Effects of Battle and Journey Metaphors on Charitable Donations for Cancer Patients

Alex Liebscher (aliebsch@ucsd.edu)
Sean Trott (sttrott@ucsd.edu)
Benjamin Bergen (bkbergen@ucsd.edu)
Department of Cognitive Science, UC San Diego
La Jolla, CA 92093 USA

Abstract

Having cancer is often described metaphorically as a battle ("my fight against cancer") or as a journey ("my path through cancer treatment"). Previous experimental work has demonstrated that these metaphors can influence people's reasoning and emotional inferences about experiences with cancer (Hendricks, Demjén, Semino, & Boroditsky, 2018; Hauser & Schwarz, 2019). However, it is currently unknown how the use of these metaphorical frames translates into behavioral changes, such as the likelihood and magnitude of charitable giving. Using hand-labeled data from more than 5,000 Go-FundMe cancer-related campaigns, we ask how a campaign's use of metaphor predicts several measures of donation behavior beyond what other control variables predict (e.g. shares on Facebook). We find that the presence of either metaphor family (battle or journey) has a positive effect on campaign success and donation behavior.

Keywords: metaphor; charitable giving; crowdfunding; cancer

Introduction

People frequently talk about abstract and complex experiences metaphorically (Jamrozik, McQuire, Cardillo, & Chatterjee, 2016), which may guide how they conceptualize and reason about those experiences (Thibodeau, Hendricks, & Boroditsky, 2017). For example, experiences with cancer are frequently described using at least one of two pervasive metaphors—as a journey ("my path through cancer treatment") or as a battle ("my fight against cancer") (Sontag, 1977; Gibbs & Franks, 2002; Bowker, 1996; Magaña & Matlock, 2018; Semino, Demjén, Hardie, Payne, & Rayson, 2017). Previous experimental work has demonstrated that these metaphors can influence people's reasoning and emotional inferences about experiences with cancer (Hendricks et al., 2018; Hauser & Schwarz, 2019). However, it remains unknown whether they impact real-world behavior.

Background

Can exposure to linguistic metaphor affect cognition? Conceptual Metaphor Theory (CMT) hypothesizes that metaphors structure our knowledge of abstract concepts and how we make meaning of them (Lakoff & Johnson, 1980). This claim is corroborated by substantial evidence that different metaphorical frames can produce distinct understandings of such concepts. For instance, Thibodeau and Boroditsky (2011) found that framing a city's crime as a beast (vs. a virus) led participants to believe in the effectiveness of fighting against the crime (vs. treating the root cause). Keefer,

Landau, Sullivan, and Rothschild (2014) demonstrated that framing depression as either space (depression as down) or light (depression as dark) had positive effects on how effective participants believed fictional anti-depressants (such as "Liftix" and "Illuminix") would be in comparison to non-metaphorical medication (such as "Effectrix"). Jia and Smith (2013) found that personifying stock markets with an agentic frame ("the New York market leaped higher") led participants to imagine a stronger market trajectory, compared to a literal framing. (For an extensive review, see Thibodeau et al. (2017).) Such evidence suggests that metaphor framing may broadly influence our conceptualization of common life experiences.

Within the domain of cancer, past research has demonstrated that journey and battle metaphors may affect how individuals reason about and conceptualize the disease. For example, Landau, Arndt, and Cameron (2018) found that battle metaphors used to describe skin cancer can cause fear and anxiety, and encourage preventative intentions. On the other hand, Hauser and Schwarz (2019) found evidence that battle metaphors lead to counterproductive beliefs about the difficulty of cancer and how quickly someone with symptoms should seek medical attention. Hendricks et al. (2018) identified distinct emotional implications of battle and journey metaphors, finding that journey metaphors led people to perceive cancer more optimistically. Finally, theoretical work by Reisfield and Wilson (2004) contrasted journey and battle cancer metaphors, arguing that while journey metaphors are more peaceful, they still convey cancer's gravity.

Despite the well-theorized and growing evidence for the role of metaphor in thought, and on cancer specifically, thought may not necessarily translate into action. Current evidence focuses largely on the effects of metaphor framing on reasoning and perception, and has not yet identified whether and how these changes in conceptualization translate into real-world behavioral changes. We address this gap through the study of one common type of real-world behavior tied specifically to cancer: charitable giving. Charitable donations allow us to quantify (through individuals' donation propensity, donation amounts, etc.) the influence of metaphor on where one chooses to allocate one's resources. This builds upon other related work (e.g. Landau et al., 2018; Hauser & Schwarz, 2019), by attempting to identify actual behavioral changes, rather than intended or hypothetical action.

