

The Persuasive Impact of Text and Audio Features on Technology Crowdfunding Campaigns: An empirical study on Kickstarter

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Abstract

In technology-focused crowdfunding, campaign outcomes are connected to the strength and delivery of a persuasive message. Owing to the technical complexity of these projects, persuasive elements can be found in features scattered across the project's textual description and video pitch. To date, existing research has systematically examined the influence of textual attributes, but the impact of auricular attributes and their joint persuasive effect is not yet clearly understood. To investigate these gaps, our study uses text and audio features extracted from a dataset of 3,589 reward-based technology crowdfunding campaigns on Kickstarter. The results indicate that both text (brevity, readability and sentiment) and audio (tone neutrality, audio contour, frequency and harmonics) features of a campaign's message, positively influence crowdfunding outcomes. This influence is more pronounced when they are considered in conjunction. These results provide new theoretical insights for assessing persuasive message properties in a technology crowdfunding context. For entrepreneurs, the strength and delivery of the story put forward in technology crowdfunding are more noticeable when the joint effects of text and audio are considered.

Managerial Relevance Statement

This study contributes empirical insights on the role of text and audio features of technology crowdfunding campaigns on Kickstarter. This advances the conversation on crowdfunding success factors by examining the combined impact of text and audio features of campaign pitch videos. More specifically, it provides a set of key findings and recommendations that bear considerable managerial relevance to practitioners, namely technology crowdfunding

entrepreneurs and the broader crowdfunding ecosystem. For technology entrepreneurs, this means that crowdfunding success is not solely reliant on textual descriptions but also on the strategic use of audio elements in pitch videos. When designing their campaigns, entrepreneurs should develop digital narratives that leverage the persuasive impact of both features and aim to balance textual clarity and simplicity with engaging and emotional audio. For crowdfunding platform providers, the integration of support tools that enable campaign creators to monitor, address and refine those aspects on their campaigns is beneficial for improving the success of these projects.

Index Terms: *Technology Crowdfunding, Feature Engineering, Text Features, Audio Features, Persuasion, Kickstarter.*

1. Introduction

Crowdfunding is an evolving financing alternative for entrepreneurs [1] that provides a low-entry barrier for accessing the financial marketplace. This allows founders to address early-stage funding gaps [2] through digital platforms that enable the collection of small funding amounts from a broad set of potential investors [3]. Crowdfunding categories include lending, equity, rewards and donation [4], and its benefits are universal and multifaceted [5]. As a funding option, its adoption is noticeably increasing, with the latest estimates indicating that the global crowdfunding market is expected to grow at a compound annual rate of 4.4% from 2021 to 2028ⁱ and be valued at US\$1.3 billion by 2028 and US\$4.5 billion by 2032.ⁱⁱ

In addition to funding, the literature also examines the broader implications of the concept [6], with a cumulative body of work moving beyond general campaign success factors [7] to provide a more sophisticated understanding of crowdfunding. It employs, among other things, the theoretical tandems of signalling [8], institutional theory [9] and persuasion [10], [11], [12], [13]. Regarding persuasion, research suggests that this is the focal point of crowdfunding campaigns [14], and the role of the narrative has been investigated to disentangle its drivers [15], [16], [17].

To alleviate information exigencies, investors typically rely on various cues provided by entrepreneurs to evaluate a project's potential [18]. These are scattered across the digital narrative [19] and manifested through project, textual and multimedia features that represent information relevant to the campaign [20]. Research suggests that the persuasiveness of the narrative is an important precursor for funding success [21]. Conditioning the investment decisions on project characteristics enables the depiction of their predictive capacity [22], with research having established project-related characteristics for campaign success [23]. However, these characteristics alone are not sufficient to drive persuasion in crowdfunding context, as the outcomes of a campaign are also linked to the media provided to potential

investors [24]. Another stream of literature has investigated the impact of issue-relevant sources such as textual information [25], which stresses the importance of informational value accrued in empirical properties from project textual descriptions [26], [27].

To maximise their project's funding potential and reach a state of legitimacy [28], entrepreneurs may also extend the narrative by relying on the persuasive qualities of the video pitch. The campaign video tells the story of the project in a concise manner [29]. In the absence of face-to-face interactions, the video reflects an essential component of the persuasive message [30] that requires credible vocal communication [31]. To this end, crowdfunding research lacks consensus on the persuasive appeal of auricular properties [32]. Audio features represent a peripheral source of the persuasive message [13], [33] and are conduits of expression [34]. However, there has been limited empirical assessment of their persuasive value, and connections with other parts of the digital narrative remain unexplored. This is particularly important in technology crowdfunding projects, which, by design, have a technical underpinning. As such, research needs to examine the concomitant effect of both issue-relevant and peripheral sources on crowdfunding outcomes. To address these gaps, this study poses the following questions: *Do the textual and audio features of a technology crowdfunding campaign significantly influence its success? If so, how do they each individually and in combination contribute to the effectiveness of the campaign?*

We inform our theoretical reasoning on persuasion theory [35], [36], [37] to empirically examine the persuasive qualities as depicted from textual and audio features. Drawing from a sample of 3,589 technology crowdfunding campaigns between 2014 and 2023, the results of our study highlight the impact of textual and audio attributes and their joint effect on campaign outcomes. The study theoretically contributes to the persuasive value of these distinct features and quantifies their joint impact on technology crowdfunding projects. It also has implications for practice. By detailing the features that can be optimised, we provide technology

entrepreneurs with guidance on the features that can be refined to enhance their project's persuasive qualities.

The rest of the paper is organised as follows. Section 2 presents an overview of technology crowdfunding, highlighting its unique characteristics and the critical success factors relevant to our study. This informs the study's central position on the persuasive value of text and audio features and provides the foundation for our hypotheses. Section 3 introduces the study's methods and operationalisation of the variables. Section 4 provides the outcomes of the study's analysis. Section 5 discusses the results and the study's theoretical and practical contributions, with Section 6 presenting the study's limitations and recommendations for future research.

