

Codo: Fundraising with Conditional Donations

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ABSTRACT

Crowdfunding websites like Kickstarter and Indiegogo offer project organizers the ability to market, fund, and build a community around their campaign. While offering support and flexibility for organizers, crowdfunding sites provide very little control to donors. In this paper, we investigate the idea of empowering donors by allowing them to specify conditions for their crowdfunding contributions. We introduce a crowdfunding system, Codo, that allows donors to specify *conditional donations*. Codo allows donors to contribute to a campaign but hold off on their contribution until certain specific conditions are met (e.g. specific members or groups contribute a certain amount).

We begin with a micro study to assess several specific conditional donations based on their comprehensibility and usage likelihood. Based on this study, we formalize conditional donations into a general grammar that captures a broad set of useful conditions. We demonstrate the feasibility of resolving conditions in our grammar by elegantly transforming conditional donations into a system of linear inequalities that are efficiently resolved using off-the-shelf linear program solvers. Finally, we designed a user-friendly crowdfunding interface that supports conditional donations for an actual fund raising campaign and assess the potential of conditional donations through this campaign. We find preliminary evidence that roughly 1 in 3 donors make conditional donations and that conditional donors donate more compared to direct donors.

Author Keywords

Conditional donations; crowdfunding; linear program (LP)

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI):
Miscellaneous

INTRODUCTION

Crowdfunding websites like Kickstarter [4], IndieGoGo [3], and DonorsChoose [2] have recently been highly successful in enabling organizations and individuals to quickly and easily raise money online [5]. These sites form a focal point for

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projects and provide three basic services to facilitate fundraising. First, they are online platforms for disseminating information about causes, second, they integrate with social networking services like Facebook and Twitter to spread the word, and third, they incorporate an online payment system to collect donations. However, while some online platforms provide funding-specific features to organizers, donors themselves cannot specify even basic conditions that must be met for them to donate to a cause.

Despite their general absence from crowdfunding websites, donor-specified conditions are a natural stipulation for which there are many real-world examples and socio-economic motivations. In this paper we propose the idea of empowering donors to specify conditions for their crowdfunding contributions through *conditional donations*.

Recent works show that the funding model has a significant effect on donor perceptions of projects, donor willingness to contribute to causes, and the eventual success of campaigns [13, 29]. Specifically, all-or-nothing donation conditions such as those employed by Kickstarter [4] have been demonstrated to help reduce donor apprehensions about project risk. Our goal is to explore the idea of allowing donors to specify conditions for their donations beyond *organizer-specified*, global, all-or-nothing conditions.

Supporting *donor-specified* conditional donations raises many novel research challenges. We address the following questions in this paper:

1. *Which conditional donations make sense to users and how should such conditions be specified?* Programmers can easily define conditionals in the form of if-then-else statements over a collection of variables, but conditional donations are a novel and potentially challenging concept for laypersons to specify. Simple conditions such as, "I will donate if Alice donates", are straightforward, but slightly more complex constructions such as, "I will match Alice's or Bob's donation if they donate at least 50 dollars", can quickly become unwieldy and potentially ambiguous. We explore the space of potential English constructions through a micro study to assess both the clarity and perceived usefulness of conditional donation statements (Section **Needs Assessment**).

2. *How and when do we resolve a set of conditional donations into actual donations?* Conditions specified by individuals may result in *standoffs* that should ideally be resolved if possible, e.g. Alice will donate \$10 only if Bob donates, Bob will donate \$10 only if Alice donates. Our solution relies on constructing a conditional donation grammar where expressible

conditional donations are elegantly transformed into a system of linear equations. The system of linear equations is solvable in polynomial time using off-the-shelf linear program (LP) solvers (Section **System Overview**). Our solution resolves *standoffs* immediately; every direct or conditional donation specified results in Codo executing the solver to resolve as many unresolved conditional donations as possible.

3. How do we visualize a user’s impact? Unlike unconditional donation systems, in Codo, any donation can potentially trigger the resolution of multiple conditional donations. Thus, a user donating \$5 can create a ripple effect where \$100 is added to the donation pool from resolved conditional donations. It is therefore possible that if a user even slightly increases their donation, they could create a much larger impact. We take advantage of this design opportunity by presenting donors with the *potential* impact of their intended donation (Section **Interface Design**).

4. Do conditional donations increase donations per user? We partnered with a student-body charitable campaign, Kitty Pool, that was collecting donations to set up a fund to cover emergency veterinary expenses for stray campus animals (mostly cats) as well as vaccination, neutering, and surgical expenses. We assess the potential usefulness of conditional donations through fundraising metrics and qualitative participant feedback (Section **Preliminary Evaluation**).

We begin with a needs assessment for conditional donations. We then describe the design and evaluation of, Codo, a crowdfunding system to support conditional donations.

NEEDS ASSESSMENT

We categorize conditional donations into three broad classes: directed conditions, group conditions, and global conditions.

Directed conditions are donations that are conditioned on (one or several) specific individuals. For example, a person who is donating to a clean water charity might condition her donation on celebrity and clean water champion Matt Damon donating.¹ The condition is directed at Matt Damon; only if Matt Damon donates to fulfill the condition, will the person who specified the condition donate. Challenge schemes, like the viral ‘ALS Ice Bucket Challenge’, where a donor directly challenges specific individuals raises awareness about a campaign [1], and also allows donors to collectively decide whether a cause is worthy of their support.

