021). Consequently, FsQCA can provide valuable insights to explain the intricate relationships (e.g., substitute or complement) between variables and compensate for

the limitations of variance-based methods (e.g., regression analysis and PLS-SEM) (Misangyi and Acharya 2014; Aw et al. 2022).

FsQCA calibration and analysis

Data calibration is an initial step in the FsQCA method and refers to a transformative process that converts raw numerical data into set membership scores based on pre-defined anchors or thresholds. Following Ragin's (2008) recommendation, this study employs a direct calibration method, which uses three anchors to structure a fuzzy set. The anchors include the thresholds for full membership (0.95), full non-membership (0.05), and the cross-over point (0.5). After calibration, cases with a membership score of 0.5 are excluded from the analysis (Ragin 2008). To prevent these cases from being discarded, we followed the recommendation of Fiss (2011) and manually transform values with a membership of 0.5 to 0.501. Through data calibration, the raw data is transformed into fuzzy set scores ranging from 0 to 1.

After data calibration, following Ragin's (2008) suggestion, we conducted a necessity analysis of all antecedent variables and their negations to assess whether generation of high crowdfunding performance has necessary conditions. By testing each causal condition independently, we found that the highest consistency is 0.75, which was below the cut-off value of 0.90 (as shown in Table 8). Therefore, no necessary condition was identified.

Table 8 Necessary condition analysis

Condition	FR		BA	
	Consistency	Coverage	Consistency	Coverage
T_sadness	0.69	0.70	0.74	0.66
~T_sadness	0.60	0.65	0.59	0.56
T_joy	0.66	0.68	0.67	0.61
~T_joy	0.65	0.69	0.67	0.62
T_fear	0.62	0.74	0.66	0.71
~T_fear	0.72	0.66	0.70	0.57
T_disgust	0.59	0.73	0.63	0.69
~T_disgust	0.75	0.68	0.75	0.60
T_anger	0.64	0.68	0.68	0.64
~T_anger	0.67	0.68	0.66	0.60
F_anger	0.61	0.66	0.61	0.59
~F_anger	0.63	0.63	0.65	0.58
F_disgust	0.61	0.65	0.61	0.57
~F_disgust	0.62	0.63	0.65	0.59
F_fear	0.60	0.65	0.60	0.58
~F_fear	0.64	0.64	0.67	0.59
F_happiness	0.68	0.69	0.68	0.61
~F_happiness	0.61	0.66	0.65	0.62
F_neutral	0.73	0.69	0.73	0.61
~F_neutral	0.60	0.70	0.63	0.65
F_sadness	0.67	0.69	0.68	0.62
~F_sadness	0.62	0.66	0.64	0.60
F_surprise	0.63	0.67	0.63	0.59
~F_surprise	0.61	0.62	0.64	0.59

The data analysis is performed using the fuzzy truth table algorithm available in FsQCA 3.0. The causal conditions in this analysis include textual emotion-related variables (i.e., textual sadness, anger, fear, disgust, and happiness) and facial emotion-related variables (i.e., facial anger, disgust, fear, happiness, neutral, sadness, and surprise). Considering the textual and facial emotion-related variables as causal conditions is appropriate, as previous studies demonstrate that these emotion-related indicators have a significant impact on crowdfunding (e.g., Kamatham et al. 2021; Yoo et al. 2023). The outcome variables are *funds raised* and *backers*, which are two key indicators used to measure the quality of crowdfunding projects. This study aims to explain two dependent variables that broadly represent crowdfunding performance: funds raised (FR) and backers (BA). Since the study's main purpose is to improve crowdfunding performance, the configuration analyses only analyze the configuration pathways associated with high crowdfunding performance. For both the FR and BA outcomes, we set the consistency cutoff at 0.80; PRI consistency cutoff at 0.60 (following Patala et al. 2021); and coverage or frequency cutoff at five cases per configuration.

FsQCA results

Following Fiss's (2011) suggestion, we use parsimonious and intermediate solutions to distinguish between core and peripheral conditions. A core condition refers to a factor that consistently appears in both the intermediate and parsimonious solutions, indicating its importance influence on the outcome. In contrast, a peripheral condition refers to a factor that solely appears in the intermediate solution, suggesting a relatively lesser impact on the outcome. Following previous FsQCA studies, we interpret configurations based on both core and peripheral conditions. Tables 9 and 10 display the configurational pathways for achieving high funds raised and high backers, respectively.

As shown in Tables 9 and 10, the consistency scores for all solutions are above the recommended minimum value of 0.9, indicating that these causal conditions are sufficient to generate high levels of both funds raised and backers (Ragin 2008). In summary, there are four combinations that are consistently sufficient to result in high levels of compensation for either FR (FR1–FR4) or BA (BA1–BA4), respectively.

