

Understanding the Effects of Endorsements in Scientific Crowdfunding

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ABSTRACT

Understanding the factors that persuade backers to donate to research projects has become increasingly important with the rising popularity of scientific crowdfunding. Although there are many similarities between enterprise and scientific crowdfunding, some factors differentiate these two forms of crowdfunding. One such factor is the use of endorsements. The endorsement helps backers gain trust based on expert opinions about the competency of the researchers and the usefulness of the projects. We analyzed 810 endorsements from scientific campaigns posted on Experiment.com and derived a taxonomy of topics discussed in the endorsements. A regression analysis revealed that when endorsers explained the skills of the campaign owners, the probability of success of the campaign improved; on the contrary, when endorsers reiterated the goal of the project, the campaign was less likely to succeed. We conclude with design implications formulated from our findings to better support scientific crowdfunding.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation:

Author Keywords

Crowdfunding; Scientific Crowdfunding; Endorsement.

INTRODUCTION

The gradual decrease of success rates of national funding agencies like NSF [22] and NIH [17] has motivated researchers to find alternative funding sources. One newly-explored alternative for funding scientific research is crowdfunding, in which researchers request financial support from the crowd through online campaigns. Examples of popular scientific crowdfunding platforms include Experiment.com [8], RocketHub [25], and crowd.science [5]. Scientific crowdfunding campaigns not only allow researchers to engage the general public in the research process but also help researchers obtain funding in a relatively short time compared to traditional research funding processes [14].

While enterprise crowdfunding, such as Kickstarter, has been extensively studied, there is still a lack of research on scientific crowdfunding. Although there are many similarities between these two types of crowdfunding platforms [14], one important factor that differentiates scientific from enterprise crowdfunding is the general objectives of these two types of campaigns; while backers of most enterprise crowdfunding campaigns receive some rewards from the creators, backers typically do not receive rewards for supporting scientific crowdfunding projects. Rather than focusing on rewards, backers of scientific crowdfunding are likely to focus on factors such as scientific values, preparedness of the project team, and the likelihood of success. Therefore, it is likely that backers may have a different motivation for supporting these campaigns.

Because backers may not have the expertise to evaluate scientific crowdfunding projects, to attract backers' attention, creators often request external endorsements from scientists or researchers in related areas. This form of endorsement is unique to scientific crowdfunding (although implicit endorsement by other backers may serve similar functions in enterprise crowdfunding). Intuitively, endorsements are powerful persuasive cues as they increase the level of trust of potential backers, who may eventually donate to a campaign [16]. While important, there is a lack of systematic research on the impact of endorsements on scientific crowdfunding.

This paper focuses on the analysis of campaign endorsements on Experiment.com. In particular, we derived a taxonomy of endorsement topics and developed a logistic regression model to identify the relationship between different types of endorsements and the final outcomes of the campaigns. We adopted the theoretical framework of the Elaborative Likelihood Model (ELM) which claims that persuasion can be effective based on the motivation of users in two ways: 1) the central route and 2) the peripheral route. In the context of scientific crowdfunding, endorsements can be thought of as a central cue that reinforces the deliberate processing of the research skills of the campaign creators by potential backers. On the other hand, products or services in the form of rewards can be considered peripheral cues which are not directly related to the quality of the research project. By studying the dynamics of scientific crowdfunding campaigns, we aim to find how differences in the nature of campaigns may prime potential backers to selectively attend either central or peripheral persuasion cue.

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RELATED WORK

A large number of research studies have identified predictors of success for enterprise crowdfunding. For example, the inclusion of a short video [19], regular project updates [29], the size of project creator's social network [23], motivational phrases used in the description [18], and an appropriate reward structure [10] increased the likelihood of reaching a funding goal for enterprise crowdfunding campaigns. Prior work [11, 7, 19] has also studied a comprehensive list of static and dynamic features such as the funding goal, project categories, and the amount of money pledged over time and found that these features can increase the prediction accuracy of success up to 74%.