2. Background and Related Work

2.1 Technology Crowdfunding Characteristics and Critical Success Factors

In a rewards-based model, entrepreneurs set the funding parameters, and in return backers are offered a participating reward, usually the product [20]. The most observed rewards-based campaign types refer to the 'All-or-Nothing' (AON) and 'Keep-It-All' (KIA) models [38]. AON, the focus of this study, assumes that, when a campaign is successfully funded within the specified timeframe, all parties benefit: entrepreneurs secure financial resources for their project and investors receive the product. Conversely, such a model is characterised by a sharing of the risk that campaign targets will not be reached [39].

The crowdfunding concept embodies the platform economy with a clear consumer focus [40]. Platforms originating in North America account for nearly 50% of the global crowdfunding volume [41]. Kickstarter is one of the most recognised AON platforms, with technology being a focal category [42]. The popularity of campaigns originating in the United States may increase the influence of cross-side network effects, where an increase in project supply also leads to an increase in the number of investments [43]. This is particularly

important in technology crowdfunding, considering platform adoption and utilisation in the United States and the existence of governance strategies that may influence project performance outcomes [44].

The level of attention given to rewards-based crowdfunding has mushroomed, with a body of literature attempting to depict factors that enable campaign success. [6] suggests that research areas of interest are reflected in studies exploring depictions of crowdfunding characteristics, actors and the campaign. Regarding campaign characteristics, research has been particularly productive in examining project-related influences [19], soft information contingencies [20] and the role of multimedia content in depicting the success of crowdfunding projects [45]. One of the key conceptual challenges of past crowdfunding research is the lack of a uniform definition of 'success', with previous work employing various measures [7]. This suggests considerable challenges in setting a consistent list of contributing factors. Notwithstanding this limitation, when investigating success determinants at the project level, past research has indicated the importance of setting funding goals that realistically reflect the project's ambition alongside its contribution frequency [46]. This is important in technology crowdfunding, considering that backers tend to posit the dual capacity of both investors and 'technology patrons' [12]. In addition, technology projects that demonstrate their geographic location tend to be more successfully funded [47].

As evidence of product quality is often unavailable, funding decisions are predominantly linked to the project description, which contains project-relevant textual information. Research supports the exemplary role of textual antecedents related to the positive influences of language [48], [49] and textual qualities such as length, complexity, readability and emotion [13], [24], [26], [50], [51], [52], [53]. In addition, to enhance depictions of project quality, entrepreneurs also rely on the complementarities offered by peripheral cues derived

from multimedia elements [54], [55]. Previous studies have confirmed the antecedent role of video inclusion [2], [30], [56] and images [57], [58].

2.2 Persuasive Narrative in Technology Crowdfunding

Technology crowdfunding is intrinsically complex when compared to other project categories, as the outcome tends to be a tangible product [2], [12]. The narrative provides a perspective where “*apparently independent and disconnected elements of existence are seen as related parts of a whole*” [172:36]. A convincing narrative is conducive to campaign outcomes [60] and contingent on the founder’s capacity to communicate the project’s qualities in a persuasive way [61]. The persuasive effect of narratives is concrete and well-established [62] and its importance is recognised in rewards-based crowdfunding [63].

In technology crowdfunding, entrepreneurs must produce a narrative on a digital platform to appeal to potential investors across communities of interest [64]. Although narrative factors influence crowdfunding investment decisions [19], technology entrepreneurs are faced with unique challenges related to the technical characteristics of project offerings [65], the asymmetrical nature of technology-related information [47], [66], the risks inherent in innovative projects [67] and the project and operational complexities arising from successful funding [68]. The characteristics of technology crowdfunding are more pronounced at the campaign level for the following three reasons.

First, technology campaigns should offer context-specific information to persuade potential backers to invest and, at the same time, demonstrate points of differentiation from other offerings [69]. Second, revealing too many technical details could pose plagiarism risks [70], taking into consideration the novel and authentic nature of technology offerings [71]. Third, entrepreneurs must compromise between readability and technical content to avoid hindering understandability [48], [72]. Owing to these intricacies, the persuasive effect of

antecedents cannot be universally assumed and needs to be expressed in a manner relevant to the message properties. We discuss these properties in the subsequent section.

2.2.1 Persuasive Message Properties in Technology Crowdfunding

The persuasion content involves the recipient, the message, the source and the setting in which the message is delivered [73], [74]. As “*...the fundamental purpose of [crowdfunding] campaigns is persuasive*” [14:602], the message leverages the funder’s parallel information-processing abilities [75] to inform backing decisions. To overcome the intrinsic challenges of technology projects and informing campaign design, the message should follow the persuasive fundaments of trust, social proof, scarcity, simplicity and imaginary [36], [76], [77], [78], consistent with promotional practices that raise backer awareness and mitigate risks [47].

Research suggests that trust is an essential condition for overcoming risks in online transactions, such as those related to reward-based crowdfunding [79], [80]. Social proof reflects a persuasive message quality [81], [82] as communication of the technological benefits and disclosure of project updates [83], [84], alongside visual content [24], establishes credibility and allows entrepreneurs to leverage its persuasive potential [58], [85]. The role of social proof in reward-based crowdfunding has been discussed as a predictor of contribution intentions [15]. Scarcity represents a prime backer investment motivation [86] and indicates opportunity and time-limited availability [36]. Information simplicity refers to the importance of clear and concise communication, free from technical jargon [87], [88]. Finally, the imaginary property suggests the persuasive value of multimedia attributes [57], amplifying project recall [50].