Considering FR first, as shown in Table 9, the overall solution consistency and coverage are 0.90 and 0.26, respectively, which are appropriate values for both indicators (Woodside 2013). In summary, the causal combinations in Table 9 account for 26% of the outcome instances. To achieve high levels of FR, solutions FR1–FR4 propose various combinations in which the factors studied may be present or absent, depending on how they interact with each other. Note that in all four configurations, all facial emotions are present as either core or peripheral conditions, demonstrating the importance of facial emotions in charitable crowdfunding. Specifically, solution FR1 suggests that in the absence of textual anger, projects with textual disgust as the core condition and complementary textual happiness along with seven facial emotions as peripheral conditions can produce high levels of FR. This indicates that initiators can gain sympathy and assistance from people by expressing the direness of their situation in a specific combination (textual disgust is always associated with the direness of their situation). It is an interesting discovery, as textual disgust was

Table 9 Configurations for achieving high funds raised

Configuration outcome	Solutions			
	FR1	FR2	FR3	FR4
<i>Textual emotions</i>				
T_sadness		●	●	●
T_happiness	•		•	⊗
T_fear	⊗	●	⊗	●
T_disgust	●	⊗	⊗	•
T_anger	⊗	⊗	●	●
<i>Facial emotions</i>				
F_anger	•	●	•	●
F_disgust	•	•	•	•
F_fear	•	•	•	•
F_happiness	•	●	●	●
F_neutral	•	•	•	•
F_sadness	•	•	●	●
F_surprise	•	•	•	•
Consistency	0.91	0.92	0.93	0.94
Raw coverage	0.19	0.18	0.17	0.17
Unique coverage	0.03	0.01	0.01	0.01
Solution coverage	0.26			
Solution consistency	0.90			

Core conditions are represented by ● (presence) and ⊗ (absence). Peripheral conditions are represented by • (presence) and ⊗ (absence). Blank spaces indicate conditions that are not important

Table 10 Configurations for achieving high backers

Configuration outcome	Solutions			
	BA1	BA2	BA3	BA4
<i>Textual emotions</i>				
T_sadness	•	•	•	●
T_happiness	⊗	⊗	⊗	•
T_fear	•	•	•	⊗
T_disgust	•	•	•	●
T_anger	•	•	•	⊗
<i>Facial emotions</i>				
F_anger	●	⊗	⊗	•
F_disgust	⊗	⊗	⊗	•
F_fear	⊗	⊗	⊗	•
F_happiness	⊗	⊗	⊗	•
F_neutral	⊗	●	⊗	•
F_sadness	⊗	⊗	●	•
F_surprise	⊗	⊗	⊗	•
Consistency	0.94	0.92	0.94	0.93
Raw coverage	0.16	0.18	0.17	0.19
Unique coverage	0.01	0.02	0.02	0.08
Solution coverage	0.30			
Solution consistency	0.90			

Core conditions are represented by ● (presence) and ⊗ (absence). Peripheral conditions are represented by • (presence) and ⊗ (absence). Blank spaces indicate conditions that are not important

identified as an insignificant independent variable in MRA but emerged as a core causal condition in FsQCA. The difference between the MRA and FsQCA results can be explained by the limitations of net effects analyses. Net effects analyses focus on the independent variables' direct and indirect effects on the outcome variables and ignore the complexity of antecedent combinations (Woodside 2013), while FsQCA can capture these specific combinations, and thus provide different insights than MRA. Next, solution FR2 suggests that projects with textual sadness, textual fear, facial anger, and facial happiness as the core conditions and the other five facial emotions as peripheral conditions can produce high levels of FR. Solution FR3 suggests that projects with textual sadness, textual fear, facial sadness, and facial happiness as the core conditions and complementary textual happiness along with the other five facial emotions as peripheral conditions can produce high levels of FR. Solution FR4 suggests that projects with textual sadness, textual fear, textual anger, facial anger, facial sadness, and facial happiness as the core conditions and complementary textual disgust along with the other four facial emotions as peripheral conditions can produce high levels of FR. Solutions FR2–FR4 disclose that both textual sadness and facial happiness exist as core causal conditions and FR3–FR4 reveal that both textual anger and facial sadness exist as core causal conditions in achieving high FR. These results support the MRA findings that demonstrate the central roles of textual sadness, textual anger, and facial happiness in charitable fundraising. Further, solutions FR2–FR4 not only validate the results of the regression analysis but also offer fresh insights, suggesting that facial sadness, facial anger, and textual fear can act as core factors and promote higher fundraising when combined with other factors in specific configurations.