Crowdfunding and donation behavior

In our effort to fill this gap, we measure the success of crowdfunding campaigns as a function of metaphor usage. Crowdfunding, the process of accumulating funds through many small donations, has grown significantly in the past decade (Short, Ketchen Jr, McKenny, Allison, & Ireland, 2017). Previous research has discovered links between crowdfunding campaign success and various predictors, for example, the social distance between donors and recipients (Agrawal, Catalini, & Goldfarb, 2015) and the fundraiser's passion toward the campaign (Li, Chen, Kotha, & Fisher, 2017).

Cancer-focused crowdfunding campaigns are extremely common, given the often rapid progression of the disease and expense of treatment. Indeed, as of 2020, one crowdfunding platform, GoFundMe, claims to have raised over $650 million annually for medical fundraising, which makes up one-third of their campaigns (GoFundMe, 2020). Crucially, crowdfunding campaigns offer an interpretable set of variables that allow us to quantify relationships between donation behavior and the language used in a campaign—specifically, the metaphors used to describe an individual's cancer experience. Jointly, the extensive independent work on crowdfunding, cancer experiences, metaphorical framing, and charitable donation psychology make the success of cancer-related crowdfunding campaigns a promising measure of social behavior that may be affected by metaphor.

Current work

This study investigated the relationship between the usage and presence of metaphor and donation behavior in online crowdfunding campaigns. It addresses three main questions, and three secondary points.

First, does the presence of at least one battle or journey metaphor predict the success of a campaign? One would expect under CMT and the literature on metaphor framing that campaigns which present a cancer appeal metaphorically will recruit mappings derived through embodied experience. The difference in a reader's ability to grasp or relate to the metaphor target given a metaphorical or a literal appeal may indeed have an impact on people's willingness to change their behavior (Flusberg, Matlock, & Thibodeau, 2017).

Second, does donation behavior change when narratives mix metaphors? Gibbs and Franks (2002) claim that multiple metaphors are necessary to understand the different aspects of illness, treatment, and healing. Perhaps readers understand, sympathize with, and donate more when narratives use a combination of metaphors. Conversely, mixed metaphors may cause confusion or hinder comprehension. Ceccarelli (2004) argues that although mixed metaphors may thoroughly convey the target concept, less apt metaphors can also detract from the more apt metaphor's rich associations.

Third, does one metaphor family influence donation behavior differently than the other? Previous work on battle and journey metaphors offers conflicting predictions. Battle metaphors may encourage people to act, but they also may

encourage a fatalistic mindset, degrading one's perspectives on preventative measures (Hauser & Schwarz, 2019). Battle metaphors may also overemphasize the physical and biological aspects of cancer, while ignoring the psychological and social aspects (Nie et al., 2016). On the other hand, journey metaphors may highlight the many possibilities one may face during one's experience and avoid concepts such as winning, losing, and failing (Reisfield & Wilson, 2004). Journey metaphors may also lead people to have a more optimistic outlook towards eventual healing (Hendricks et al., 2018). However, journey metaphors may be less motivating or persuasive than battle metaphors. Overall, battle metaphors may potentially incite charitable action at the expense of encouraging fatalism and conveying undesirable features; journey metaphors may convey an auspicious situation, yet fail to motivate donors.

Even within each metaphor family, we might expect campaign success to depend on *how* the metaphors are used. First, more rather than fewer metaphors within a campaign narrative may make the narrative more vivid or cumulatively construct a more complex mental image (Werth, 1994; Ortony, 1975). Further, some metaphors are more conventional than others. As metaphors become more conventional, there is a gradual shift in how they are processed (Bowdle & Gentner, 2005; Desai, Binder, Conant, Mano, & Seidenberg, 2011; Cardillo, Watson, Schmidt, Kranjec, & Chatterjee, 2012). Consequently, novel metaphors, which generally elicit stronger neural and affective signatures, may be more compelling. Lastly, metaphorical frames may more effectively structure conceptualizations when the frame is introduced at the beginning of the stimulus, compared to the end (Thibodeau & Boroditsky, 2011).

Methods

Data collection

We scraped real campaigns soliciting donations for cancer treatment directly from GoFundMe. GoFundMe is a popular crowdfunding platform that hosts a wide spectrum of campaigns, including cancer-related fundraisers. In February 2019, we searched the site for a set of cancer-related keywords (e.g. *leukemia*, *neuroblastoma*, *breast cancer*, etc.) and collected the resulting campaigns until we had 10,000 total campaigns.