In technology crowdfunding, the digital narrative is formulated by both issue-relevant and peripheral characteristics that reflect these prescient tendencies. Issue-relevant information reflects the message content related to the main topic’s characteristics [10]. This is linked to

the innovation being introduced, providing credible evidence [89] and presenting information content pertinent to a conclusion [37]. Given the intricacies of technology crowdfunding, persuasion properties move beyond the message content, suggesting that aspects peripheral to issue-relevant information also assist intuitive decisions [90], [91], [92]. The following sections further delineate the textual and auricular properties and their role in the persuasive message.

2.2.2 Textual Properties

In technology crowdfunding, the text that appears on the project page provides entrepreneurs with the opportunity to tell a persuasive narrative to backers, considering the informational value of user-generated content [93], [94]. The textual content has a dual purpose: on the one hand, it provides pertinent information for informed backer decisions [26] and on the other it acts as a persuasion fundament in the digital narrative [19], [95].

Research concerned with the predictive power of text in a crowdfunding context is expansive, reinforcing the notion that textual properties are integral to persuasion techniques [96]. Previous studies have examined the empirical value of language [72], [78], linguistic style [48], content [25], [97], semantics [98] and structural [16], [99] properties. Project descriptions reflect the central theme of the campaign and enable the provision of a persuasive message that captures backers' attention [100], [101]. Textual properties in project descriptions provide issue-relevant persuasive information with an enduring effect on the funder's decision [13], as they may influence the persuasiveness of the message [89].

2.2.3 Auricular Properties

In exploring the characteristics of persuasion, research suggests that auricular properties may have explanatory potential [102]. This is of particular importance for technology crowdfunding, where entrepreneurs are able to enhance the digital narrative with the provision of a video pitch that lets them communicate project characteristics and demonstrate positive psychological capital [103]. As a peripheral source of information, the pitch is driven by

entrepreneurs [104], who are in control of the non-verbal expressions of their voice [105]. Speech information may be persuasive and influence campaign outcomes, [106] and, by the same token, vocal behaviour may also shape investor preferences [107], [108].

Despite past work indicating the centrality of the entrepreneurial pitch in predicting campaign outcomes [109], few studies have attempted to examine the impact of auricular properties. Speech quality and display authenticity influence the persuasion potential of crowdfunding [110], while vocal properties that demonstrate enthusiasm [111] and passion are linked to funding goals [34]. These theoretical prescriptions suggest that the persuasive impact of a campaign may be shaped by the auricular properties displayed in the digital narrative.

2.3 Hypotheses

2.3.1 *Text Features*

Text features have been extensively studied as determinants of rewards-based crowdfunding outcomes and previous work suggests that readability and textual tone reflect primary points of empirical interest [112]. Readability indicates the quantity and quality of information available to backers [113], whereas tone indicates the sentiment and emotion that can be deduced from text [101].

Text-related readability and understandability can influence a campaign's persuasive appeal, and, in turn, the amount of funds pledged [72], with project description length and textual clarity influencing the funding outcomes of crowdfunding campaigns [87], [114], [115]. A more readable project description [56] with simpler language relates to backers [88], [116] and is conducive to funding success. In addition, the tone of the textual message may impact the feelings of the reader and shape funding decisions [101]. Sentiment associated with successful reward crowdfunding outcomes [117] and features that trigger excitement and technical inclusiveness represent predictors of funding success [24]. To this end, we propose the following hypothesis:

H1: Controlling for all other campaign attributes, text features have a significant effect on the outcome of a crowdfunding campaign

2.3.2. Audio Features

The video pitch offers an additional medium of expression for entrepreneurs [34] to transmit attitudes and information about their technology projects and themselves [118] via audio features of their voice [119]. By regulating volume, pitch and speech rate, project creators can enhance their campaign's persuasive appeal [102]. Audio features that convey information of merit may elicit a recipient's response [120], in conjunction with emotional cues of the speech voice [121], suggesting that persuasion delivery may be influenced by vocal features [122].

Research on the validating qualities of audio characteristics from the crowdfunding pitch is still in its infancy [103]. Audio features can be extracted from two sources: voice-overs and background music. Notwithstanding the paucity of empirical results, a few studies suggest that audio may unmask additional campaign insights [32], with loudness, variability and vocal pitch being important [123]. As audio features can be utilised to express emotions, competence and trustworthiness [124], in conjunction with Hypothesis 1 we propose the following:

H2: Controlling for all other campaign attributes, audio features have a significant effect on the outcome of a crowdfunding campaign.

2.3.3 The Joint Effect of Text and Audio Features

The intricacies of technology crowdfunding suggest a connection between text and audio features. This is important, as content congruence may lead backers to make assumptions about project quality [11] and increase the likelihood of success [55]. Campaign presentation elements influence pledges [13], and the concomitant effect of features across the digital narrative is an emerging domain of inquiry that is attracting growing research attention [25], [125].

Considering technology crowdfunding's reliance on conveying technical details to non-experts, a joint effect may be useful to fully realise the persuasive potential of the campaign. This is due to the interdependent nature of text and audio, which may shape funding outcomes [57]. As both sets of features serve as functionally equivalent cues in an integrated persuasion process [33] and the distance between these two elements is merely empirical [126], we posit that the synergistic effect may provide reinforcing evidence on how persuasive the digital narrative is. To this end, we extend our empirical investigation to explore the joint role of text and audio features and examine the following hypothesis:

H3: Controlling for all other campaign attributes, the joint effect of text and audio features have a significant effect on the outcome of a crowdfunding campaign.

3. Data and Methods

3.1 Dataset Description and Variable Operationalisation

Data were collected from Kickstarter for crowdfunding campaigns that focused on the technology gadgets category, and which were concluded between 2014 and 2023. From the initial sample of 4,096 eligible campaigns, we selected only those that had expired, and which included a video pitch. We did not consider any active campaigns. By filtering these requirements, a final sample of 3,589 technology projects was included. An overview of the baseline variables and their descriptive statistics is provided in Table 2, while Figure 1 illustrates the variables of interest and their sources from an example technology campaign landing page.