For BA, as shown in Table 10, the overall solution consistency and coverage are 0.90 and 0.30, respectively, which are appropriate values for both indicators (Woodside 2013). In summary, the causal combinations in Table 10 account for 30% of the outcome instances. To achieve high levels of BA, solutions BA1–BA4 also propose four different configurational pathways. In detail, solution BA1 suggests that, in the absence of facial surprise, projects with facial anger as the core condition and complementary textual sadness, textual fear, textual disgust, and textual anger as peripheral conditions can produce high levels of BA. Solution BA2 suggests that, in the absence of facial surprise, projects with facial neutral as the core condition and complementary textual sadness, textual fear, textual disgust, and textual anger as peripheral conditions can produce high levels of BA. Solution BA3 suggests that, in the absence of facial fear, projects with facial sadness as the core condition and complementary textual emotions of sadness, fear, disgust, and anger as peripheral conditions can produce high levels of BA. To summarize, in configurations BA1–BA3, all negative textual emotions exist as peripheral conditions, highlighting the insignificance but necessity of negative textual emotions to elicit sympathy from backers. Further, according to the results of BA1–BA3, when facial fear or facial surprise is absent as a core or peripheral condition, the effects of facial anger, facial neutral, and facial sadness are interchangeable. Facial fear and facial surprise both reflect the initiator's perception of danger and uncertainty about their situation, and thus they play similar roles in charitable crowdfunding. Therefore, the results of BA1–BA3 suggest that

when the situation is not completely uncontrollable, appropriately expressing negative or neutral facial emotions can be advantageous for gaining support from potential backers. Solution BA4 suggests that, in the absence of textual anger, projects with textual sadness and textual disgust as the core conditions and complementary textual happiness, along with seven facial emotions as peripheral conditions, can produce high levels of BA. It's evident that BA4 and FR1 exhibit a high level of consistency in leading to high crowdfunding performance, indicating the universality and importance of these two combinations in leading to various high crowdfunding outcomes. At the same time, it is worth noting that the configuration paths leading to high FR and high BA are mostly different. The underlying reason for this disparity is that decisions of whether and how much to donate are two relatively independent processes. Specifically, even if potential backers decide to donate, the exact amount they contribute is influenced by multiple factors. These factors may include project-related information (e.g., textual emotion, facial emotion, etc.) and individual circumstances (e.g., their financial situation). As a result, crowdfunding outcomes are shaped by the intricate interplay between project-related factors and individual circumstances; the decisions of whether and how much to donate represent two distinct facets of this multifaceted process.

Based on these results, there are no single condition configurations, suggesting no single condition alone is sufficient to achieve high levels of compensation for either FR or BA. Instead, it is the complementary effect of antecedent conditions (i.e., textual emotions and facial emotions) that leads to high outcome levels. In addition, the FsQCA results confirm that potential backers are not concerned about whether the text and facial expressions convey the same emotion. Instead, potential backers may expect to experience various emotions in charitable crowdfunding. Therefore, a greater variety of emotional appeals is a more compelling reason for potential backers to make donations because they elicit more intense sympathy. As a result, these novel FsQCA results resonate with proposition 3. In conclusion, the FsQCA results not only suggest the configurational pathways that can lead to high levels of FR and BA but also demonstrate the complementarity of textual and facial emotions in influencing crowdfunding performance.

Discussion

Drawing on LMAT and ECT, this study offers an insightful and comprehensive understanding of how emotions affect the persuasive process of charitable crowdfunding. Our results offer several key findings. They first reveal how funding outcomes are affected by textual emotions. In general, negative textual emotions have greater impact on crowdfunding performance than positive textual emotions. However, while a positive textual emotion (i.e., happiness) cannot drive donations, not all negative textual emotions can promote favorable funding outcomes. More specifically, textual sadness is found to be conducive to improving all funding outcomes (i.e., funds raised and backers); textual anger, however, results in fewer funds raised and fewer backers. Moreover, other negative textual emotions (i.e., fear and disgust) do not have significant impacts on any of our funding outcomes. One possible reason for this phenomenon is that potential backers have different expectations regarding the various textual emotions included in a project

description. According to language expectancy theory (Burgoon et al. 2002), backers' responses to a project description depend on whether the language expression matches their expectations. For example, they prefer to see project initiators using sincere and sad language to describe the challenges faced by beneficiaries and the importance of the project, rather than angry language used to complain. In this scenario, textual sadness is more likely to encourage backers to donate, while textual anger may have a discouraging effect on backers.