As scientific crowdfunding is relatively new, few empirical studies have studied it. An early investigation found that having a large audience, using accessible and persuasive language, and having outreach efforts impact outcomes of scientific crowdfunding campaigns [28]. In a recent study, Hui et al. [14] found that scientists were attracted to crowdfunding because it allowed them to receive social approval from a large number of donors in contrast to receiving reviews from a small grant reviewer panel.

To add to the scientific crowdfunding literature, as an initial step, we focused on the use of endorsements in other social media. In 2012, LinkedIn allowed its members to provide social proofs of their connections' skills and expertise, which encouraged people with fewer skills on their profile to add more [1]. Endorsements further serve to connect people via social grooming [6]. In advertising, prior research [27] has found that when a celebrity endorses more and more products, consumers' perceptions of celebrity's credibility become less favorable. In medical crowdfunding, Kim et al. [15] found that the perceived credibility of a medical crowdfunding campaigns can be evaluated through collective social endorsements, redundancy across various sources, and online community discussions. In academic recommendations and job applications, endorsements are processed as the letter of recommendation (LOR). Research on LOR has shown that specific mentions of applicant's knowledge, work habits, skills, ethics, and accomplishments in the LOR were perceived to be a highly valued information by the reviewers [24, 12, 13].

Similar to LOR, the endorsements for scientific campaigns are also presented in written format. Because of their similarities, we expect to see similar topics, found in the LOR, in the endorsements for scientific crowdfunding campaigns, although some variations are possible due to the contextual differences in these platforms.

METHODOLOGY

Experiment.com allowed creators to ask other scientists to endorse their projects from August 2013 [2]. For our study, we chose Experiment.com over other platforms for two reasons. Unlike other platforms, Experiment.com is dedicated to scientific crowdfunding only. Moreover, Experiment.com has projects in 21 scientific categories which is rarely found in other equivalent platforms. Experiment.com recommends that campaign creators seek endorsements from people that

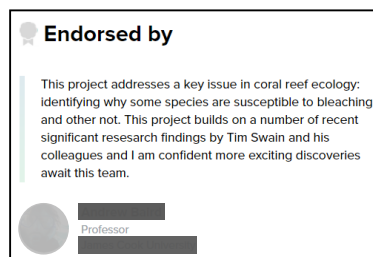


Figure 1: A sample endorsement from a scientific crowdfunding campaign posted on Experiment.com

potential backers will trust, such as advisors, colleagues, collaborators, department chairs, or people affected by the research topic. These endorsements are placed at the bottom of projects' Webpages along with the endorsers' names and affiliations. Figure 1 shows an example endorsement.

To understand what topics endorsers typically highlight in their endorsements, we tried to collect the URLs of all the launched campaigns from Experiment.com up until July 2016. As Experiment.com does not have an exposed ID for each project, we first collected the usernames of all users (backers, project owners, and endorsers) from all of the projects available on the Website's discover project page. Later, we extracted all of the distinct projects mentioned on users' profile pages. Using this strategy, we collected 1037 (92%) projects out of 1127 total projects launched in Experiment.com (as reported in the status page of Experiment.com). Among these campaigns, we considered only 982 "non-live" campaigns for our analysis (campaigns past their deadlines) to ensure that we knew the final outcome of the campaigns (successful or unsuccessful). Among the "non-live" campaigns, 337 campaigns had at least one endorsement. We extracted all of the endorsements and performed a mixed method analysis. In total, we collected 810 endorsements. Of the 982 non-live campaigns, 645 campaigns had no endorsements. Among these without-endorsement campaigns, 259 were successful and 386 were unsuccessful. This indicates that there must be factors other than endorsements that make a campaign successful. However, in the limited scope of this paper we chose not to analyze the effect of other factors. This comparison is indeed important and we should be studied.

To develop a topic taxonomy of the above endorsements, two coders from our research team thoroughly investigated all the endorsements and iteratively developed a coding scheme for the endorsement topics [26]. The process involved three cycles of coding and revision until consistent patterns emerged in the data. After the coding scheme was established, a third coder examined it to verify the methods. In the second stage, we used a hierarchical logistic regression analysis to produce an analytical model for the campaign outcomes.