Each campaign was then coded for individual battle and journey metaphors. A search for battle and journey keywords (e.g. *war*, *battling*, *path*, etc.) provided fragments of campaign text which were then hand-annotated as cancer-related metaphors or not. Other well-documented cancer metaphors were sparse: cancer as a force or natural disaster (Bowker, 1996; Gibbs & Franks, 2002) showed up fewer than 2 times per 10,000 words. Whether a keyword was metaphorical was coded through a process similar to Steen's (2010) procedure. For each potential metaphor, we manually inspected and determined its contextual meaning. If a more concrete meaning could be found and the unit's intended target was can-

cer, then the unit was deemed metaphorical. This ensured that nonspecific ("my journey through life") and unrelated metaphors ("he fought the insurance company") were labeled correctly as not examples of cancer metaphors. An exemplary metaphorical battle phrase was "This is one fight that no one prepares for" and an exemplary metaphorical journey phrase was "My mother has a very long hard journey ahead of her." After annotating, we limited campaigns to those launched in 2013 or later and originating from the US. This produced a total of 5,309 annotated campaigns in the final dataset. Battle metaphors occurred about 3.2 times per 1,000 words, and journey metaphors about 0.8 times per 1,000 words. For comparison, Semino, Demjén, Demmen, et al. (2017) found patients in an online forum used violence metaphors 1.8 times per 1,000 words and journey metaphors 1.5 times per 1,000 words.

Variables

Dependent measures Campaign success was operationalized in three ways: the number of donors who contributed to the campaign (Number of Donors), the campaign's average donation per donor (Mean Donation), and whether the campaign met its funding goal (Success). Number of Donors was modeled as a truncated Negative Binomial distributed random variable to account for count data greater than zero with unequal dispersion and mean parameters. Mean Donation was log-transformed and modeled with a linear regression to account for the positive, continuous nature of mean donations. Success was modeled with an unregularized logistic regression.

Covariates To measure the effect of metaphor, we controlled for a number of covariates. Prior work has identified factors that significantly influenced charitable giving, including the campaign's funding goal (Gleasure & Feller, 2016), number of words in the main text (Gleasure & Feller, 2016), campaign launch month (Ekström, 2018), number of photos and videos present on the page (Courtney, Dutta, & Li, 2017), number of Facebook friends of the campaign owner (Mollick, 2014), number of shares on Facebook (Agrawal et al., 2015), and number of campaign updates (Xu et al., 2014). We also identified several other factors a priori, including launch day of the week, launch year, fundraising duration, and inferred cancer type. Continuous variables were scaled; those with a meaningful zero were divided by one standard deviation, whereas those without a meaningful zero were centered then divided by two standard deviations (see Gelman, 2008).

We controlled for these covariates in case they were confounded with metaphor use. For instance the number of words in the main text could correlate with metaphor usage. For example, Littlemore, Krennmayr, Turner, and Turner (2014) found that as the proficiency of English second language learners increased, so did the density of metaphors in their writing. It is not implausible that authors with greater English proficiency would write longer and more elaborate crowdfunding campaigns, producing a relationship between
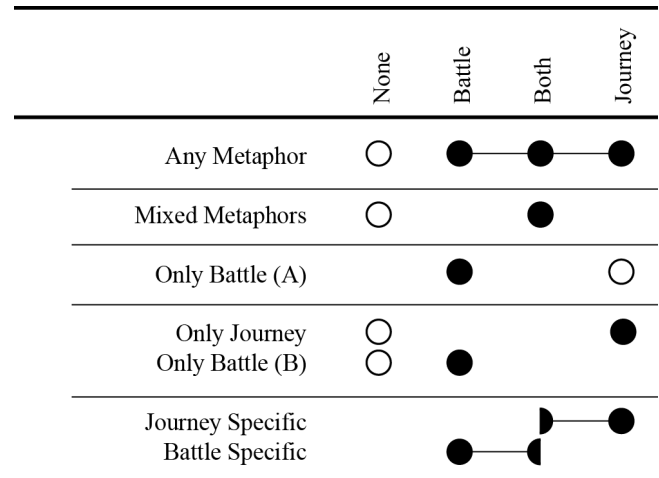

Figure 1: This analysis compared subsets of the full dataset: literal campaigns, campaigns which only use battle or journey metaphors, and campaigns which use both metaphors. All predictors were binary except for Journey Specific and Battle Specific. Open circles denote the negative class(es); filled circles denote the positive class(es); semi-circles denote partial inclusion of campaigns in that class.

metaphor presence and text length. Indeed, within our data, campaigns that include either battle or journey metaphors have a significantly higher average number of words in the main text (M = 401.2) than literal campaigns (M = 257.4), $t(5497.4) = 24.2, p < 0.001$.