Group conditions are donations conditioned on the behavior of specific groups. Group conditions may be useful if, for example, a person wishes to donate to clean up the streets of their neighborhood, but will only do so if enough members of their community donate as well. Many community causes suffer from a perceived *free rider problem* [18] — people may hesitate to donate if they believe that members of the community will enjoy the benefits of clean streets without contributing anything. By allowing people to condition their donation on sufficient group participation, people are able to mitigate the risk of free-riding. Group conditions could also be defined so as to allow users to scale the size of their individual

¹Matt Damon is the founder of the H2O Africa Foundations.

contribution to the contribution of others (e.g. “I will match donations from my community”).

Finally, *global conditions* are conditional donations based on overall fundraising metrics such as total funds raised or number of donors so far. On ‘all-or-nothing’ crowdfunding sites like Kickstarter, project organizers specify a project’s funding goal, and a project collects money only if the funding goal is met. However, donors themselves may wish to decide when a project has gathered critical mass, especially for projects that do not have well-defined funding goals. Without a system like Codo, users have to periodically revisit a project site to check whether their donation conditions have been met before contributing.

We conducted a mechanical turk study to assess understandability and perceived usefulness of several specific conditional donation statements. In the study we asked turkers to rank on a 5-point Likert scale (i) how understandable they found each of the conditional donation statements listed in Table 1 from “very difficult to understand” to “very easy to understand” and (ii) how likely they were to formulate such a donation statement in an online donation platform from “very unlikely” to “very likely”. For quality assurance, we asked users to perform simple donation calculations for each statement. If a respondent’s comprehensibility score for several donation statements did not match the accuracy of their calculations. Only turkers with a 98% HIT approval rate or higher were allowed to participate in the survey.²

We summarize the results of this study in Table 1; we find the following results:

1. Directed conditional donations are the most easy to understand and the most likely to be used. Matching donations are both difficult to comprehend and least likely to be used. If a crowdfunding platform wishes to provide partial support for conditional donations, it should support those that are easy to understand and specify.
2. All respondents weakly preferred at least one conditional donation to a direct donation: i.e. they gave an equal likelihood score to the direct donation and a conditional donation. Moreover, 13% of respondents *strictly* preferred a conditional donation over the direct donation. These differences in user preferences motivate the development of an expressive conditional donation system, where users can pose conditions of varying complexity.

SYSTEM OVERVIEW

In this section, we discuss how we formalized conditional donations into a general grammar through the design of Codo. Codo is a conditional donation optimizer and database, complete with a language specification, parser, and python library that allows campaign organizers to build fundraising applications with Codo in the back-end. We describe the supported

²Note that it is difficult to generalize mechanical turk survey results to particular user populations due to the absence of certified demographic information on participating turkers.

Conditional Donations		Comprehensibility		Usage Likelihood		Preference to Direct	
Category	Example	Avg.	Dist.	Avg.	Dist.	\succeq (weak)	\succ (strict)
Direct	I will donate \$10	4.79	■■■■■	4.34	■■■■■	100	0
Directed	I will donate \$10 if my friend Alex donates	4.67	■■■■■	3.80	■■■■■	65	8
Directed	I will donate \$10 if my friend Alex donates at least \$5	4.62	■■■■■	3.63	■■■■■	59	3
Group	I will donate \$10 if someone from my hometown donates	4.65	■■■■■	3.58	■■■■■	57	5
Global	I will donate \$10 if the total of all donations is at least \$20	4.58	■■■■■	3.47	■■■■■	51	6
Group	I will donate \$10 if members of my hometown donate at least \$100 total	4.44	■■■■■	3.40	■■■■■	56	4
Global	I will donate \$10 if at least 10 people donate	4.41	■■■■■	3.35	■■■■■	49	4
Group	I will donate \$10 if at least 3 members of my hometown are donating at least \$5 each	4.31	■■■■■	3.25	■■■■■	47	5
Global	I will donate \$10 if at least 10 people donate \$5 each	4.48	■■■■■	3.23	■■■■■	44	3
Group	I will donate \$10 if at least 50	4.10	■■■■■	3.16	■■■■■	48	8
Group	I will donate \$10 if at least 3 members of my hometown are donating	4.32	■■■■■	3.11	■■■■■	44	4
Matching	I will match donations from members of my hometown 2:1 up to \$50	3.56	■■■■■	2.58	■■■■■	33	3
Matching	I will match donations from Alex 2:1 up to \$50	3.43	■■■■■	2.58	■■■■■	31	2

Table 1. Average self-reported comprehension and usage likelihood scores (on a 5-point Likert Scale) of different conditional donations by 100 mechanical turkers. Conditional donations are sorted by average usage likelihood score. Preference measures are based on respondents who gave equal or higher usage likelihood scores to a conditional donation over a direct donation.

grammar of conditional donations, how the optimizer interprets and resolves conditional donations, and how we designed a front-end integrating Codo to support conditional donations.

The Grammar of Conditional Donations

Codo supports a wide range of conditional donations through the grammar illustrated in Figure 1. The grammar supports simple conditions such as “I will donate \$100 if 30 people donate” to fairly complex conditions such as “I will match limit \$100 2:1 group ‘CS department’ if group ‘CS department’ has 10 participants donating $\geq \$10$ each and if total $\geq \$2000$ ”.