RESULTS

Among the 337 non-live campaigns with at least one endorsement, 211 campaigns successfully raised their target goal and the remaining 126 campaigns did not. On average, successful campaigns had 2.56 (SD:1.30) endorsements whereas unsuccessful campaigns had 1.88 (SD:0.98) endorsements. We

Topics	Detailed Description
	Example Endorsements
Campaign owner's skills and access to resources	Described the academic achievements, competence, interpersonal skills, and explicit access to resources of the campaign owner/s essential to conduct the research project Example: "Dr. Hopkins is an outspoken advocate for human rights and a passionate, enthusiastic, and hard-working researcher whose contributions towards assuring diverse groups have a voice are widely known and respected"(E259).
Importance of the research project	Explained why the proposed project is important and how specifically the findings from the project will fill the information gap in the corresponding research domain Example: "This project has interesting theoretical and practical implications. The study design is straightforward, the analytical techniques are appropriate, and the insights gained will be valuable"(E139).
Overall scientific benefit	Explained why new research in a general direction is necessary from a broad perspective, without describing any specific details related to the proposed project Example: "Genetic variations in mosquitoes can lead to pronounced differences in their ability to spread mosquito-borne viruses like Zika virus. To most effectively control potential future outbreaks of Zika, we need to understand how well mosquitoes can transmit Zika"(E287).
Reiteration of the project	Described briefly what the campaign owners were planning to do in the proposed project Example: "Dr. Michael Ferro's proposed a project to conduct an expedition to the West Coast of America to document previously unknown species in the genus Sonoma" (E109).
Endorser's relationship with the campaign owner	Explained the personal relationship of the endorser with the campaign owner Example: "Lee Bryant worked for me as a field biologist on a project in 2013" (E379).
Affiliation of the endorser and the campaign owner	Explained institutional affiliation of the endorser and campaign owner Example: "As Professor and Chair of the Department of Mechanical Engineering, I'm very pleased to endorse the UW ZeroG Team's project" (E349).
Worthiness of the project for crowdfunding	Explained why the proposed project would be appropriate for crowdfunding Example: "Crowdfunding is particularly appropriate for studying the Zika virus outbreak because this kind of outreach is a public good and requires immediate support. (E30)"
Confirmation of endorser's monetary support	Stated that he/she already pledged for the project and explicitly mentioned to donate money Example: "I am glad to financially support the novel approach being proposed to detoxify sewage. Please donate for this project " (E98).
Others	Endorsed the project without any specific reason Example: "I would be happy to endorse this project" (E731).

Table 1: Topics identified from the endorsements of scientific crowdfunding campaigns through manual. We provided a short description for each topic along with an example endorsement corresponding to each topic.

found the difference in the average number of endorsements for successful and unsuccessful campaigns to be statistically significant ($t(308)=3.80$, $p=0.0001$).

Topics Extracted from the Endorsements

Table 1 lists the nine topics identified through manual coding by two coders. The Cohen's kappa coefficient [3] between the coders was 0.73. A brief description of each of these topics along with an example endorsement can be found in Table 1. Figure 2 shows the percentage of frequencies of these topics for successful and unsuccessful campaigns. The most frequently mentioned topic was the overall scientific benefit (26.19%) closely followed by the campaign owner's skills and access to resources (23.31%) and the importance of the research project (21.64%).

Although this qualitative analysis helped us find the main topics stated in endorsements for scientific crowdfunding campaigns, it did not reveal how endorsements affected the overall outcomes of the campaigns. To this end, we conducted a logistic regression analysis using the frequency of the topics found in the qualitative analysis as predictor variables, and the outcome (success or not) as the independent variable.