Predictors of interest We were first interested in the overall effect of metaphor presence on donation behavior. The variable Any Metaphor represented whether the campaign included at least one battle or journey metaphor. Yet, this may conflate the individual effects of journey and battle metaphors. Thus, the Only Journey and Only Battle (B) variables represented whether the campaign contained only journey or only battle metaphors, respectively. To measure the effect of using mixed metaphors, the Mixed Metaphors variable represented whether a campaign included either both metaphor families, or neither.

To align our work with the literature that has contrasted battle and journey metaphors, we compared campaigns which used only battle metaphors with those that used only journey metaphors. The Only Battle (A) variable was used to make this distinction. See Fig 1 for a visualization of which campaigns were included in Only Battle (A) and Only Battle (B).

We also tested for effects contingent on *how* metaphors were employed. We first examined the influence of metaphor prominence on campaign success with the Journey Salience and Battle Salience variables. These two predictors represented the ratio of metaphorical keywords (within each metaphor family) to the total number of words within each campaign. For example, an appeal with 100 total words and five metaphorical journey keywords would have a Journey Salience of 0.05.

Table 1: Categories of variables included in the analyses.

Dependent Variables	Covariates	Predictors of Interest
Number of Donors	Funding Goal	Any Metaphor
Donors	Narrative Length	Mixed Metaphors
Mean Donation	Duration	Only Journey
Success	Cancer type	Only Battle
	Faceboook Shares	Journey Salience
	Facebook Friends	Battle Salience
	Updates	Journey Rarity
	Photos	Battle Rarity
	Day of Week	Journey Earliness
	Month	Battle Earliness

The conventionality, or rarity, of metaphors in the appeal may also affect donation behavior. To account for this, we define Journey Rarity and Battle Rarity over each campaign; both were sums of the rarities of the metaphorical keywords used in each campaign. First, let M_f be the number of different keywords in the f metaphor family. The rarity for the f metaphor family of the nth campaign is the sum of each metaphorical keyword's count in the campaign, C_{n_i}, weighted by $W_{i,f}$. This weight is the scaled, inverse term frequency of the ith keyword across all documents. Thus, rarity for the f metaphor family of the nth campaign is:

$$R_{n,f} = \sum_{i=1}^{M_f} W_{i,f} \times C_{n_i} \quad \text{where} \quad W_{i,f} = \left(\frac{C_i}{T_f}\right)^{-r}$$

where r is the scaling constant (we use $r = 0.4$) and T_f is the total number of metaphorical keywords within the family. This is analogous to TF-IDF, but places less weight on infrequent terms. To reify this idea, consider two campaigns: the first employs one metaphorical use of "enemy" (e.g. "Cancer was Jennifer's worst enemy") and the second employs two metaphorical uses of "beating" (e.g. "He has steadily been beating cancer... Beating this disease is all he wants."). From the corpus, we know a priori that $W_{enemy,battle} = 8.2$ and $W_{beating,battle} = 3.2$, therefore $R_{1,battle} = 8.2$ and $R_{2,battle} = 3.2 \times 2 = 6.4$.

Finally, how soon metaphors are introduced in an appeal may influence donation behavior. We define the Journey and Battle Earliness variables, which were the relative positions of the first metaphors within each campaign. For example, if the first journey metaphor in a campaign of 100 total words occurs at the 20th word, then Journey Earliness for this campaign would be 0.2. In Fig 1, Salience, Rarity, and Earliness were collapsed into the Journey Specific and Battle Specific categories.

Variable selection We addressed the questions introduced above using a series of nested model comparisons. For each question, we subset the data to include only relevant

campaigns, then fit base models for each dependent variable (Number of Donors, Mean Donation, Success) including all of the non-metaphorical covariates and random effects. The final base models for each question were determined using backward stepwise regression to eliminate insignificant, non-metaphorical covariates. We then included each metaphor predictor of interest and asked whether the addition of that predictor improved the model fit (as measured by a log-likelihood ratio test over the difference in model deviance). The only random effect present was an intercept-only effect of year, since we did not exhaust all possible years that campaigns could be published. Models were built with *lme4* (Bates, Maechler, Bolker, Walker, et al., 2014) in the R framework (R Core Team, 2018).

Results

We report the log-likelihood ratio tests for each model comparison, and when useful, the coefficient and 95% Wald confidence interval. For an overview of which subsets of campaigns were included in each question's analysis, see Fig 1.