Table 2 shows how each condition is transformed into equivalent linear inequalities. Each user i pledges an amount x_i provided their condition y_i is met. If the user’s conditions are met $y_i = 1$, otherwise $y_i = 0$. The actual donation given by a user is thus $x_i \times y_i$. The total donation amount collected so far for a campaign is $\sum_i x_i \times y_i$. Codo solves the system of linear equations with the objective of maximizing total donation amount.

In Table 2, the group condition 4, “I will donate 10 USD if group G donates”, requires only one member of the group to donate for the condition to be met. $\sum_{g \in G} y_g$ counts the members of group G who actually donated. If none of the members donated then $y_i \leq 0$ and user i will not donate. If one or more members of the group donate, the optimizer will maximize total donations by setting y_i to its maximum possible value of 1 and user i donates their pledged amount x_i .

The grammar allows multiple conditions to be attached to a donation conjunctively through AND clauses. In its linear program representation a conjunction of c conditions is simply $y_i \leq (y_i^1 + y_i^2 + \dots + y_i^c)/c$ where y_i^1, \dots, y_i^c are the conjuncts. Since user i only donates if $y_i = 1$, all conjuncts have

to be satisfied for the fraction $(y_i^1 + y_i^2 + \dots + y_i^c)/c$ to evaluate to one. Codo’s optimizer also supports ORs (disjunctions) of conditions but we chose not to include them in our grammar: formulating conditions with ANDs and ORs requires users to grasp and apply the precedence rules of logic operators, which is difficult with Codo because its language has an English syntax and natural languages are prone to ambiguity.

The grammar is designed to only support *monotonic* conditions (i.e. a user cannot negatively condition on other donations). These conditions are therefore not supported: “I will donate \$10 only if Fred does not donate” or “if Fred donates at most \$10” or “if Fred donates exactly \$10”. This limitation is necessary for system efficiency and, more importantly, for politeness. Non-monotonic conditions lead to non-linear programs that may not be resolved in polynomial time. They can also alienate users; as the system optimizes for maximum total donation, a user’s donation might be ignored in favor of another. For example, after the system accepts a donation from Matt Damon, if a new user, Brad Pitt, pledges a larger donation conditioned on Matt Damon not donating, then the system will favor Pitt’s contribution thereby rejecting Damon’s donation and thereby potentially alienating him. Also, since the set of satisfiable non-monotonic conditions change with time, the behavior of a system that allows them can be extremely confusing to users. Thus, conditions are strictly monotonic in Codo.

Interpreting and Resolving Conditional Donations

Codo is currently *time-oblivious*. Consider a campaign that already has 100 donors. If a new donor pledges to donate \$10 if ten people donate, the condition is validated immediately. Codo accepts the user’s donation because there are already 10 or more donors contributing to the campaign. This, however, can be counter-intuitive to some users who expect such a conditional donation to be interpreted as “I will donate 10 USD if ten *more* users donate”. We plan to extend the language and

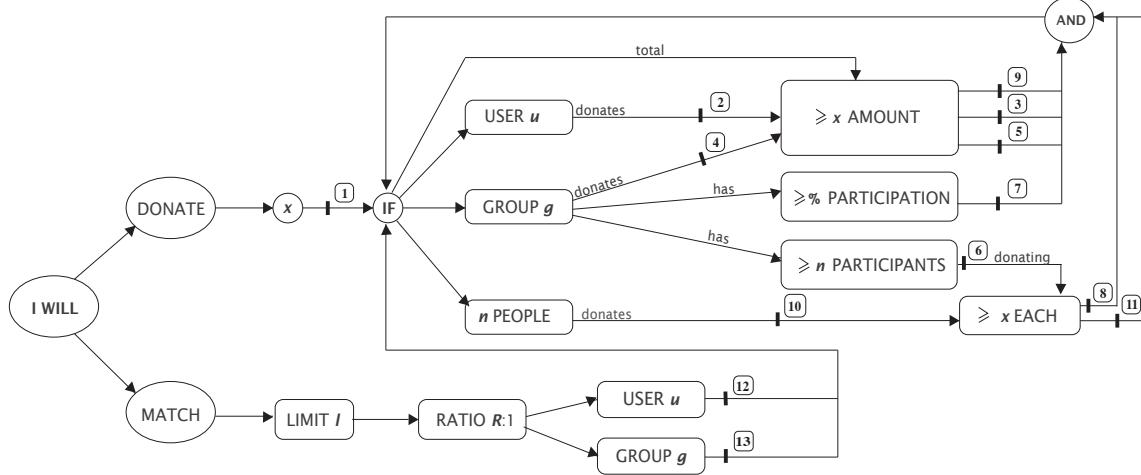


Figure 1. The Grammar of Conditional Donations. Thirteen exit points are enumerated and denoted with an accompanying mark. Each exit point represents a conditional donation rule. For example, exit point 1 refers to the simple direct donation: “I will donate x [USD].” Exit point 12 refers to the matching donation: “I will match, limit l [USD], ratio $R : 1$ user u ’s [USD]”. Examples for each exit point are listed in Table 2.

optimizer of Codo to be time-aware to allow such rules and also to allow users to expire their pledges.