INSERT Table 2 around here

Considering that there were a number of overfunded projects, which may reflect the well-known tendency of setting conservative funding goals in AON project design [127], we utilised a logarithmic transformation of the dependent variable. This provided us with a number

of advantages and a simpler approach to examine key contingencies in a continuous variable regression framework. The campaign success ratio allowed us to disregard the currency in which the campaign was designed to receive pledges.

INSERT Figure 1 around here

Campaign time was measured as the number of days from launch to project end, consistent with current Kickstarter platform recommendations.ⁱⁱⁱ Campaign preparation time was measured as the number of days between the campaign registration on the platform and the day that the campaign was launched. In our sample, both successful and unsuccessful projects ran for an average of 36 days. We also considered campaign location – within or outside the USA – to control for platform penetration and usage effects, in line with current literature [128].

3.2 Feature Engineering

3.2.1 *Text Features from Project Description*

Textual feature engineering represents a fundamental approach to understanding crowdfunding success [52], [53], [129]. For this research, features were extracted from project descriptions appearing on the campaign landing page. Several features were extracted to determine the length and extent of content by using the *textstat.py* Python library. Most projects supplemented campaign description with a set of comments, a feature that reflects a quantifiable measure of campaign engagement and was incorporated as a control variable on all examined models.

The main project description text also incorporates images and infographics. As we wanted an isolated measure for visuals accompanying the textual description, we incorporated the number of images that appeared in the project description as part of the extracted textual features. Text appearing in images has also been considered to measure the description length

of the campaign text, which accounts for the total number of words in the project description. We measured reading time as the estimated time it would take a potential backer to read the project description, including images. This was calculated by dividing the number of words in the project description by the average reading speed, estimated to be around 200–250 words per minute, and then adding a penalty for each figure. Readability was measured using the Flesch–Kincaid Reading Ease Score [130], [131], which provides an estimate of the project's description understanding, consistent with existing literature [132]. The measure considers the sentence length and the number of syllables per word on a scale from 0 to 100. We also depicted sentiment and emotion in the project description. While for sentiment the assumption is that crowdfunding project descriptions will be generally positive, we aimed to extract the emotional aspect of the sentiment category using Ekman's basic emotions theory [133], operationalised through the Plutchik wheel of emotions model [134]. To this end, emotion and sentiment were calculated in tandem, utilising word embeddings via a language transformer model (BERT), which is highly accurate and fine-tuned on the Go Emotions dataset [135]. We focused on the positive emotions of Plutchik's framework, namely the combined presence of trust, anticipation and joy in the presence of the examined text.

3.2.2 *Audio Features from Video Pitch*

Audio feature extraction represents a novel addition to information retrieval [136], [137]. Audio mining investigations have recently appeared in the crowdfunding context [125]. However, research has only recently started to explore its emancipatory potential and persuasion qualities [138].

Technical audio features were extracted using the *librosa* Python package [139]. Five features were determined. Neutral tone was calculated using word embeddings (BERT) and extracting the neutrality of the spoken audio content, which we transcribed from the audio file of each video using the Amazon Web Services (AWS) Transcribe web service. Neutrality was

measured in the same way, considering that several videos did not carry any speech and only consisted of background music over the presentation of the project's use case and, thus, the measure was applied in the audio wave. The root mean square (RMS) measured the average loudness of a waveform, considering all instances [140], and was computed over each frame from the audio samples of the campaign video. The Mel-frequency cepstral coefficient (MFCC) was also extracted from the audio wave to capture the auditory perception of the audio signal. This is a generally accepted feature used in speech recognition [141] and speech-based human emotion recognition research [142], with its applications recently expanding to the crowdfunding context [32]. Finally, we also considered two simpler measures that tackle the audio signal's loudness. Audio contour was calculated as an average over the fundamental frequency at each point of time and was intended to check how consistent the audio signal accompanying the campaign video was. The harmonics-to-noise ratio (HNR) was used to determine sound hoarseness [143]. Both of these latter metrics represent an original addition of our work to crowdfunding research, as a novel approach to measure the signal quality and consistency of the campaign video.

4. Results

4.1 Estimation Strategy

We defined crowdfunding success of a project as the ratio of total funds raised (amount pledged) over the funding goal of the project for the duration of the campaign, consistent with relevant literature [23], [41]. We operationalised this as follows:

$$\text{Funding Success} = \frac{\text{Total Amount Pledged}}{\text{Funding Goal}}$$
$$= \begin{cases} < 1, \text{project unsuccessfull.} \\ \sim 1, \text{project funded to the goal} \\ \gg 1, \text{project is overfunded.} \end{cases}$$

for a project j with a set of project characteristics P_j that exhibit textual properties T_j and auricular properties M_j . We considered a linear estimation as follows:

$$\ln(\text{Funding Success}_j) = \sum_{i=1}^P \beta_i P_{ij} + \sum_{i=1}^T \gamma_i T_{ij} + \sum_{i=1}^M \delta_i M_{ij} + C + \varepsilon_j$$

where P_{ij} are the observed values of project characteristics for project j , T_{ij} are the observed values of textual properties for project j , M_{ij} are the observed values of auricular properties for project j , and ε_j is the error term for project j . To test the impact of each group of covariates on funding success as provided in Hypothesis 1 (impact of text features), Hypothesis 2 (impact of audio features) and Hypothesis 3 (joint impact), we considered the following framework of likelihood ratio tests on restricted and full models.

[INSERT **Table 3** around here]

To test the predictions of the restricted model (M1) and each of the other three models (M2 to M4), we utilised an ordinary least squares (OLS) regression framework, estimating the effects of explanatory variables, consistent with current practice in crowdfunding research [144], [145]. In doing so, we also followed the standard procedural remedies for evaluating the impact of collinearity and the distributional requirements of the dependent variable, which was transformed using a logarithmic transformation. None of these was of concern in our analysis. Table 3 provides the estimation of the four models. Considering that our dependent variable is a proportion (success ratio), we utilised clustered standard errors to make the coefficient estimates more robust [146].