Second, even allowing for the direct effects of textual emotions, our results still disclose emotional contagion effects of some facial emotions on backers' decisions, revealing the vital role of facial emotions in driving donations and attracting backers in charitable crowdfunding. More specifically, facial happiness is found to be significantly effective in improving funding performance across all our outcomes. Facial anger can help attract more backers, but facial fear and surprise are found to result in fewer backers; other facial emotions, including disgust, neutral, and sadness, do not have significant impacts on any of our funding outcomes. This result seems somewhat unexpected, as many scholars generally suggest that sad facial expressions lead to favorable fundraising outcomes (Small and Verrochi 2009). On the contrary, happy facial expressions may not be well suited for charitable crowdfunding scenarios and thus may hinder fundraising (Lee and Park 2020). A possible reason for this phenomenon could be that backers have seen too many sad facial expressions, causing them to become aesthetically fatigued or in a state of compassion collapse. They may try to experience more positive emotions (e.g., happy facial emotions) to counteract the effects of negative emotions caused by seeing sad facial expressions (Merchant et al. 2010).

Third, in addition to using MRA to examine the net effects of textual and facial emotions on crowdfunding performance, this study utilizes FsQCA to examine the combined effects of emotion-related variables on crowdfunding performance. Applying FsQCA not only partially corroborates the results of the regression analysis, but also provides a more profound insight into the role of emotions in crowdfunding performance. Specifically, some emotions, such as textual disgust, facial neutral, and facial sadness, were identified as insignificant independent variables in MRA but emerged as core causal conditions in FsQCA. The differences between the MRA and FsQCA results are attributed to the limitations of net effect analysis. Net effect analysis focuses on the overall impact of independent variables on the dependent variable, while ignoring the specific combinations that lead to high levels of crowdfunding performance. However, FsQCA maintains the integrity of individual cases and identifies combinations of causal conditions that can lead to high levels of crowdfunding performance (Woodside 2013). Consequently, the FsQCA results may differ from the MRA results. In addition, although MRA dominates complementarity studies (Ho et al. 2016), it may be less effective when exploring interactive relationships between multiple variables due to issues such as multicollinearity (Woodside 2013). Applying FsQCA enables us to observe that no single condition alone is sufficient to achieve high levels of either FR or BA, demonstrating the complementarity of textual and facial emotions in influencing crowdfunding performance. The complementarity may be attributed to the fact that people perceive textual and facial emotions through

different neural systems, and Chinese tend to experience multiple different emotions concurrently (Hideg and Van Kleef 2017). The hybrid emotional expressions that combine textual and facial emotions can guide potential backers through a wider range of emotional stages, eliciting more intense sympathy and encouraging them to make donations.

Finally, by examining the effects of specific textual and facial emotions on two funding outcomes in an integrative approach and using a configurational analysis to test the complementarity between textual and facial emotions, our results allow us to observe and compare the overall differences between these two types of emotions. While textual emotions present similar effects on both funds raised and backers among the underlying variables (refer to Table 7), facial emotions illustrate more significant overall impacts in attracting backers (with four significant linear terms) than in increasing funds raised (with only one significant linear term). At the same time, the configuration analysis results show that no single best configuration of textual and facial emotions leads to high crowdfunding performance. Instead, it is the complementary effect of antecedent conditions (i.e., textual and facial emotions) that leads to high outcome levels. In other words, textual and facial emotions jointly influence crowdfunding performance and complement each other in their effect on crowdfunding outcomes. This novel finding not only suggests that facial emotions function in a way that complements textual emotions but also indicates that facial emotions, as visual cues, should affect backers' donation behaviors via a cognitive process distinctive from that of textual emotions. People are more susceptible to facial emotions (processed via a lower-order cognitive pathway) to become backers of a charitable crowdfunding project (Chen et al. 2023); however, when making more donations, they need to extract more information (i.e., textual emotions in our case) from crowdfunding narratives by initiating the language-mediated and higher-order cognitive process (Chen et al. 2023).

Research implications

This study offers several major contributions to existing research. First, while emotions are widely explored in charitable crowdfunding research (e.g., Chen et al. 2021; Kamatham et al. 2021; Wu et al. 2022), the effects of specific emotions presented in narratives are rarely examined in charitable crowdfunding. Furthermore, most studies (e.g., Lee and Park 2020; Kamatham et al. 2021; Wu et al. 2022) focus on only one aspect of emotions (e.g., textual or facial), thus failing to offer a full picture to delineate the influencing mechanisms of emotions on funding outcomes. By examining textual and facial emotions simultaneously in an integrative model, this study provides a more detailed and comprehensive understanding of emotions in charitable crowdfunding and thus complements the crowdfunding (e.g., Lee and Park 2020; Zhao et al. 2022) and charitable donation research (e.g., Small and Verrochi 2009; Fisher and Ma 2014). More specifically, although our results reveal that the overall negative-emotion-oriented narratives are more likely to generate favorable funding outcomes in charitable crowdfunding, our study further suggests that not all negative emotions, whether textual or facial, can lead to favorable funding outcomes in charitable crowdfunding. Some (e.g., textual sadness and facial anger) have positive effects, some (e.g., textual anger and facial fear) have negative effects, and others (e.g.,

textual fear, textual disgust, and facial sadness) have no significant effects. This finding regarding the varied effects of emotions is also consistent with previous studies (e.g., Baron 2008; Pengnate and Riggins 2020; Ge et al. 2022), in which emotions are found to play an important but inconsistent role in driving human behaviors. Each emotion, having unique features (Ekman 1992), might have a distinctive underlying mechanism in driving human decisions. Our findings thus suggest the contingency view of emotions: the effects of specific emotions should be carefully examined and evaluated in a specific context.