Codo shrewdly deals with conditional donation *standoffs*. A standoff occurs with directed conditions if two users condition on each other (user 1 will donate 10 USD if user 2 donates and user 2 will donate 5 USD if user 1 donates) or a group users condition cyclically on each other (user 1 on user 2, user 2 on user 3, ..., user n on user 1). Codo’s optimizer resolves such standoffs by accepting donations from all users involved in the cyclic condition dependency. With group or global conditions, a standoff occurs if n users condition on at least $n - 1$ users donating. For example, eleven users each pledging to donate if ten users also donate. In this case, Codo also accepts donations from the eleven users.

Codo’s flexible optimizer supports the mixing of several non-monetary donation currencies such as time or effort. We plan, for example, to use Codo to support a health and wellness campaign where users pledge physical ‘steps’ or money. Codo’s objective function can also be altered to maximize other functions such as total participation.

In the presence of conditional donations, a new donation (conditional or direct) can trigger one or more unresolved conditional donations. Codo’s python library allows front-end designers to enumerate each of these trigger values, or *impact points*. Impact points exposed by the Codo API can be used by the front-end to visualize strategic donation opportunities to maximize impact and encourage donors. We explore potential visualizations that take advantage of impact points in the following section.

Performance

Codo attempts to resolve each conditional donation on entry. Once a donation i is resolved, we eliminate its condition from the LP problem by setting $y_i = 1$. This keeps the LP problem small. State-of-the-art LP solvers are quite efficient:

our tests show that CPLEX can solve LPs with hundreds of thousands of conditions within minutes on consumer laptops. Codo could be further optimized by batching and resolving conditional donations periodically. We note that users do not expect real time resolution of their conditions because they understand that it takes time for their conditions to be met. When a user’s conditions are met, Codo asynchronously notifies them by email. Thus, non-linear LP algorithms provide acceptable performance.

Interface Design

Codo provides a powerful and expressive language for conditional donations. This gives fundraising campaign organizers an extensive set of features with which to build their online fundraising platform. To explore how best to present conditional donations to potential donors, we partnered with a student-run fundraising campaign that collects donations to cover veterinary costs for stray campus animals, Kitty Pool. Given the novelty of conditional donations, we helped the campaign design the Kitty Pool website interface. Figure 2 is a screenshot of Kitty Pool’s donation webpage; it illustrates the different user-interface design choices we made.

To balance Codo’s power with simplicity at the user interface level, we chose to enable only a subset of conditional donations. This is currently important since users are still unfamiliar with online conditional donations. In our interface, we allow users to make either a direct donation, a global “challenge your community” donation (Table 2.11) or a directed “challenge your friends” donation (Table 2.3) through simple, intuitive forms. As users grow more familiar with conditional donations, we expect online crowdfunding platforms to expose more complex conditional donations.

We selected this particular set of conditional donations using the results from our micro study rankings of conditions by their comprehensibility and usage likelihood (see Needs As-

Exit Example donation point	y_i	x_i
1 I will donate 10 USD	$y_i = 1$	$x_i = 10$
Directed Conditions		
2 I will donate 10 USD if user j donates	$y_i \leq y_j$	$x_i = 10$
3 I will donate 10 USD if user j donates ≥ 5 USD	$y_i \leq \frac{x_j \times y_j}{5}$	$x_i = 10$
Group Conditions		
4 I will donate 10 USD if group G donates	$y_i \leq \frac{\sum_{g \in \{G \setminus i\}} y_g}{\sum_{g \in \{G \setminus i\}} x_g \times y_g}$	$x_i = 10$
5 I will donate 10 USD if group G donates ≥ 100 USD	$y_i \leq \frac{100}{\sum_{g \in \{G \setminus i\}} y_g}$	$x_i = 10$
6 I will donate 10 USD if group G has ≥ 3 participants	$y_i \leq \frac{3}{\sum_{g \in \{G \setminus i\}} y_g}$	$x_i = 10$
7 I will donate 10 USD if group G has $\geq 50\%$ participation	$y_i \leq \frac{0.5 \times G }{\sum_{g \in \{G \setminus i\}} y_g}$	$x_i = 10$
8 I will donate 10 USD if group G has ≥ 3 participants donating ≥ 5 USD each	$y_i \leq \frac{\sum_{g \in \{G \setminus i\}} \left[\frac{x_g \times y_g}{5} \right]}{3}$	$x_i = 10$
Global Conditions		
9 I will donate 10 USD if total ≥ 20 USD	$y_i \leq \frac{20}{\sum_{u \in \{U \setminus i\}} x_u \times y_u}$	$x_i = 10$
10 I will donate 10 USD if 100 people donate	$y_i \leq \frac{100}{\sum_{u \in \{U \setminus i\}} y_u}$	$x_i = 10$
11 I will donate 10 USD if 100 people donate ≥ 5 USD each	$y_i \leq \frac{100}{\sum_{u \in \{U \setminus i\}} \left[\frac{x_u \times y_u}{5} \right]}$	$x_i = 10$
Matching Donations		
12 I will match limit 100, ratio 2: 1 user j	Condition dependent	$x_i = 2 \times x_j \times y_j$ $x_i \leq 100$
13 I will match limit 100, ratio 2: 1 group G	Condition dependent	$x_i = 2 \times \sum_{g \in \{G \setminus i\}} x_g \times y_g$ $x_i \leq 100$

Notes: $y_i \in \{0, 1\}$; $x_i \geq 0$; $U = \{\text{the set of all registered users}\}$

Table 2. Each conditional donation has an equivalent linear inequality. Representing each user donation in this form allows Codo to use off-the-shelf LP solvers like IBM CPLEX to resolve all conditional donations. For simplicity and brevity, we do not fully linearize the above equations — some equations multiply two variables. Linearization, however, is straightforward as we always multiply a binary with a continuous variable.

essment section). For Kitty Pool, we excluded group conditionals because they would require the existence, naming, and integration of pre-defined online groups. However, we were able to use university network identifiers to implement “challenge your friends” in the directed conditional donation because the campaign was limited to members of the university.