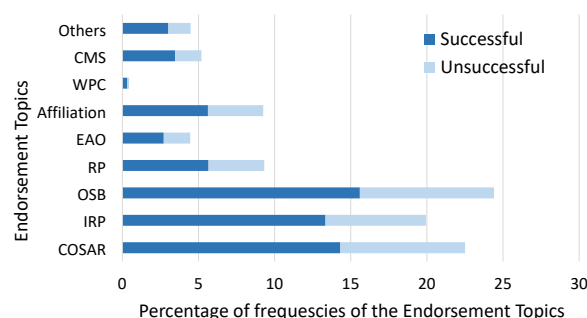


Figure 2: Percentage of the frequencies of the endorsement topics for successful and unsuccessful campaigns. Abbreviation of the topics: COSAR: the campaign owner's skills and access to resources, IRP: the importance of the research project, OSB: overall scientific benefit, RP: a reiteration of the project, EAO: the endorser's association with the campaign owner, Affiliation: affiliation of the endorser and the campaign owner, WPC: the worthiness of the project for crowdfunding, CMS: the confirmation of the endorser's monetary support, and Others: other generic endorsements without any specific reason

Factor Analysis

To avoid over-fitting of the regression model, we reduced the dimensionality of the original space by performing factor analysis before including the variables into the regression model. We found six main factors for which the sum of square loading is greater than 1. Those six factors are: 1) the campaign owner's skills and access to resources, 2) the importance of the research project, 3) the overall scientific benefit, 4) a reiteration of the project, 5) the affiliation of the endorser and the campaign owner, and 6) a confirmation of the endorser's monetary support. There were three topics for which the loadings were below the cut-off threshold (0.60). Those topics were: 1) the endorser's association with the campaign owner (loading: 0.45 in factor 5), 2) the worthiness of the project for crowdfunding (loadings: 0.23 in factors 6), and 3) others (loadings: 0.16 in factors 6). We did not include these three topics in the regression analysis.

Logistic Regression Analysis

Previous studies showed that campaign representation features were predictive of success for enterprise crowdfunding [11, 7, 19]. To understand how endorsements predicted outcomes over and above campaign representation features, we also initialized our logistic regression model with these features, which included the campaign's funding goal, duration, the number of lab notes, the number of images, the number of URLs, and the number of comments. We then added the frequencies of the six endorsement topics as independent variables. The quality of our model was measured using Nagelkerke's R^2 [21].

Table 2: Logistic regression coefficients and p-values (asterisk (*) indicates statistical significance $p < 0.05$).

	Predictor Variables	β	SE	P
Variables used for Model Initialization $R^2 = 0.36$	Funding Goal	0.75	0.21	0.02 *
	Duration	0.11	0.13	0.03 *
	#of Lab Notes	0.33	0.09	0.08
	# of Images	0.28	0.25	0.04 *
	# of URLs	0.41	0.49	0.31
	#of Discussions	0.58	0.27	0.03 *
Frequencies of the Endorsement Topics Included Later $R^2 = 0.51$ $R^2_{\Delta} = 0.15$	Campaign owner's skills and access to resources	0.31	0.18	0.03 *
	Importance of the research project	-0.10	0.21	0.63
	Overall scientific benefit	0.08	0.20	0.69
	Reiterate the project	-0.63	0.28	0.02 *
	Affiliation	-0.08	0.34	0.81
	Confirmation of monetary support	0.24	0.80	0.03 *

Table 2 depicts the β coefficients, errors, and significance estimates for the model. The R^2 value for the initial model was 0.36. After adding the endorsement topics, the R^2 value for the model became 0.51. This shows that endorsement topics have an additional 15% prediction power for the campaigns' outcome over the campaign representation features. The Wald statistics for R^2_{Δ} was significant after adding the frequencies of the endorsement topics. Three out of six topics were statistically significant. Among these three significant topics, 1) the campaign owner's skills and access to resources and 2) a confirmation of endorser's monetary support were positively correlated with the outcomes and 3) a reiteration of the project was negatively correlated with the outcomes of the campaign.

DISCUSSION AND DESIGN IMPLICATIONS

Our mixed-method study shows that endorsements predicted the final outcome of scientific crowdfunding campaigns. We found that the most effective type of endorsement was the discussion about the campaign owner's skills and his or her explicit access to resources such as a rare dataset or important equipment essential for a project. This finding is consistent with the theoretical framework of ELM. The positive effect of endorsements, discussing researchers' skills and efficiency for research projects, shows a persuasion effect through the central route of potential backers. Although further research is needed to test generalizability, our findings indicate that backers in scientific crowdfunding value the competence of the campaign creators most. This may suggest a philanthropic perspective that is tacitly motivating the backer's community.