INSERT **Table 4** around here

4.2 Evaluation of Coefficients and Hypotheses

All four models presented a good fit, with adjusted R^2 values of 0.380 (M1), 0.505 (M2), 0.419 (M3) and 0.516 (M4), respectively. Regarding project controls, the average pledge per backer

is significant across all models, a finding in line with the literature [147], which may also suggest some form of bandwagon effect [148]. From a persuasion perspective, the high coefficient of average pledge per backer across all four models indicates the trustworthiness of the campaign [149]. The coefficient for comment quantity was positive yet non-significant across all models. This is an intriguing result that highlights the inconclusiveness of crowdfunding literature in terms of the role of comment quantity, which was reported as either positive [25], [26] or non-significant [46], [63]. This suggests that, in technology crowdfunding, comment quantity does reflect visibility and a high level of interest. However, it does not enact the quality of engagement necessary to persuade others to pledge. This also justifies our depiction of comment quantity as a control variable in our persuasion models.

Regarding campaign running time, the coefficient is negative and statistically significant across all four models, indicating that longer campaigns may not be successful. This suggests that lengthier campaigns may decrease the sense of scarcity, reducing the campaign's persuasiveness [36]. Campaign preparation time was negative yet non-significant across all models. This implies that longer preparation time does not necessarily translate into crowdfunding success outcomes [65]. From a persuasion perspective, this result suggests that preparation time may not be indicative of the campaign's merit and could be broadly attributed to the simplicity principle [88]. Campaign year was also consistently significant across all four models, suggesting a time trend that can be interpreted bilaterally. On the one hand, this reflects the influence of market timing and campaign relevance,^{iv} where mainstream focus on technology allows campaign creators to tap into emerging market trends and provide solutions that resonate with the audience [150]. On the other hand, platform design efficiency advancements allow campaign creators to enhance the quality of their campaigns [151] and provide more affluent, fine-grained experiences to backers, suggesting the increasing sophistication of campaigns over time [2]. This alignment with current audience interests

reflects the centrality of investment timing, reinforcing the scarcity principle [152]. Finally, country was significant across all four models, suggesting that technology campaigns originating in the USA are more likely to succeed, indicating possible cross-side network effects [43].

Model 2 presents results on the text features associated with crowdfunding success. We can report that reading time ($\gamma = -0.084; p < 0.01$) and readability ($\gamma = -0.041; p < 0.01$) were both negative, suggesting that longer reading time and textual complexity leads to less successful campaign outcomes [131]. This is consistent with the intended persuasion functions that suggests that message conciseness and text simplicity in a technology crowdfunding context are significant [87]. In Model 2, we can also observe an interesting set of depictions regarding images ($\gamma = 0.057; p < 0.001$) and emotion ($\gamma = 0.018; p < 0.001$) that reflect the imaginary persuasive function [77]. In terms of the positive depiction of images, this is consistent with the literature, suggesting that the number of images influences campaign success [153] and suggestive of the persuasive appeal of images on funding decisions [58]. Our non-significant depiction of text sentiment ($\gamma = 0.013; n.s.$) also aligns with recent work that did not report any statistically significant association [23]. Finally, in terms of our unique measure of the Ekman emotions ($\gamma = 0.018; p < 0.001$), we find support in the textual modality of emotion expression [51] as an indication of the persuasive appeal of its positive valence [154].

Model 3 reports results associated with audio features, which reflect peripheral cues in the digital narrative [54]. Literature on audio signals and their links to human behaviour and speech signal processing [155] is rich with corroborating evidence that extends to our context of inquiry. In more detail, neutral tone ($\delta = 1.512; p < 0.001$) positively contributes to crowdfunding success, indicating that a balanced tone may be universally appealing [121], as it reinforces the backer's trust towards the project. The positive MFCCs ($\delta = 0.100; p < 0.001$)

indicate a measure connected to perceived charisma [156], which, in turn, is interlinked to persuasion [157]. The negative value of the average root mean square (Avg_RMS) ($\delta = -2.090$; $p < 0.001$) shows a prevalence of speech calmness and less stressful tone, which reflects confidence and perceptions of competence [158] and provides support for persuasive speech delivery [159]. The negative values of spectral frequency ($\delta = -0.017$; $p < 0.001$) – which in our study was introduced as a form of ‘audio contour’ – suggest that a lower-pitched voice may be conducive to a more trustworthy, persuasive pitch [158]. The negative values of the HNR ($\delta = -0.055$; $p < 0.001$) indicate a higher proportion of noise relative to harmonic components [160]. This is expected, considering that most campaign videos incorporate background music when introducing a human voice.

Model 4 documents the existence of joint persuasive effects of text and audio features associated with crowdfunding success. This indicates an interplay among the issue-relevant and peripheral cues, suggesting a single mechanism of information processing [33], [37]. The empirical results of Model 4 indicate better fit (adjusted $R^2 = 0.516$), when compared to baseline (adjusted $R^2 = 0.380$), text-only (adjusted $R^2 = 0.505$) and audio-only (adjusted $R^2 = 0.419$) models. This suggests that, in a technology crowdfunding context, information processing is fundamentally linked to the backer’s subjective judgement of both sets of features [13], and shows the complementary effect of both on crowdfunding success [31]. Following the study’s theoretical framework and model specification, we evaluated each hypothesis between a restricted and full model, as specified in Table 3. Table 5 presents the outcomes of our hypothesis tests.

INSERT Table 5 around here

5. Discussion and Implications

The focal point of this study was the depiction of persuasive qualities of text and audio features from project descriptions and the video pitch on technology crowdfunding campaigns. Drawing from persuasion theory, we developed a theoretical framework that discussed the relevance of features dispersed across the digital narrative. By utilising a sample of 3,589 technology-focused projects, we examined the influence of both text and audio feature sets and empirically validated their joint impact on campaign success.