Does the presence of any metaphor influence campaign success? To identify the effect of any metaphor on campaign success, we compared full models including a fixed effect of Any Metaphor to models omitting only this term. All 5,309 campaigns were used in the analysis (with 3,116 in the positive class of Any Metaphor). A significant main effect was revealed with the inclusion of Any Metaphor for Number of Donors [$\beta = 0.14$, CI (0.09, 0.19), $\chi^2(1) = 35.1, p < 0.001$] and Mean Donation [$\beta = 0.11$, CI (0.08, 0.13), $\chi^2(1) = 60, p < 0.001$]. Model fit was marginally improved for Success [$\beta = 0.15$, CI (-0.01, 0.32), $\chi^2(1) = 3.3, p = 0.07$]. See Fig 2 for the residuals of the model omitting Any Metaphor, which shows the model fit improvement made possible by adding Any Metaphor.

Does the presence of a specific metaphor influence campaign success? To identify the effects of each specific metaphor family on campaign success, we fit full models including either Only Journey or Only Battle (B). The former set of models included 2,643 campaigns that used either *only* journey metaphors or no metaphors at all (450 were in the positive class of Only Journey). The latter included 4,201 campaigns that used *only* battle metaphors or no metaphors at all (2,008 were in the positive class of Only Battle (B)). The inclusion of Only Journey significantly improved model fit for Number of Donors [$\beta = 0.12$, CI (0.03, 0.20), $\chi^2(1) = 7.8, p < 0.01$] and Mean Donation [$\beta = 0.09$, CI (0.04, 0.14), $\chi^2(1) = 12.8, p < 0.001$], but not Success [$\chi^2(1) = 1.0, p = 0.32$]. The inclusion of Only Battle (B) significantly improved model fit for Number of Donors [$\beta = 0.11$, CI (0.06, 0.16), $\chi^2(1) = 16.5, p < 0.001$] and Mean Donation [$\beta = 0.10$, CI (0.07, 0.13), $\chi^2(1) = 43.7, p < 0.001$], but not Success [$\chi^2(1) = 1.6, p = 0.21$].

Does the presence of both metaphors influence campaign success? To identify the effect of mixed metaphors on cam-
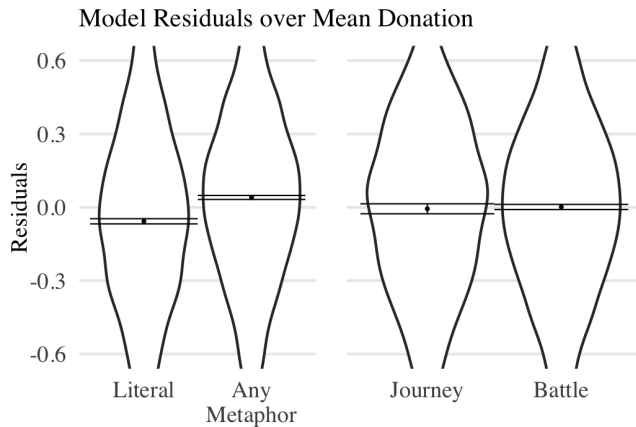
Figure 2: Residual distributions for two metaphor predictors of interest (left: Any Metaphor, right: Only Battle (A)), for two base models that didn't include the metaphor predictor of interest. Including the predictors captured the residual deviance made apparent by the gap between standard error bars.

paign success, we compared full models including a fixed effect of Mixed Metaphor to models omitting this term. The 2,851 campaigns with either both metaphors or neither were used, with 658 in the positive class of Mixed Metaphors. The inclusion of Mixed Metaphors significantly improved model fit for Number of Donors [$\beta = 0.18$, CI (0.10, 0.26), $\chi^2(1) = 20.3, p < 0.001$] and Mean Donation [$\beta = 0.10$, CI (0.06, 0.15), $\chi^2(1) = 19.3, p < 0.001$]. Model fit was marginally improved for Success given the addition of the Mixed Metaphors variable [$\chi^2(1) = 2.9, p = 0.09$].

Does campaign success vary between metaphors? We also asked whether campaign success varied between the metaphor families. The analysis was limited to campaigns with either *only* battle metaphors or *only* journey metaphors; there were 2,458 such campaigns in total, with 2,008 in the positive class of Only Battle (A). Neither models for Number of Donors, Mean Donation, nor Success fit significantly better when Only Battle (A) was added [all $\chi^2(1) < 1.0$]. See Fig 2 for the residuals of the model omitting only Battle (A), which shows the model fit would hardly be improved by including the variable.