We also found that campaign representation features are positively correlated to the success of the campaign. This finding is consistent with Mollick's findings that show project representation features can improve the prediction accuracy of success for enterprise crowdfunding [19]. We believe that our initial findings will encourage platform designers to explore the effectiveness of endorsements not only for scientific crowdfunding but also for enterprise crowdfunding.

Although written endorsements are the only explicit endorsement included in the campaigns' Webpage, this is not the only type of endorsement a campaign can receive. Another possible type of endorsement is the endorsement conveyed through campaign videos and from sources outside of the campaign page (e.g., blogs). To understand the full impact of endorsements, further investigation is needed to analyze the importance of video endorsements along with the social status of the endorsers.

LIMITATIONS

The success of scientific crowdfunding depends on many factors. This paper only focuses on how topics mentioned in endorsements can affect the outcome of scientific crowdfunding campaigns. Our findings may not generalize to all other platforms, types of projects, and different platform rules. A comprehensive study with a larger data set or an additional analysis of endorsements on other platforms like equity crowdfunding platforms [9, 4] can further validate the results.

CONCLUSION

Our results suggest that it is beneficial for campaign creators to have a thoughtful discussion with their endorsers about their projects to motivate endorsers to write informative and passionate endorsements instead of writing generic ones. In addition, platform designers can provide more specific guidance to campaign owners and potential endorsers based on our findings. Our results have shown that endorsers describing a general scientific benefit was not predictive of success. Although this finding does not invalidate the importance of stating the overall scientific benefit in endorsements, it suggests that focusing more on the creators' skills is more useful. It may be that for crowdfunding (versus NSF/NIH funding), donors may pay more attention to personal skills and abilities—consistent with existing literature in the crowdfunding domain [20].