The results highlight that text features related to reading time, readability, sentiment and emotion are of rich persuasion value, and affect funding success, supporting Hypothesis 1. These findings are broadly consistent with the extant literature [24], [72], [101], [115], [117], suggesting that, in the case of technology crowdfunding, textual information in the project description represents an issue-relevant information source of the digital narrative, and is related to a project's successful funding. In addition, our introduction and empirical support of a novel class of audio features related to tone neutrality, RMS, audio contour, MFCCs and HNR contributes to our understanding of the persuasive value of peripheral information sources and its importance for funding technology projects, in support of Hypothesis 2. Our study's detection of a joint persuasive effect from both sets of text and audio features, in support of Hypothesis 3, suggests that the persuasive impact in a technology crowdfunding campaign can be fully realised by utilising both its textual content and the way the message is delivered.

The joint effect depicted in Model 4 also invites a multilevel interpretation. In more detail, in technology crowdfunding the digital narrative reflects elements of persuasion identified in text and audio features. Backers evaluate information provided in a continuum, treating features as equivalent, and the decision to back a campaign is determined by their own basis for judgement [33]. Our study provides several implications for theory and crowdfunding practice, which are discussed in more detail in the following sections.

5.1 Theoretical Implications

The study provides empirical valence on the application of persuasion theory in the rewards-based technology crowdfunding context [10], [19], [30], by depicting the impact of text and audio features on technology crowdfunding success. The results confirm the antecedent role of textual properties, consistent with the previous literature [72], [96], [99]. Our empirical portrayal of the positive effect of features and emotion in text is suggestive of its persuasive appeal for technology crowdfunding. This is of particular importance in an AON campaign framework – where entrepreneurs have an incentive-seeking goal and backers are motivated to receive a tangible outcome, subject to successful completion of the campaign [161]. The textual part of the digital narrative represents a trust formation enabler, aiming to reduce information asymmetry. By providing technically inclusive project descriptions, campaigns may be more appealing to a diverse population of backers beyond technology enthusiasts, reducing the perceived risk of non-delivery [39].

Our study also advances knowledge on technology crowdfunding success factors, with the introduction of auricular properties of voice [102] as a persuasion conduit. The depiction of a positive effect of audio features suggests an interesting extension of the role of voice in persuasion [158], which is of particular relevance in crowdfunding, as a context characterised by the absence of face-to-face interactions. Unlike text, audio features convey unique qualities that engage backers by enhancing trust and portraying competence. The auricular dimension has been largely overlooked by previous research and our study provides subtle new ways to theorise upon its value and impact as a success determinant.

In addition to the empirical depiction of the positive impact of both sets of features on funding success in isolation, our investigation of a joint persuasive effect represents a parallel theoretical contribution that informs understanding of how textual and auricular properties can have a synergistic effect in projects characterised by technical complexity. The resulting theoretical prescription extends traditional conceptualisations of persuasion in the digital

context by suggesting that issue-relevant (e.g. textual features, emotion and sentiment) and peripheral properties (e.g. tonality and pitch) may have a deterministic effect on crowdfunding success. By considering the additive effect of text and audio, contrary to work suggesting overshadowing effects among different modalities [57], our study finds evidence for the importance of multimodal persuasion elements that influence crowdfunding success [31]. We expand on these theoretical prescriptions in the following section, which discusses the practical contributions of our work.

5.2 Practical Implications

Crowdfunding is transitioning from a product experimentation concept to an area suitable for innovation and technology assessment [162]. This study's findings provide valuable practical insights regarding text and audio reasoning to support crowdfunding campaign design and management. As technology reflects the least successful category on Kickstarter^v [163], these depictions are relevant to entrepreneurs who wish to craft their project's digital narrative, platforms that host AON technology projects and broader crowdfunding policy.

Entrepreneurs should consider configurations of design features that shape the success of their project by thinking of both text and audio features as if on a continuum. Project textual descriptions that prioritise readability and avoid exhaustive technical jargon in favour of a balanced approach have a direct impact on campaign success. These are reflected in features relevant to clarity and simplicity. Moreover, the likelihood of funding success is enhanced when the text contains some form of emotional resonance. In addition to textual clarity in project descriptions, audio features are design elements [102] that can be leveraged and amplify the persuasive appeal of campaigns. Beyond the design stage, in evaluating their project's relative performance while the campaign is operational, entrepreneurs can adapt certain campaign features [52], [164] and make functional adjustments to the digital narrative presented in project, textual and multimedia features.^{vi} As the study's findings are suggestive

of the cumulative effect of text and audio features on campaign outcomes, this enables entrepreneurs to strategically leverage those changes to achieve an optimal mix of details presented [165]. By optimising elements related to information quantity in the description and adjusting audio and visual content, entrepreneurs enhance their chances of fully realising their funding goals.

The study's findings can be used as a guideline for crowdfunding platform providers of AON technology campaigns. By increasing the number of design features available to entrepreneurs [166], providers can enable fine-tuning of certain campaign elements conducive to persuasion. In addition, platform providers should also introduce entrepreneurs to actionable tools beyond campaign metrics and analytics to help them improve the quality of their project's audio content, which, in turn, may increase the likelihood of success of technology projects.

Crowdfunding is a game-changer for funding innovation projects [167] and a driving force for the advancement of technology [41]. Considering that our results were focused on features that increase the likelihood of funding success, these may be of genuine interest for policymakers looking to grow their technology entrepreneurial ecosystems by increasing campaign transparency and informed decision-making [168].

6. Limitations and Future Research

This study offers novel insights into the persuasive value of text and audio features of technology crowdfunding campaigns. As with all studies, it is also susceptible to a number of limitations that present opportunities for future research.