Does the way metaphors are deployed influence campaign success? Finally, we were interested in how the way each metaphor was used influenced campaign outcomes. First, using only campaigns that contained at least one journey metaphor, we compared full models for each dependent variable including fixed effects for Journey Salience, Journey Rarity, and Journey Earliness to models omitting these. In total, 1,108 campaigns were included in these first analyses. Model fit for Number of Donors was not significantly improved with Journey Salience [$\chi^2(1) = 1.4, p = 0.23$], Journey Rarity [$\chi^2(1) < 1.0$], or Journey Earliness [$\chi^2(1) < 1.0$]. Fit for Mean Donation was not significantly improved with Journey Salience [$\chi^2(1) = 1.1, p = 0.30$] or Journey Earliness

[$\chi^2(1) < 1.0$], although it was improved with Journey Rarity [$\beta = 0.05$, CI (0.01, 0.09), $\chi^2(1) = 5.9, p = 0.02$]. Fit for Success was not significantly improved with Journey Salience [$\chi^2(1) < 1.0$], Journey Rarity [$\chi^2(1) < 1.0$], or Journey Earliness [$\chi^2(1) = 2.4, p = 0.12$].

Second, using only campaigns that contained at least one battle metaphor, we compared full models for each dependent variable including fixed effects for Battle Salience, Battle Rarity, and Battle Earliness to models omitting these. In total, 2,666 campaigns were included in these analyses. Model fit for Number of Donors was significantly improved with Battle Rarity [$\beta = 0.07$, CI (0.01, 0.12), $\chi^2(1) = 5.4, p = 0.02$], but not with Battle Salience [$\chi^2(1) < 1.0$] or Battle Earliness [$\chi^2(1) = 2.0, p = 0.16$]. Fit for Mean Donation was not improved by the addition of Battle Salience [$\chi^2(1) = 2.0, p = 0.16$], Battle Rarity [$\chi^2(1) < 1.0$], or Battle Earliness [$\chi^2(1) < 1.0$]. Fit for Success was not improved with Battle Salience [$\chi^2(1) < 1.0$], Battle Rarity [$\chi^2(1) = 1.9, p = 0.16$], or Battle Earliness [$\chi^2(1) = 2.7, p = 0.10$].

Discussion

Across a large number of crowdfunding campaigns, we analyzed the correlation between donation behavior and patterns of metaphor usage. We focused on donations for cancer appeals, which often use well-documented metaphors, because of the lack of naturalistic evidence for metaphor's influence on a real-world behavior, like charitable giving.

The results suggest that campaigns that use at least one metaphor family—regardless of whether it is a journey or battle—attract about 15% more donors and about 11% larger average donations. For comparison, in the same models, an increase in goal amount (a significant non-metaphorical covariate) was associated with about 37% more donors and 13% larger mean donations. It may be the case that readers' understanding of the gravity of cancer relies on being guided by a more familiar, experience derived mapping. This is supported by the fact that campaigns which only used journey metaphors and campaigns which only used battle metaphors were also associated with increases in both the number of donors and the average donation. Metaphors may not only be a conceptual guide, but, according to work in persuasive communication and social pragmatics, they may influence donors' perceptions of the patient and the author. Reinsch Jr (1974) suggested that figurative language affects the speaker's perceived credibility by increasing their perceived authoritativeness. This may have an impact on how people donate their money: higher credibility is known to encourage individuals to donate to online medical fundraisers (Kim, Kong, Karahalios, Fu, & Hong, 2016). However, the link between metaphor presence and judgements of credibility is still disputed (Sopory & Dillard, 2002). Metaphor's effect on donor behavior may also be attributed to models of illness being shared between the author and the donor, which could influence how donors resonate with and understand the appeal. Through spoken metaphors, Coreil, Wilke, and Pin-

tado (2004) identified shared models of illness that breast cancer patients used in a support group. Ideally, knowing the donor's past relationships with cancer and their models of illness could help differentiate this explanation. All together, there appears to be a strong correlation between the likelihood and magnitude of charitable giving and the presence of a metaphorical frame. This effect may be the result of metaphors structuring donors' conceptualizations about cancer, but other social and cultural influences may be contributing to the persuasiveness of the metaphors used.

The lack of relationship between donor behavior and the family of metaphor suggests, like Flusberg, Matlock, and Thibodeau (2018) claimed, that idiosyncrasies may prevent one metaphor from being universally more apt. Some donors may respond more positively to battle metaphors, other to journey metaphors. As Fetterman, Bair, Werth, Landkammer, and Robinson (2016) argue, it is unsurprising that individual differences may impact the function of each metaphor family. To increase donor generosity across many individuals, it may help to mix both journey and battle metaphors. We see a strong correlation between campaign success and mixed metaphors. This is consistent with Gibbs and Franks's (2002) proposal that understanding the full impact of cancer benefits from the combined contributions of multiple different metaphors.