Second, drawing upon ECT (Hatfield et al. 1994) and LMAT (Hoffman 2002), our study not only reveals the underlying cognitive mechanisms through which backers perceive emotional signals, but also illustrates how they process textual and visual cues differently. In doing so, we contribute to existing emotion studies (e.g., Lee and Park 2020; Zhao et al. 2022) by uncovering the cognitive mechanisms underlying the impacts of emotions and by drawing on theoretical perspectives to gain an insightful understanding of emotions. It also contributes to existing emotion studies by providing a comprehensive theoretical framework for understanding the effect of emotions. In addition, based on ECT and LMAT, our study examines and uncovers the effects of specific textual and facial emotions on funding outcomes in charitable crowdfunding. The results suggest that the same emotions (e.g., textual and facial happiness), when signaled via two different channels (i.e., text and photo), might have distinct effects on funding outcomes in charitable crowdfunding. This finding is inconsistent with Zhao et al.'s (2022) findings that textual sadness hinders donations from potential backers and facial emotions do not affect project fundraising. One possible reason could be social and cultural differences. The projects in our study were all created in China, while the projects in their study were all created in the U.S. Emotions are susceptible to cultural factors and might undergo distinctive cognitive processes in another cultural context (Lim 2016). Therefore, our results are significantly different from theirs. Furthermore, these findings not only deepen our understanding of emotions in the literature (e.g., Lee and Park 2020; Zhao et al. 2022) but also confirm our argument that textual and facial emotions affect human decisions via different underlying cognitive mechanisms.

Third, applying FsQCA and its contrast with MRA also represents an important methodological contribution to emotion research. Although MRA offers clear indications of the statistical significance, strength, and direction of the relationship between independent and dependent variables and dominates complementarity studies (Ho et al. 2016), it may be less effective for exploring the interactive relationships between multiple variables due to issues such as multicollinearity (Woodside 2013). Applying FsQCA enables us to observe the complementary relationships between multiple textual and facial emotions. The FsQCA results show that no single condition is sufficient to achieve high levels of compensation for either FR or BA, suggesting that facial emotions, as low-order cognitive cues, function as a complement to textual emotions, which are high-order signals, in their effect on charitable crowdfunding outcomes. Some scholars suggest that when information is delivered via both images and texts, different forms of information presentation can facilitate audiences' cognitive processing by providing complementary and relevant information cues, thus making the

information more likely to persuade the audience (Riaz et al. 2018). By using configuration analysis to examine the complementarity between textual and facial emotions, our study confirms and extends this view. We not only confirm the essential role of facial emotions in addition to textual emotions in charitable crowdfunding but also disclose how facial and textual emotions function as complements (Riaz et al. 2018) in the persuasive process of prosocial behaviors. As a result, applying FsQCA demonstrates potential superiority over the variance-based approaches in handling causal complexity and provides additional insights into the findings from variance-based methods (Aw et al. 2022). However, while FsQCA demonstrates potential superiority over MRA, this does not imply that the FsQCA results have greater or lesser efficacy. MRA is effective in revealing the direct and overall impacts of independent variables on dependent variables, but it fails to capture asymmetric relationships between them, leading to outcomes that may not be relevant to any specific case within the dataset (Ho et al. 2016). Meanwhile, FsQCA maintains the integrity of individual cases and focuses on antecedent combinations that lead to high outcomes; thus, it can effectively capture asymmetric relationships between variables. However, it cannot accurately analyze effect sizes of various influencing factors. Therefore, there is no clear superiority or inferiority between MRA and FsQCA results. Instead, applying both methods allows us to reveal causal asymmetry and observe the impact of emotional expression on enhancing crowdfunding performance from multiple perspectives (El et al. 2010). For example, the MRA results indicate that facial anger does not have a significant impact on funds raised, but facial anger appears in FR1–4 as either a central or peripheral element. As FsQCA captures the asymmetric relationships between independent and dependent variables, it provides a more comprehensive view of emotions' impacts on crowdfunding performance, thereby complementing the MRA results. Furthermore, the differences between the results of the two methods allow us to observe more possibilities leading to high performance. For example, both FR1–4 and MRA emphasize the importance of considering the role of happy facial expressions in fundraising. However, it is also important to note that sometimes a happy facial expression may have a significant impact only when it co-occurs with other facial expressions, whether these expressions are central or peripheral. Integrating MRA and FsQCA will bring forth new perspectives for future research in this field (Pappas and Woodside 2021).