Visualizing Impact

Unlike unconditional donation systems, in Codo, any donation can potentially trigger the resolution of multiple conditional donations. Thus, a user donating \$5 can create a ripple effect where \$100 is added to the donation pool from resolved conditional donations. This dependency between donor actions presents us an interesting design opportunity to visualize impact. Through a series of focus groups (five users each) we developed the simple, yet effective interactive visualization in Figure 2. As users explore different donation amounts, conditional donations that would be resolved by that donation appear at the top of the list of “challenges” with an unlocked-lock icon. Conditional donations that are close to resolution are also displayed with information on the donations needed to resolve them.

We briefly discuss two alternate visualizations (Figure 3) that we discarded because our focus-groups found them confusing or disorienting. We defer a detailed investigation of possible conditional donation visualizations for future work.

Impact Bars - Our first visualization attempt (Figure 3[a]) allows users to interact with a donation input slider. The slider has different *impact points* marked on its scale. These impact points illustrate the minimum donation amounts required to unlock a new set of conditional donations. At the bottom of the slider, a bar chart shows (i) a sample of past donations, (ii) the current donation amount and (iii) a bar for every conditional donation that is resolved as a consequence of the current donation. Users found this visualization disorienting as changes in the donation amount led to bars appearing or disappearing.

Impact Ripples - Our second visualization attempt (Figure 3[b]) relies on a water ripple metaphor: “the bigger your donation, the bigger the ripple it creates.” As the user increases the donation amount, a donation bubble grows from the bottom of the visualization. Conditional donations are placed at a radial distance away from the center of the visualization equivalent to the donation amount required to resolve the

The screenshot shows the Kitty Pool Campaign website. At the top, it displays "1196 AED FUNDS RAISED", "36 FUNDERS", "3 CHALLENGES", and "4 DAYS LEFT". A large image of a cat is on the left, with three callout boxes: "Users can make a direct unconditional donation.", "Users can make a global conditional donation.", and "Users can make a directed conditional donation and nominate up to 5 friends by entering their netIDs." Below the image, there are three donation forms: "MAKE A DIRECT DONATION" (example: I will donate 20 AED), "CHALLENGE YOUR COMMUNITY" (example: I will donate 20 AED ONLY if 10 people donate 10 AED each), and "CHALLENGE YOUR FRIENDS" (example: I will donate 20 AED if Bob donates 20 AED). To the right, a box says "Users can see the latest stats of the campaign - the funds raised, the number of funders, the number of unresolved conditional donations, and the number of days left in the campaign." Another box says "In addition to notification emails, users also get a notification if they are mentioned in any directed conditional donations by their friends." A third box says "Impact Visualization: The user gets to see a list of conditional donations that they are helping to resolve. This list gets updated based on the user's current donation amount." Below these are several challenge cards with user names like jc2977, jp1377, ty556, am56, and asp120, along with their donation requirements and counts.

Figure 2. User Interface for the Kitty Pool Campaign.

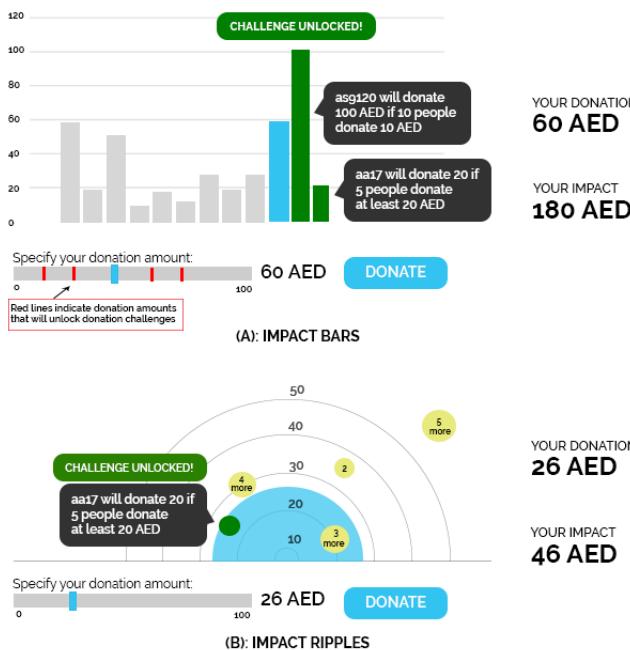


Figure 3. Two conditional donation impact visualizations that were focus-group tested.

condition. Hovering over a conditional donation reveals its details. As the donation amount grows, some conditional donations are resolved, which may in turn resolve more conditional donations leading to larger ripple effects — these donations move into the donation bubble. While some users found this interaction entertaining, for most users it was too complex. Instead, users preferred a simpler visualization that only showed which conditional donations were resolved and not specifically how they were resolved.