Our findings are relevant to the AON model in rewards-based technology crowdfunding. As such, future research should explore the nature and persuasive value of these information features across different project categories. This would be beneficial for understanding how text and audio importance varies, depending on the distinct attributes observed in each category. Such an investigation would also add to the generalizability of the

persuasive core in rewards-based crowdfunding and may unmask the relative importance of each feature set in different project categories (e.g. textual information in the publishing category or voice characteristics in film and video projects).

In addition, our sample was drawn from a single platform. Owing to the exploratory nature of our investigation and its emphasis on technology projects, Kickstarter was a suitable choice. Therefore, future studies could incorporate data from multiple platforms to address any potential platform network effects [43]. This also opens the door for future research to consider the primary scope of persuasion in terms of the commercial or non-profit nature of each campaign and determine the persuasive attributes that are more conducive.

From a feature engineering perspective, our data explicitly focused on a limited number of text and audio features, driven by their persuasion value. Future research may explore the digital narrative complexity by incorporating richer multimodal elements. As the debate on the persuasive value of audio in crowdfunding is in its infancy, we focused on a limited number of features. Future research could further expand on our theorisation and explore the impact of additional audio features, alongside a deeper examination of their interactions with other parts of the digital narrative.

Finally, we relied on the exploratory value of cross-sectional secondary data to depict our hypotheses. Future research might examine the persuasive value of these features through interventions and counterfactual scenarios in a laboratory testing context, by presenting the same campaign content with differing text and audio configurations to depict their persuasive appeal.

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Table 2: Overview of Crowdfunding campaigns in the dataset and core variables

	Unsuccessful (52%) (N=1,853)	Successful (48%) (N=1,736)	Overall (100%) (N=3,589)
Funding ratio (Pledged/Goal)			
Mean (SD)	0.147 (0.201)	15.2 (82.9)	7.41 (58.1)
Median [Min, Max]	0.0533 [0.000, 0.981]	4.50 [1.00, 3280]	0.699 [0.000, 3280]
Number of Backers			
Mean (SD)	42.1 (98.8)	986 (1940)	498 (1430)
Median [Min, Max]	14.0 [1.00, 2620]	369 [4.00, 28100]	69.0 [1.00, 28100]
Number of comments			
Mean (SD)	5.03 (13.2)	393 (763)	193 (565)
Median [Min, Max]	1.00 [0, 195]	143 [0, 8250]	11.0 [0, 8250]
Preparation time (days)			
Mean (SD)	1.39 (2.64)	1.22 (2.54)	1.31 (2.60)
Median [Min, Max]	0.559 [0.002, 46.8]	0.549 [0.002, 47.6]	0.550 [0.002, 47.6]
Campaign time (days)			
Mean (SD)	36.9 (11.3)	36.4 (9.80)	36.6 (10.6)
Median [Min, Max]	30.0 [4.73, 67.0]	31.5 [3.00, 80.7]	30.6 [3.00, 80.7]
USA Based Campaign			
No	720 (38.9%)	769 (44.3%)	1489 (41.5%)
Yes	1133 (61.1%)	967 (55.7%)	2100 (58.5%)

Table 3: Hypothesis testing framework

Hypothesis	Restricted Model - ℓ_0	Full Model - ℓ_1
H1	$M1: \ln(\text{Funding Success}_j) = \sum_{i=1}^P \beta_i P_{ij} + C + \varepsilon_j$	$M2: \ln(\text{Funding Success}_j) = \sum_{i=1}^P \beta_i P_{ij} + \sum_{i=1}^T \gamma_i T_{ij} + C + \varepsilon_j$
H2	$M1: \ln(\text{Funding Success}_j) = \sum_{i=1}^P \beta_i P_{ij} + C + \varepsilon_j$	$M3: \ln(\text{Funding Success}_j) = \sum_{i=1}^P \beta_i P_{ij} + \sum_{i=1}^M \delta_i M_{ij} + C + \varepsilon_j$
H3	$M1: \ln(\text{Funding Success}_j) = \sum_{i=1}^P \beta_i P_{ij} + C + \varepsilon_j$	$M4: \ln(\text{Funding Success}_j) = \sum_{i=1}^P \beta_i P_{ij} + \sum_{i=1}^T \gamma_i T_{ij} + \sum_{i=1}^M \delta_i M_{ij} + C + \varepsilon_j$

Table 4: Model Results for Different Configurations of the Features

	M1	M2	M3	M4
<i>Project Controls (Baseline)</i>				
Average Pledge per Backer (Log)	0.586*** (0.038)	0.407*** (0.038)	0.528*** (0.038)	0.393*** (0.038)
# Comments	0.002 (0.005)	0.001 (0.005)	0.002 (0.005)	0.001 (0.005)
Campaign Running Time	-0.022*** (0.004)	-0.022*** (0.004)	-0.023*** (0.004)	-0.022*** (0.004)
Campaign Preparation Time	-0.018 (0.021)	-0.016 (0.020)	-0.022 (0.020)	-0.015 (0.020)
Campaign Year	0.231*** (0.019)	0.104*** (0.019)	0.216*** (0.019)	0.101*** (0.019)
USA based	0.742*** (0.095)	0.557*** (0.094)	0.706*** (0.094)	0.545*** (0.093)
<i>Text Features (H1 – H3)</i>				
Reading Time		-0.084** (0.032)		-0.088** (0.032)
# Images		0.057*** (0.003)		0.053*** (0.003)
Readability		-0.041** (0.014)		-0.043** (0.014)
Sentiment		0.013 (0.156)		0.018 (0.155)
Emotion		0.018*** (0.005)		0.017** (0.005)
<i>Audio Features (H2- H3)</i>				
Neutral Tone			1.512*** (0.188)	0.493* (0.210)
Avg. RMS			-2.090*** (0.607)	-1.691** (0.572)
Audio Contour			-0.017*** (0.005)	-0.015** (0.005)
MFCCS			0.100*** (0.010)	0.059*** (0.009)
HNR			-0.055*** (0.014)	-0.022 (0.014)
Constant	-470.682*** (38.423)	-214.582*** (38.086)	-438.918*** (38.391)	-208.205*** (38.052)
<i>N_{campaigns}</i>	3,589	3,589	3,589	3,589
<i>Adjusted R²</i>	0.380	0.505	0.419	0.516
<i>Residual Std. Error</i>	2.494 (df = 3582)	2.228 (df = 3577)	2.414 (df = 3577)	2.204 (df = 3572)
<i>F Statistic</i>	367.114*** (df = 6; 3582)	333.652*** (df = 11; 3577)	236.025*** (df = 11; 3577)	239.968*** (df = 16; 3572)