Finally, although emotions are generally signaled through multiple channels in crowdfunding and other types of online businesses (e.g., e-commerce, live streaming e-commerce, and the sharing economy), most existing studies examine emotions by focusing on a single channel, such as text (e.g., Uparna and Bingham 2022; Wu et al. 2022), photos (e.g., Davis et al. 2021; Yoo et al. 2022, 2023), and videos (e.g., Jiang et al. 2019; Warnick et al. 2021). Recognizing the need to study emotions presented in multiple channels in an integrative framework, very few scholars (e.g., Zhao et al. 2022) have begun to examine the impacts of both textual and facial emotions simultaneously. Our study joins this school of studies to investigate emotions presented in both narratives and photos using deep learning and text mining techniques. Our novel findings further uphold the need to examine multiple types of emotions with a comprehensive framework (Lee and Park 2020). Our study contributes a framework that combines

multiple computer-aided analysis methods (Short et al. 2010; Lu et al. 2022) to investigate the impacts of different types of emotions; moreover, it could be extended and applied in other research settings, such as commercial crowdfunding and live streaming commerce. This framework could also be extended and applied to study informational signals other than emotions that are also conveyed via multiple channels. Considering the popularity of online businesses and the universal use of multimedia in such businesses, a more comprehensive framework is undoubtedly necessary and important for us to gain more insightful understandings in such relatively new online settings.

Practical implications

Our study also offers some practical implications. It can provide project initiators (e.g., agents and fundraisers) of charitable crowdfunding with some useful suggestions. The study first discloses the vital but complex role of emotions in affecting funding outcomes. Although the overall more negative emotions presented in the narratives of pitches are found to lead to more backers and funds, the effect of each emotion varies. Emotional appeals could then be considered a useful tool for soliciting financial support in charitable crowdfunding. In our case, project initiators could properly increase textual sadness, facial happiness, and facial anger and reduce facial fear and facial surprise in crowdfunding pitches to improve funding performance. In addition, although some emotions, such as textual disgust, facial sadness, and facial neutral, were identified as insignificant independent variables in MRA, they emerged as core causal conditions in FsQCA. This implies that initiators can appropriately express these emotions in specific combinations to attract more potential backers for donations. Further, consistent with previous research (e.g., Ekman 1992; Baron 2008; Pengnate and Riggins 2020), our study also suggests that each emotion might have unique features and underlying cognitive processes that affect prosocial behaviors. In addition, initiators should be alert to the phenomenon of compassion collapse, where potential backers may become desensitized or indifferent to the sufferings of others if they are exposed to an overload of emotional information. Project initiators should evaluate the impact of each emotion in the corresponding contexts, treat their effects with particular caution, and adjust their emotionally appealing strategy accordingly.

Second, our research reveals how facial emotions function differently than textual emotions in their effect on funding outcomes in charitable crowdfunding. The same emotions (e.g., anger and happiness), if presented in different channels (i.e., texts and photos), might have different or even opposite impacts on funding outcomes. Moreover, facial emotions are found to complement the effects of textual emotions by showing more ability to attract backers. In detail, the MRA results reveal that while textual emotions have similar effects on both funds raised and backers among the underlying variables (refer to Table 7), facial emotions exhibit more significant overall impacts on attracting backers (with four significant linear terms) than increasing funds raised (with only one significant linear term). Furthermore, the FsQCA findings indicate that in most combinations (i.e., FR2–FR4) leading to high FR, both facial and textual emotions play core roles. However, in most combinations (i.e., BA1–BA3) leading to

high BA, specific facial emotions assume a core role, while textual emotions play a peripheral role. These findings suggest that project initiators should signal emotions via multiple channels, such as texts, photos, and videos. More importantly, they could leverage the complementarity between textual and facial emotions and use multiple channels to convey appropriate emotions to achieve better funding performance. It is noteworthy that the MRA and FsQCA results are not entirely consistent. This does not imply a conflict between the results of the two methods; on the contrary, the combination of these two methods provides a more comprehensive insight into the impact of emotional expressions on enhancing crowdfunding performance. In detail, MRA is more suitable for analyzing the overall and direct impacts of independent variables on dependent variables, while FsQCA focuses more on the role of specific combinations in leading to high performance. In summary, the two methods can complement each other in revealing relationships between variables; thus we recommend project initiators integrate the results of both MRA and FsQCA to formulate emotional expression strategies. According to our results, project initiators could present faces in photos with more happiness or anger to attract more backers and use more words related to sadness in narratives to convince backers to make more contributions. They should, of course, note the detailed differences between textual and facial emotions so that they can take advantage of the positive impacts of some emotions (e.g., anger) presented in one channel while avoiding the negative effects of such emotions in the other channel.