PRELIMINARY EVALUATION

To explore the potential of conditional donations, we conducted a comparative user study through the Kitty Pool campaign of two donation features: direct and conditional. Our goal was to assess (i) the number of donors who chose conditional vs. direct donations, (ii) the donor contributions each donation feature, and (iii) donor feedback from using Codo.

Selecting a Cause

In addition to helping us better design user interfaces for campaigns that support conditional donations, we chose to evaluate Codo through Kitty Pool for the following reasons:

1. A laboratory study of conditional donations, with hypothetical charitable causes and forced donation scenarios, fails to completely capture user choice and behavior when performing a task as private and intimate as donating to a cause. Thus, studying conditional donations for an actual cause, the Kitty Pool campaign, strikes a balance between our need to gather sufficient, realistic data and ability (or

inability) to manage user biases, avoid demand characteristics, and control test features.

- Kitty Pool's charitable cause — setting up an emergency vet fund for campus cats — is *not* as polarizing as fundraising for a political candidate, as controversial as fundraising for Planned Parenthood, PETA³, etc., as heart-rending as fundraising for victims of disease, war or crimes, as exclusive as fundraising for a fraternity's end-of-year bash party, nor as organized as fundraising by religious houses. We minimize the confounding effects of human emotion and ideology on our study through our campaign choice. While one can argue that treating campus cats is somewhat a niche cause, the campaign attracts contributions from a diverse set of university members (see demographic data below). It also addresses a community issue and hence is susceptible to free-riding. Studying the effect of conditional donations on polarizing or controversial fundraising campaigns is an interesting topic for future work.

Participants and Methods

Through posts on social media, bulletin board advertisements and university announcements on the university's intranet, members of the university were made aware of the Kitty Pool campaign and directed to the campaign's website to get more information and make online donations. To eliminate security concerns around online payments, Kitty Pool adopted an honor pledge system: users make donation pledges and once the campaign ends, emails with instructions on how to transfer funds will be forwarded to donors who made direct contributions or whose conditional donations were resolved.

In the course of 8 days, 28 participants made donations with Kitty Pool. There were 17 female and 11 male participants. There were 13 undergraduate students, 12 university staff, and 3 faculty members. The participants had never used an online donation system deployed on Codo before. The participants pledged a total of 2191 AED⁴ (\approx 597 USD), 1285 AED (\approx 350 USD) through conditional donations and 906 AED (\approx 247 USD) through direct donations.

Users saw the three donation options in Figure 2:

Direct Donation: Users fill in their donation amount in the textbox or click up/down arrows within the box to increment/decrement their donation. The default donation amount is 20 AED. The minimum donation amount allowed was 5 AED.⁵

Global Conditional Donation: Users fill in their donation amount (default: 20 AED, min: 5 AED) and the minimum number of people (default: 10 people, min: 1 person) that must donate along with the minimum amount they should each contribute (default: 10 AED, min: 5 AED). This conditional donation is described in Table 2.11.

³Note Kitty Pool does raise funds to neuter, spay and treat injured and sick cats.

⁴AED (Dirham) is the currency of the United Arab Emirates. The study was conducted in Abu Dhabi. 20 AED \approx 5.45 USD.

⁵The placement of the direct donation form above the conditional donations might have influenced some users to choose direct donations over conditional donations.

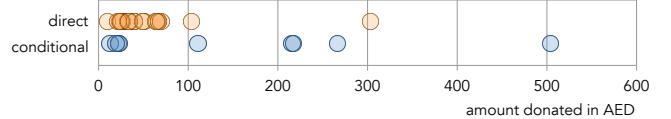


Figure 4. Donor contributions for direct and conditional donations. Black bars indicate average donation amount for each feature. A small amount of random jitter (≤ 5 AED) was added to spread donation amounts for visual clarity — users tend to donate in multiples of 5.

Directed Conditional Donation: Users fill in their donation amount (default: 20 AED, min: 5 AED) and the university network identifiers of up to 5 other people along with the minimum amount they should each contribute (default: 10 AED, min: 5 AED). This conditional donation is described in Table 2.3.

Roughly 1 in 3 users made conditional donations. Of the 28 participants, 9 (32%) made conditional donations and 19 (68%) made direct donations. The proportion of users who made conditional contributions is slightly higher than what we anticipated from our needs assessment where roughly 13% of the respondents strictly preferred conditional donations over direct donations.

Conditional donors on average made higher contributions. We performed a one-way ANOVA of donation amounts with donation type (direct vs. conditional) as an independent factor. We found a significant effect of donation type ($F_{1,26} = 4.86, p < 0.05$). In Figure 4, we notice that mean donation amounts are higher for conditional donations ($\mu = 143$ AED) compared to direct donations ($\mu = 48$ AED).

Qualitative Results

Of the nine conditional donations, only four were resolved at the time of writing this section. Table 3 lists all nine conditional donations and whether they were resolved or not. Only 130 AED of the 1285 AED ($\approx 10\%$) were resolved. We note the following interesting observations: (i) users who make bigger pledges have more challenging conditions (Table 3.2, 3.7-9)(i) users who challenge more participants, ask less from them (Table 3.7-9) and (iii) a user challenged his/her friends differently, perhaps based on a perceived willingness to donate (Table 3.2). Contrary to the results of the mechanical turk study, we found that more donors constructed global conditional donations (7 users) compared to directed conditional donations (2 users).