REFERENCES

1. Mathieu Bastian, Matthew Hayes, William Vaughan, Sam Shah, Peter Skomoroch, Hyungjin Kim, Sal Uryasev, and Christopher Lloyd. 2014. LinkedIn skills: large-scale topic extraction and inference. In *Proceedings of the 8th ACM Conference on Recommender systems*. ACM, 1–8. DOI: <http://dx.doi.org/10.1145/2645710.2645729>
2. Experiment Blog. 2014. <http://blog.experiment.com/post/102283938857/endorsements-explained>. (22 Jan 2014).
3. J Cohen. 1960. A coefficient of agreement for nominal scales. *Educational and Psychosocial Measurement*, 20, 37–46. (1960).
4. crowdfunder. 2016. <https://www.crowdfunder.com/>. (2016).
5. crowd.science. 2016. <https://crowd.science/>. (2016).
6. Judith Donath. 2007. Signals in social supernets. *Journal of Computer-Mediated Communication* 13, 1 (2007), 231–251.
7. Vincent Etter, Matthias Grossglauser, and Patrick Thiran. 2013. Launch hard or go home!: predicting the success of kickstarter campaigns. In *Proceedings of the first ACM conference on Online social networks*. ACM, 177–182. DOI: <http://dx.doi.org/10.1145/2512938.2512957>
8. Experiment. 2016. <https://experiment.com/>. (2016).
9. Fundable. 2016. <https://www.fundable.com/>. (2016).
10. Michael D Greenberg and Elizabeth M Gerber. 2014. Learning to fail: experiencing public failure online through crowdfunding. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 581–590. DOI: <http://dx.doi.org/10.1145/2556288.2557110>
11. Michael D Greenberg, Bryan Pardo, Karthic Hariharan, and Elizabeth Gerber. 2013. Crowdfunding support tools: predicting success & failure. In *CHI'13 Extended Abstracts on Human Factors in Computing Systems*. ACM, 1815–1820. DOI: <http://dx.doi.org/10.1145/2468356.2468682>
12. A Gerson Greenburg, Jennifer Doyle, and DK McClure. 1994. Letters of recommendation for surgical residencies: what they say and what they mean. *Journal of Surgical Research* 56, 2 (1994), 192–198. DOI: <http://dx.doi.org/10.1006/jsre.1994.1031>
13. Robert M Guion. 2011. *Assessment, measurement, and prediction for personnel decisions*. Taylor & Francis.
14. Julie S Hui and Elizabeth M Gerber. 2015. Crowdfunding Science: Sharing Research with an Extended Audience. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*. ACM press, 31–43. DOI: <http://dx.doi.org/10.1145/2675133.2675188>
15. Jennifer G Kim, Ha Kyung Kong, Karrie Karahalios, Wai-Tat Fu, and Hwajung Hong. 2016. The Power of Collective Endorsements: Credibility Factors in Medical Crowdfunding Campaigns. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. ACM, 4538–4549.
16. Bennett Klusas. 2016. <https://medium.com/@bklusas/freedom-through-crowdfunding-35a01b0fca14>. (25 Feb 2016).
17. Mike Lauer. 2016. Grant Renewal Success Rates: Then and Now. (2016). <https://nexus.od.nih.gov/all/2016/05/26/grant-renewal-success-rates-then-and-now/>.
18. Tanushree Mitra and Eric Gilbert. 2014. The language that gets people to give: Phrases that predict success on kickstarter. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing*. ACM, 49–61. DOI: <http://dx.doi.org/10.1145/2531602.2531656>
19. Ethan Mollick. 2014. The dynamics of crowdfunding: An exploratory study. *Journal of Business Venturing* 29, 1 (2014), 1–16. DOI: <http://dx.doi.org/10.1016/j.jbusvent.2013.06.005>
20. Thomas Müllerleile and Dieter William Joenssen. 2015. Key success-determinants of crowdfunded projects: An exploratory analysis. In *Data Science, Learning by Latent Structures, and Knowledge Discovery*. Springer, 271–281.
21. Nico JD Nagelkerke. 1991. A note on a general definition of the coefficient of determination. *Biometrika* 78, 3 (1991), 691–692.
22. NSF. 2015. Report to the National Science Board on the National Science Foundation’s Merit Review Process Fiscal Year 2014. (2015). <http://www.nsf.gov/nsb/publications/2015/nsb201514.pdf>.
23. Vineeth Rakesh, Jaegul Choo, and Chandan K Reddy. 2015. Project recommendation using heterogeneous traits in crowdfunding. In *Ninth International AAAI Conference on Web and Social Media*.
24. Lillian M Range, Andrea Menyhert, Michael L Walsh, Kimeron N Hardin, Jon B Ellis, and Ray Craddick. 1991. Letters of recommendation: Perspectives, recommendations, and ethics. *Professional Psychology: Research and Practice* 22, 5 (1991), 389. DOI: <http://dx.doi.org/10.1037/0735-7028.22.5.389>
25. RocketHub. 2016. <https://www.rockethub.com/>. (2016).
26. David R Thomas. 2006. A general inductive approach for analyzing qualitative evaluation data. *American journal of evaluation* 27, 2 (2006), 237–246.
27. Carolyn Tripp, Thomas D Jensen, and Les Carlson. 1994. The effects of multiple product endorsements by celebrities on consumers’ attitudes and intentions. *Journal of consumer research* 20, 4 (1994), 535–547. DOI: <http://dx.doi.org/10.1086/209368>

28. Rachel E Wheat, Yiwei Wang, Jarrett E Byrnes, and Jai Ranganathan. 2013. Raising money for scientific research through crowdfunding. *Trends in ecology & evolution* 28, 2 (2013), 71–72. DOI : <http://dx.doi.org/10.1016/j.tree.2012.11.001>
29. Anbang Xu, Xiao Yang, Huaming Rao, Wai-Tat Fu, Shih-Wen Huang, and Brian P Bailey. 2014. Show me the money!: An analysis of project updates during crowdfunding campaigns. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 591–600. DOI : <http://dx.doi.org/10.1145/2556288.2557045>