The way campaign owners and patients employ these metaphors (which metaphor family they use, using unconventional metaphors, etc.) does not appear to reliably guide behavioral responses in the data we report here. Contrary to Werth (1994), who suggested that sustained metaphors across a text would positively affect mental conceptualizations, we find no relation between the salience of metaphors and campaign success. Furthermore, according to Thibodeau and Boroditsky (2011), we would expect metaphors introduced earlier in the narrative to structure the donor's conceptualization more, helping donors make meaning out of the appeal. Not finding this effect may be the result of donors' careful consideration of the entire text in their decision to relinquish their money; or perhaps framing in the context of cancer doesn't act in the way it does for crime, where the remaining narrative is framed by the initial metaphor.

This analysis is limited by being correlational in nature. Future work will test if metaphor presence exhibits a *causal* relationship with donation behavior by manipulating the presence or absence of metaphors in an experimental context. Future work may also benefit from measuring the cognitive complexity of the natural crowdfunding appeals, which may influence, for example, donors' perceptions of the worthiness of the campaign.

Conclusion

The way we frame certain experiences through metaphors may influence not only our conceptualizations, but also our actions. In this work, we presented the first large-scale analysis of the relationship between metaphor "in the wild" and real-world behavior. Using over 5,000 cancer-related Go-FundMe campaigns, we identified a significant role of journey and battle metaphor frames in predicting both the number of donors and average amount donated. Overarching conceptual metaphors may guide how donors make meaning of the appeal, the patient, and their cancer; and in turn, they may influence donor behavior.

References

Agrawal, A., Catalini, C., & Goldfarb, A. (2015). Crowdfunding: Geography, social networks, and the timing of investment decisions. *Journal of Economics & Management Strategy*, *24*(2), 253–274.

Bates, D., Maechler, M., Bolker, B., Walker, S., et al. (2014). lme4: Linear mixed-effects models using eigen and s4. *R package version*, *1*(7), 1–23.

Bowdle, B. F., & Gentner, D. (2005). The career of metaphor. *Psychological review*, *112*(1).

Bowker, J. (1996). Cancer, individual process, and control: A case study in metaphor analysis. *Health Communication*, *8*(1), 91–104.

Cardillo, E. R., Watson, C. E., Schmidt, G. L., Kranjec, A., & Chatterjee, A. (2012). From novel to familiar: tuning the brain for metaphors. *Neuroimage*, *59*(4), 3212–3221.

Ceccarelli, L. (2004). Neither confusing cacophony nor culinary complements: A case study of mixed metaphors for genomic science. *Written Communication*, *21*(1), 92–105.

Coreil, J., Wilke, J., & Pintado, I. (2004). Cultural models of illness and recovery in breast cancer support groups. *Qualitative Health Research*, *14*(7), 905–923.

Courtney, C., Dutta, S., & Li, Y. (2017). Resolving information asymmetry: Signaling, endorsement, and crowdfunding success. *Entrepreneurship Theory and Practice*, *41*(2), 265–290.

Desai, R. H., Binder, J. R., Conant, L. L., Mano, Q. R., & Seidenberg, M. S. (2011). The neural career of sensory-motor metaphors. *Journal of cognitive neuroscience*, *23*(9), 2376–2386.

Ekström, M. (2018). Seasonal altruism: How christmas shapes unsolicited charitable giving. *Journal of Economic Behavior & Organization*, *153*, 177–193.

Fetterman, A. K., Bair, J. L., Werth, M., Landkammer, F., & Robinson, M. D. (2016). The scope and consequences of metaphoric thinking: Using individual differences in metaphor usage to understand how metaphor functions. *Journal of Personality and Social Psychology*, *110*(3).

Flusberg, S. J., Matlock, T., & Thibodeau, P. H. (2017). Metaphors for the war (or race) against climate change. *Environmental communication*, *11*(6), 769–783.

Flusberg, S. J., Matlock, T., & Thibodeau, P. H. (2018). War metaphors in public discourse. *Metaphor and Symbol*, *33*(1), 1–18.

Gelman, A. (2008). Scaling regression inputs by dividing by two standard deviations. *Statistics in medicine*, *27*(15), 2865–2873.

Gibbs, R. W., & Franks, H. (2002). Embodied metaphor in women's narratives about their experiences with cancer. *Health Communication*, *14*(2), 139–165.

Gleasure, R., & Feller, J. (2016). Does heart or head rule donor behaviors in charitable crowdfunding markets? *International Journal of Electronic Commerce*, *20*(4), 499–524.

GoFundMe. (2020). *Gofundme – cancer fundraising.* Retrieved from https://www.gofundme.com/start/cancer-fundraising (Online; accessed 29-January-2020)

Hauser, D. J., & Schwarz, N. (2019). The war on prevention ii: Battle metaphors undermine cancer treatment and prevention and do not increase vigilance. *Health communication*, 1–7.