Conditional Donation			Resolved?	
	Pledge	Depends on	Giving	why?
1	5 AED	A	5 AED	No
		B	5 AED	B must donate
2	200 AED	C	50 AED	No
		D	5 AED	D must donate
3	10 AED	10 people	10 AED	Yes
4	10 AED	10 people	10 AED	Yes
5	10 AED	10 people	10 AED	Yes
6	100 AED	5 people	10 AED	Yes
7	250 AED	10 people	50 AED	No
8	200 AED	30 people	30 AED	No
9	500 AED	50 people	10 AED	No

Table 3. Conditional donations made by users on Kitty Pool.

After donating, users were requested to fill an online questionnaire. They were asked to rate how easy it was to donate on Kitty Pool on a 5-point Likert scale from ‘very difficult’ to ‘very easy’. Users found the online donation system easy to use ($\mu = 4.5$, $----$).

We also assessed the users’ overall impression of conditional donations from ‘strong dislike’ to ‘strong like’. Users had an overall positive impression of conditional donations ($\mu = 3.34$, $----$). We asked users to elaborate by explaining how conditional donations influenced their donation behavior. Their responses suggest a richly variegated decision making process. One user was offended by the notion: “It does not [influence my decision]. The decision to donate is personal, not a game”. Another user explained that his/her decisions are based entirely on the cause. Users who were positively influenced by the conditional donation feature expressed the following sentiments: “Seeing that others are willing to donate a large amount if more people participated encouraged me to donate more. Being able to see how many of the challenges my donation will contribute to was very useful”, “I donated more than I had initially intended”, “It made me feel more confident in my donation”, “A lot actually: it is a new idea that will create some kind of competition”, and “Yes, to some extent they allow me to determine the amount I am able to donate so it is not too low and not too high”.

We also asked users to rate how likely they would be to donate if a friend made a conditional donation contingent on their donation. Users were likely to accept such challenges ($\mu = 3.73$, $----$). One user pointed out that directed conditional donations encouraged a sense of reciprocity *between donors* rather than reciprocity in the form of gifts from organizers to donors: “If I challenge someone to donate to this cause they could challenge me to donate to the cause of their choice as well”.

RELATED WORKS

Crowdfunding

Crowdfunding websites like Kickstarter [4] and Indiegogo [3] are a recent phenomenon that have popularized online fundraising for many kinds of projects. Crowdfunding has been incredibly successful, with Kickstarter alone raising \$1.5M per day, involving 8 million backers, and fully funding 38% of projects [5]. Crowdfunding is used to raise money for a variety of different purposes and crowdfunding sites have specialized to focus on specific niches including: creative projects, new businesses, art projects, education, investigative journalism, and charity [4, 3, 7, 2]. Yet, many crowdfunding projects today fail to collect sufficient funding ($> 50\%$) [5], which suggests that existing donation mechanisms may not be adequate.

Recent studies on the crowdfunding phenomenon have been prolific. Gerber et al. [16] identify reasons why organizers choose to use crowdfunding platforms to raise capital, which include: raising awareness, making connections with customers, retaining creative control, measuring interest, gaining approval, and learning more about fundraising. The motivations of donors similarly vary; beyond supporting a cause,

donors participate to collect rewards, help others, support like-minded people, and join a community. Muller et al. explored the role of identity on enterprise crowdfunding in terms of geography, corporate structure, and of working in groups [25]. Other work by Mitra et al. investigated the role of language in persuasion of crowdfunding backers [23].

Crowdfunding mechanisms can have a significant impact on the success of a project. Recent works find that the funding model affects donor perceptions of projects, donor willingness to contribute to causes, and the eventual success of campaigns [13, 29]. Furthermore, encouraging people to make immediate donations can make a difference for whether a project is funded [28]. These studies point out that many design opportunities exist, including finding ways to activate social networks to improve outcomes [20]. Our work is a direct response to these observed design opportunities in crowdfunding: Codo offers a novel mechanism that allows people to more immediately donate and engage their social networks.

Conditional Donations

With conventional (offline) fundraising, many examples of conditional donations already exist. *Matching gifts* are one example of a classic form of conditional donations, i.e an organization or angel investor matches user donations at a given rate up to a maximum amount. For example, *I will match 2:1 all donations up to \$1000*. Karlan et al. find that a match offer increases individual contributions to the cause [22] as well as the probability of a donation [21]. Another study by Sanders et al. on charitable giving suggests that alternate forms of matching such as non-linear matching, social adoption matching, and competitive matching are even better at encouraging donations when compared to standard one-to-one matching [27]. Matching gifts, in both its standard and alternate forms, have not translated to online crowdfunding sites. Codo is the first crowdfunding system to allow donors to conditionally match specific individuals and groups, and condition on donation amounts or participation.

Cooperation, Coordination, and Collective Action

Crowdfunding campaigns frequently fund a public good [17, 29]. Studies in experimental economics show that roughly 50% of people are conditionally cooperative when funding a public good [14, 9, 15, 12, 19]; people’s contributions have a positive correlation to their beliefs about what others are contributing. Furthermore, Chaudhuri et al. [9] show that awareness of other *conditional cooperators* leads to increased contributions, especially among those who identify as conditional cooperators. This gives us an interesting opportunity to present conditional donations to other potential donors.