Platform operators could also benefit from our results. They should use rich media in their platforms to allow project initiators to convey emotions through multiple channels. They could also evaluate and monitor the impacts of emotions on funding outcomes on a regular basis by relying on their data and analytical abilities and offer guidance to initiators on how to leverage emotions via appropriate channels to achieve better funding outcomes. Finally, platform operators could help initiators gain a deep understanding of each emotion and its underlying cognitive process by arranging focus groups or in-depth interviews with backers. Together with big data analysis, this will help initiators craft better emotionally appealing strategies in charitable crowdfunding.

Limitations and future research directions

The current research has some limitations. First, we analyzed data from only one charitable crowdfunding platform, which adopts the “KIA” model. There are other types of crowdfunding platforms that use other models. Therefore, although the data site we used is a typical and famous platform, our results may not be simply generalized to other platforms. Second, our study was conducted in a Chinese cultural context. Emotions are susceptible to cultural factors and might undergo distinctive cognitive processes in another cultural context. Special caution should then be taken when generalizing the results to other cultural contexts. For instance, some scholars have proposed that Americans tend to experience specific feelings and are likely to be disturbed by discrepancies. In contrast, Chinese tend to experience multiple different emotions concurrently and are less troubled by apparent contradictions in their own thoughts and emotions, as well as in those of others (Hideg and Van Kleef 2017; Fang et al. 2018).

Therefore, when both Chinese and Americans perceive multiple emotions simultaneously, they may generate different reactions. Future research can further explore emotions in other platforms or cultural contexts or conduct comparative studies by including multiple platforms and cultural contexts. Third, we relied on IBM Watson Natural Language Understanding (NLU) and TextMind to analyze textual emotions and Face++ to calculate facial emotion scores. Although these three methods are reliable and have been widely adopted in previous studies, our results might be subject to the computer-aided methods we adopted. Moreover, these data mining algorithms are mature products developed by leading companies in the computer field. Therefore, it would be challenging for us to test their accuracy. Future studies could use other methods, such as surveys and interviews, to validate our results. Finally, we have considered the impacts of important control variables in our model; however, this research cannot include all such possible factors, such as gender, readability, tone, and location of initiators.

In addition to the above suggestions, there are some additional directions for future studies. First, this study focused on charitable crowdfunding. Future research can apply and extend our comprehensive framework of emotion to other types of platforms, such as commercial crowdfunding and e-commerce. Second, our study and previous literature indicate mixed results on some emotions. This might suggest that the impacts of emotions might be moderated by contextual factors or that quadratic relationships might exist between certain emotions and crowdfunding performance. Future studies could explore the quadratic effects of emotions or the conditions under which emotions take various effects. Finally, we examined emotions in texts and photos in this study. Videos and live streaming are two other popular channels for expressing emotions. Future studies can explore the impacts of emotions presented in these two channels.

Conclusion

Drawing upon emotional contagion theory and language-mediated association theory, this study develops a research model to examine how textual and facial emotions affect charitable crowdfunding outcomes. The model is tested via regression analysis with a data set collected from a typical platform using computer-aided analytical techniques. An additional configuration analysis was conducted to examine the complementary relationships between textual and facial emotions in their effect on crowdfunding performance by employing the FsQCA method. Our results suggest that both textual and facial emotions can affect charitable crowdfunding outcomes. While the overall negative-emotion-oriented narratives are more helpful for leading to favorable funding outcomes, the effects of specific emotions vary. Moreover, facial emotions are found to function as a complement to textual emotions in promoting funding outcomes. These findings could offer insightful and comprehensive understanding to both researchers and practitioners of how emotions presented in crowdfunding pitches affect funding outcomes.

Appendix 1

See the Table A-1.