Hendricks, R. K., Demjén, Z., Semino, E., & Boroditsky, L. (2018). Emotional implications of metaphor: Consequences of metaphor framing for mindset about cancer. *Metaphor and Symbol*, *33*(4), 267–279.

Jamrozik, A., McQuire, M., Cardillo, E. R., & Chatterjee, A. (2016). Metaphor: Bridging embodiment to abstraction. *Psychonomic bulletin & review*, *23*(4), 1080–1089.

Jia, L., & Smith, E. R. (2013). Distance makes the metaphor grow stronger: A psychological distance model of metaphor use. *Journal of Experimental Social Psychology*, *49*(3), 492–497.

Keefer, L. A., Landau, M. J., Sullivan, D., & Rothschild, Z. K. (2014). Embodied metaphor and abstract problem solving: Testing a metaphoric fit hypothesis in the health domain. *Journal of Experimental Social Psychology*, *55*, 12–20.

Kim, J. G., Kong, H. K., Karahalios, K., Fu, W.-T., & Hong, H. (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.*

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. University of Chicago press.

Landau, M. J., Arndt, J., & Cameron, L. D. (2018). Do metaphors in health messages work? exploring emotional and cognitive factors. *Journal of Experimental Social Psychology*, *74*, 135–149.

Li, J. J., Chen, X.-P., Kotha, S., & Fisher, G. (2017). Catching fire and spreading it: A glimpse into displayed entrepreneurial passion in crowdfunding campaigns. *Journal of Applied Psychology*, *102*(7), 1075.

Littlemore, J., Krennmayr, T., Turner, J., & Turner, S. (2014). An investigation into metaphor use at different levels of second language writing. *Applied linguistics*, *35*(2), 117–144.

Magaña, D., & Matlock, T. (2018). How spanish speakers use metaphor to describe their experiences with cancer. *Discourse & Communication*, *12*(6), 627–644.

Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of business venturing*, *29*(1), 1–16.

Nie, J.-B., Gilbertson, A., de Roubaix, M., Staunton, C., van Niekerk, A., Tucker, J. D., & Rennie, S. (2016). Healing without waging war: beyond military metaphors in medicine and hiv cure research. *The American Journal of Bioethics*, *16*(10), 3–11.

Ortony, A. (1975). Why metaphors are necessary and not just nice 1. *Educational theory*, *25*(1), 45–53.

R Core Team. (2018). R: A language and environment for statistical computing [Computer software manual]. Vienna, Austria. Retrieved from https://www.R-project.org/

Reinsch Jr, N. L. (1974). Figurative language and source credibility: A preliminary investigation and reconceptualization. *Human Communication Research*, *1*(1), 75–80.

Reisfield, G. M., & Wilson, G. R. (2004). Use of metaphor in the discourse on cancer. *Journal of clinical oncology*, *22*(19), 4024–4027.

Semino, E., Demjén, Z., Demmen, J., Koller, V., Payne, S., Hardie, A., & Rayson, P. (2017). The online use of violence and journey metaphors by patients with cancer, as compared with health professionals: a mixed methods study. *BMJ supportive & palliative care*, *7*(1), 60–66.

Semino, E., Demjén, Z., Hardie, A., Payne, S., & Rayson, P. (2017). *Metaphor, cancer and the end of life: A corpus-based study*. Routledge.

Short, J. C., Ketchen Jr, D. J., McKenny, A. F., Allison, T. H., & Ireland, R. D. (2017). Research on crowdfunding: Reviewing the (very recent) past and celebrating the present. *Entrepreneurship Theory and Practice*, *41*(2), 149–160.

Sontag, S. (1977). *Illness as metaphor*. Farrar, Straus.

Sopory, P., & Dillard, J. P. (2002). The persuasive effects of metaphor: A meta-analysis. *Human communication research*, *28*(3), 382–419.

Steen, G. (2010). *A method for linguistic metaphor identification: From mip to mipvu*. John Benjamins Publishing.

Thibodeau, P. H., & Boroditsky, L. (2011). Metaphors we think with: The role of metaphor in reasoning. *PloS one*, *6*(2).

Thibodeau, P. H., Hendricks, R. K., & Boroditsky, L. (2017). How linguistic metaphor scaffolds reasoning. *Trends in cognitive sciences*, *21*(11), 852–863.

Werth, P. (1994). Extended metaphor—a text-world account. *Language and literature*, *3*(2), 79–103.

Xu, A., Yang, X., Rao, H., Fu, W.-T., Huang, S.-W., & Bailey, B. P. (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* (pp. 591–600).