Many crowdfunded projects are discrete goods that require a certain amount of money to be raised to be useful at all. For example, producing a product, starting a business, or making a film. These projects require a minimum funding threshold to be met, and potential donors may only want to donate if others are also donating. Situations where an individual’s decision depends on the preferences or decisions of others have been studied by economists in the context of matchmaking

given ranked preferences [26]. Our problem is different in that donors must express conditional donations and resolution is not a matching task.

Catalyst [10] is a system for encouraging collective action that focuses on the problem of allowing organizers to conduct events only if a participation threshold is met. For example, an event will only take place if 10 people agree to attend. Similar to all-or-nothing crowdfunding sites like Kickstarter, Catalyst’s participation threshold is organizer specified, globally defined, and participation is binary. In contrast, Codo is a system that allows individual donors to specify personal stipulations for donations, based on specific individuals or groups, and quantify their donation in relation to their condition. Furthermore, Codo is a general resolution system that can optimize for funds raised, participation, or any combination thereof.

Social Proof and Social Capital

Social proof and social capital are essential for conditional cooperation to be successful [24]. Participation by other donors signal the quality and credibility of the campaign and establishes norms for how much to donate or when to attend an event [9, 15, 19]. Information about participation by other donors removes user apprehensions of being isolated in action, and provides evidence of reciprocity for their actions from others [15]. Crowdfunding sites rely heavily on social proof by providing information on the total funds raised and the number of donors, and incentivizing the crowd with gifts proportional to their donation amounts. These gifts create a sense of belonging to a community that is privy to benefits from the campaign [8].

The use of social media networks to promote campaigns brings in substantial social capital through friends and family. The ALS Ice Bucket Challenge leveraged social capital by requiring that participants tag three others to complete the challenge within 24 hours, causing the campaign to go viral in a short period of time. A directed donation request is the most effective way to get donations, and people respond better when the request comes from family or others who have donated [11]. Tagging friends publicly increases visibility of the donation request to the donor’s peer group, which Cotterill et al. have shown to increase individual contributions [11]. Applications like Matchup.io [6] have borrowed from the success of the ALS Ice Bucket Challenge and allow users to nominate their friends to participate in fitness related challenges. Codo builds on these social exigencies by allowing donors to extend directed conditional donations to “challenge” their friends.

CODO V2.0

In this paper, we focused on introducing and exploring the idea of conditional donations into a usable formalism within our system. In our next iteration of Codo we plan to integrate with online social networks to fully leverage the benefits of social proof and social capital. We also plan to comprehensively explore the design space of impact visualizations, which we only cursorily investigated in this work. Finally, we

intend to thoroughly evaluate a more polished version of our system through a larger scale public beta.

In its initial deployment, Codo attracted monetary donations from a diverse group of university members to support the well-being of campus animals. The amount of money raised within a few days through conditional donations is both surprising and compelling. We reflect here on future design and research opportunities uncovered through our deployment and evaluation of Codo.

Time-aware semantics

Codo’s *time-oblivious* semantics means that users cannot introduce time dependencies into their conditional donations. Users, however, may wish to formulate conditional donations such as “I will donate 10 USD if ten more people donate [after me]”, “I will donate 10 USD if ten people donate in the next ten hours” or “I will match 1:1 all donations from my school for a day”. Time aware semantics allow users to construct rules that better match their condition intent. Time dependent conditions can also encourage peers and community members to contribute sooner rather than later to a cause. Moreover, supporting condition expiry allows users to revise their donations or set more achievable challenges based on the actual progress of the campaign.

Breaking monotonicity

Non-monotonic conditions such as “I will donate a million dollars if Brad Pitt does not donate” are problematic as they can alienate users or lead to confusing system behavior. Admitting such conditions could cause the current implementation of Codo to oscillate between accepting or rejecting a donation as new donations are made. Slightly relaxing our monotonicity constraint, however, can open a realm of novel and intriguing online crowdfunding platforms. For example, if the target budget is 100 dollars and the first donor pledges 99 dollars and nine other donors pledge 10 dollars each, then with relaxed monotonicity, Codo can gradually decrease the amount it accepts from the first donor to ten dollars and accept the ten dollars from the nine other donors. This allows Codo to maximize *participation* and *fairness* (10 donors who pay 10 dollar each) in contrast to a strictly monotonic system that will accept donations from only two donors (99 dollars from the first donor and one dollar from the second donor to meet the 100 dollar cap).

CONCLUSION

In this paper, we explored the potential of conditional donations as a mechanism for empowering and engaging donors of crowdfunding campaigns. We conducted a needs assessment study to test several different conditional donation statements based on their understandability and usage likelihood. We formalized conditional donations into a grammar that our system, Codo, translates into a system of linear inequalities for resolution. Overall, Codo is a general system that supports a variety of conditions such as requiring specific people or groups also contribute to the campaign, or requiring the campaign to attract a critical mass of donors or contributions. In an in-situ evaluation of Codo with the Kitty Pool fundraising campaign, we found preliminary evidence that a substantial

proportion of participants, 32%, were willing to issue conditional donations.

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