Table A-1 Robustness checks of textual emotion-related variables

Variable	OLS regression analysis		Negative binomial regression	
	Model 9		Model 10	
	Coefficient	t value	Coefficient	z value
Duration (ln)	0.086** (0.03)	3.28	0.067** (0.021)	3.17
Clear purpose	0.006 (0.128)	0.28	0.368** (0.112)	3.29
Recipient tag	0.056* (0.087)	2.26	-0.218** (0.065)	-3.33
Initiator sort	-0.002 (0.097)	-0.07	-0.010 (0.07)	-0.15
Number of updates (ln)	0.288*** (0.047)	10.85	0.212*** (0.034)	6.32
Number of pictures (ln)	-0.026 (0.06)	-1.05	0.057 (0.045)	1.25
Text length (ln)	0.092** (0.126)	2.74	-0.222* (0.092)	-2.40
Sentiment polarity	-0.108*** (0.093)	-3.73	-0.340*** (0.069)	-4.90
T_sadness	0.104** (0.359)	3.19	0.972*** (0.272)	3.57
T_pos	-0.048 (0.009)	-1.09	0.001 (0.007)	0.09
T_anxiety	0.003 (0.506)	0.10	-0.274 (0.39)	-0.70
T_anger	-0.085** (0.349)	-2.67	-1.767*** (0.254)	-6.95
F_anger	0.019 (0.03)	0.59	0.100*** (0.02)	4.98
F_disgust	-0.039 (0.03)	-1.12	0.001 (0.02)	0.05
F_fear	-0.002 (0.03)	-0.07	-0.059** (0.022)	-2.73
F_happiness	0.104** (0.023)	3.03	0.061*** (0.016)	3.74
F_neutral	0.052 (0.028)	1.33	-0.014 (0.02)	-0.70
F_sadness	0.007 (0.026)	0.20	0.007 (0.019)	0.40
F_surprise	0.030 (0.028)	0.90	-0.047* (0.021)	-2.17
_cons	7.282*** (0.884)	8.24	9.712*** (0.655)	14.84
Observations	1372		1372	
R-squared	0.176		0.008	
Log likelihood	-		-13,843.3	
F value	15.9		-	

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

See the Table A-2.

Table A-2 Robustness checks of facial emotion-related variables

Variable	OLS regression analysis		Negative binomial regression	
	Model 11		Model 12	
	Coefficient	t value	Coefficient	z value
Duration(ln)	0.089** (0.031)	3.37	0.052* (0.021)	2.50
Clear purpose	0.007 (0.129)	0.29	0.366** (0.115)	3.18
Recipient tag	0.045 (0.088)	1.77	− 0.205** (0.066)	− 3.12
Initiator sort	− 0.008 (0.095)	− 0.31	− 0.062 (0.07)	− 0.88
Number of updates (ln)	0.290*** (0.047)	10.91	0.201*** (0.034)	5.94
Number of pictures (ln)	− 0.025 (0.06)	− 1.04	0.072 (0.045)	1.59
Text length (ln)	0.072* (0.105)	2.54	− 0.233** (0.076)	− 3.07
Sentiment polarity	− 0.073* (0.097)	− 2.44	− 0.306*** (0.074)	− 4.15
T_sadness	0.120*** (0.248)	4.17	0.913*** (0.185)	4.93
T_happiness	0.005 (0.508)	0.16	0.209 (0.357)	0.59
T_fear	0.009 (0.266)	0.38	− 0.190 (0.209)	− 0.91
T_disgust	− 0.005 (0.336)	− 0.21	− 0.167 (0.252)	− 0.66
T_anger	− 0.076** (0.558)	− 3.33	− 2.879*** (0.451)	− 6.38
F_anger	0.014 (0.041)	0.51	0.177*** (0.027)	6.55
F_disgust	− 0.017 (0.039)	− 0.63	0.023 (0.027)	0.85
F_fear	0.012 (0.041)	0.44	− 0.087** (0.029)	− 2.99
F_happiness	0.099*** (0.027)	3.63	0.078*** (0.019)	4.04
F_neutral	0.055 (0.031)	1.83	0.015 (0.021)	0.72
F_sadness	0.014 (0.031)	0.52	0.008 (0.022)	0.35
F_surprise	0.027 (0.037)	1.02	− 0.053 (0.028)	− 1.88
_cons	7.460*** (0.816)	9.14	9.539*** (0.566)	16.84
Observations	1372		1372	
R-squared	0.174		0.008	
Log likelihood	−		− 13,843.3	
F value	15.12		−	

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Abbreviations

ECT	Emotional contagion theory
LMAT	Language-mediated association theory
FsQCA	Fuzzy-set qualitative comparative analysis
NLU	Natural Language Understanding
FR	Funds raised
BA	Backers
MRA	Multiple regression analysis

Acknowledgements

The authors thank the editor and the reviewers for invaluable comments and suggestions, which have improved the quality of this paper immensely. The authors would also like to thank Xiaoyang Yi for giving us advice and support on data analysis and the QCA method during the revision of this paper.

Author contributions

BL performed the drafting of the original manuscript, revision of the manuscript, management of the project, and acquisition of funding. TX conducted the data collection, data analysis and performed the writing of the original manuscript. WF gave the main idea and improvement suggestions. All authors read and approved the final manuscript.

Funding

This work is supported by the National Social Science Fund of China (Grant No. 21AGL008).

Availability of data and materials

Data is publicly collected from Tencent Gongyi online (<https://gongyi.qq.com/>).

Declarations**Competing interests**

The authors declare that they have no competing interests.

Received: 4 April 2023 Accepted: 7 February 2024

Published online: 24 May 2024

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