Note: Robust standard errors in parentheses. *p<0.05, **p<0.01, ***p<0.001

Table 5: Hypotheses Test and Results

Hypothesis	Model		LR Test	Outcome
	Restricted	Full		
H1: Controlling for all other campaign attributes, text features have a significant effect on the outcome of a crowdfunding campaign	M1 (Baseline)	M2 (Text Only)	$\chi^2(df) = 813.96$ (5); p<0.001	Accepted

H2: Controlling for all other campaign attributes, audio features have a significant effect on the outcome of a crowdfunding campaign.	M1 (Baseline)	M3 (Audio Only)	$\chi^2(df) = 238.35$ (5); p<0.001	Accepted
H3: Controlling for all other campaign attributes, the joint effect of text and audio features have a significant effect on the outcome of a crowdfunding campaign.	M1 (Baseline)	M4 (Text and Audio Combined)	$\chi^2(df) = 899.45$ (10); p<0.001	Accepted

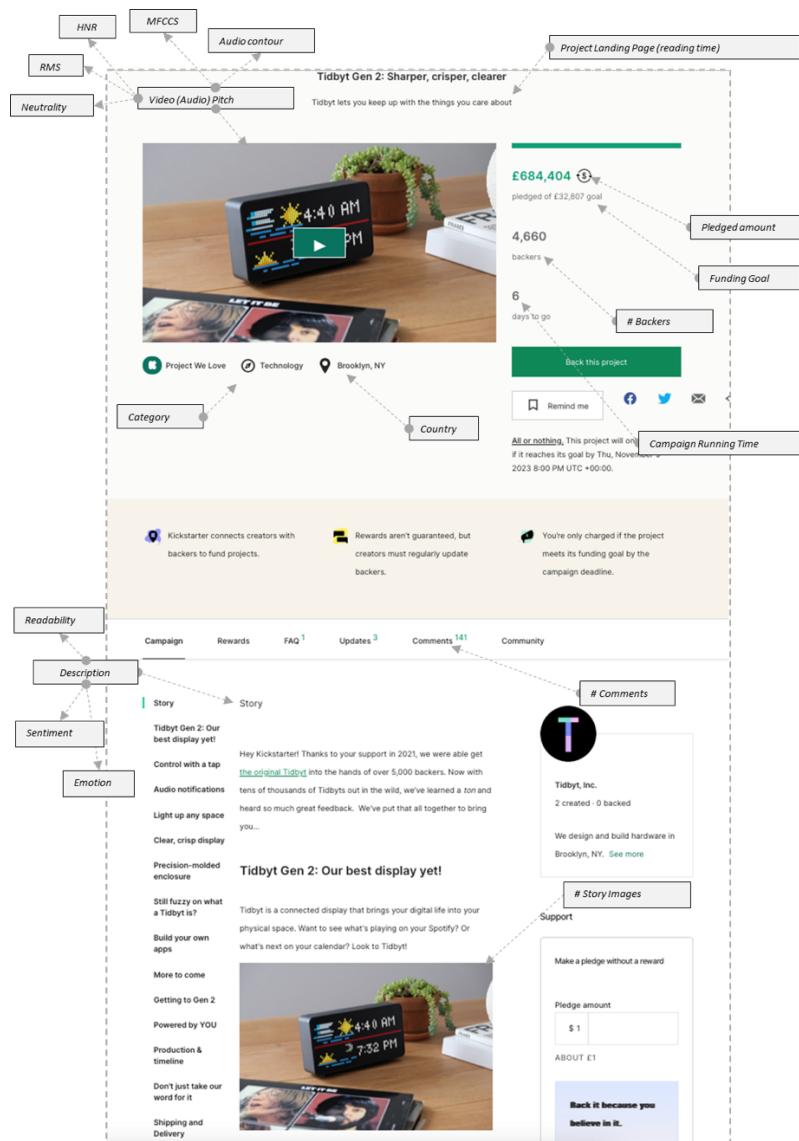


Fig 1: Campaign Features from a campaign landing page.

i **Bloomberg:** Crowdfunding Market Size Worth \$1.30 Billion by 2028 - Million Insights, Available online: <https://www.bloomberg.com/press-releases/2022-03-16/crowdfunding-market-size-worth-1-30-billion-by-2028-million-insights>

ii **Fortune Business Insights:** Crowdfunding Market Size, Share & Industry Analysis [...], 2024-2032, Available online: <https://www.fortunebusinessinsights.com/crowdfunding-market-107129>

iii **Kickstarter Support** - What is the maximum project duration? - Available online: [#~:text=Projects%20on%20Kickstarter%20can%20last,for%2030%20days%20or%20less.](https://help.kickstarter.com/hc/en-us/articles/115005128434-What-is-the-maximum-project-duration-)

^{iv} **Launchboom:** What is the Best Time to Launch a Kickstarter?, <https://www.launchboom.com/blog/what-is-the-best-time-to-launch-a-kickstarter/>

^v **Kickstarter – Stats:** Available online: <https://www.kickstarter.com/help/stats>

^{vi} **Kickstarter Support** – Can a project be edited after launching ? Available online: <https://help.kickstarter.com/hc/en-us/articles/115005135314-Can-a-project-be-edited-after-launching-#:~:text=If%20your%20project%20is%20still,be%20able%20to%20edit%20them.>