

Geographical and Organizational Commonalities in Enterprise Crowdfunding

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ABSTRACT

Enterprise crowdfunding offers a series of opportunities for voluntary or unplanned collaborations within organizations. In an enterprise crowdfunding experiment, we study the influence of interpersonal attributes-in-common on collaborations. Using ideas from Homophily Theory and Social Identity Theory, we analyze attributes-in-common in terms of multiple *identity facets*: of geography, of formal corporate structure, and of working groups/teams. We combine quantitative and self-report data to show how each identity facet has an influence on the likelihood of voluntary collaborations, and we show their “superadditive” combination. We propose new questions for theory, and we consider how our results can lead to new features and technologies to enhance voluntary collaborations in organizations.

Author Keywords

Crowdfunding; Enterprise; Organization; CSCW; Voluntary collaboration; Homophily Theory; Social identity theory.

ACM Classification Keywords

H.5.3 [Group and organizational interfaces]: CSCW.

INTRODUCTION

“Distance matters,” as Olson and Olson concluded in a landmark paper fourteen years ago [42]. Their analysis was primarily focused on geographical limits to collaboration via simultaneous or synchronous collaborations amongst members of structured teams. While their work has led to additional foundational studies of synchronous team collaboration [5, 45, 47], their treatment invoked a decades-long investigation into the impacts of geographical distance on various forms and configurations of collaborative work (e.g., [30]) that continues to be relevant for contemporary social technologies [45].

Among other contributions, the Olson and Olson paper served as a major update to research that explored the influence of distance on collaboration *before* the recent explosion in synchronous technologies and real-time collaborations. Earlier work showed that distance could impact collaboration over spans as small as 30 meters [2; 27]. As in the analysis of Olson and Olson, Espinosa and colleagues theorized the effects in terms of decreased communication quality and increased timezone stress [15]. In contrast with formal work assignments, these issues can be particularly important for voluntary collaborations in many settings and applications [37], in which the potential collaboration partners could choose whether to engage in a particular project, and could choose between projects based on factors such as ease of communication, as well as serendipitous discovery of shared interests – e.g., “watercooler” collaborations [8].

Research programmes in social psychology and sociology offer alternative explanations. *Homophily theory* proposes that people tend to associate with people who are similar to themselves [9,49]. Early research examined people’s statements and actions regarding others; more recent work has shown similar patterns of homophilous association in social media [37,51], with impact upon group performance [10]. Within this view, geographic location may serve as a cue to *similarity*, rather than *physical* constraint.

Another approach, *social identity theory*, proposes that people form part of their identities in terms of what they perceive they have in common with specified others (e.g., [24,48]; for a recent summary of social identity theory, see [50]). These perceptions can influence choices in whom to prefer to engage in certain activities [48]. Again, for social identity theory, geographic location may serve as a similarity cue.

Considered in those terms, the influence of distance may reflect fewer opportunities for the discovery of shared attributes among distant partners, rather than a problem of communication richness or effort [31,42,54] or convenience factors, such as timezone stress [15]. In this analysis, the “distance penalty” [28] might be reduced by the perception of attributes-in-common with remote potential collaborators.

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Large global enterprises may offer an opportunity to re-examine the effects of geographical distance (or commonalities based on geography) – for both the synchronous focus of [7, 42] and the asynchronous focus of [2, 31]. Potential collaboration partners can be analyzed in terms of the fractional identities that they carry, such as their geographical location or national identity. Through people’s roles in organizations, we can also consider the fractions of their identities that are derived from organizational position and/or matrixed teams or groups. We examine the influences of these different fractional identities in an experiment based on enterprise crowdfunding in a 5500-person globally distributed IT organization inside IBM, a large global corporation that conducts business in software and services.

Enterprise crowdfunding provides an interesting test of fractional identity effects in an asynchronous application. In enterprise crowdfunding, employees may create project proposals, and other employees may invest the organization’s funds in those proposals [39]. There is no formal requirement to participate. Collaboration “partners” (i.e., proposer-and-investor or proposer-and-volunteer) need to find one another, and must determine whether they have sufficient motivation to collaborate – i.e., for the investor to decide to make an investment in the proposer’s project. The enterprise crowdfunding Intranet site becomes a kind of connection-making site, where employees can engage not only in resource exchange [21], but also in serendipitous discovery of shared interests and collaborative relationships. The two published studies of crowdfunding inside academic [44] or industrial [39] organizations, suggest that members of the organization view their funding capabilities *not* as “their money,” but rather as a shared resource to be allocated for the benefit of other members of the organization.

The remainder of this paper is organized as follows. We provide background information related to geographical issues in collaboration, and our intention to re-analyze those issues in terms of homophily theory and social identity theory. Based on these theories, we propose three “facets” of people’s identities for our study. We then provide a brief orientation to Internet crowdfunding, and greater detail on our particular experiment with Intranet or “enterprise” crowdfunding. We describe our methodology, including diverse data sources that we used for a convergent analysis. Our results section describes the treatment of quantitative and qualitative data, showing how the three distinct facets of social identity have both independent and interactive influences on the likelihood of collaborating through crowdfunding. Our discussion applies these learnings to theory and design concepts. We conclude with a review of the contributions of this paper.

BACKGROUND

Geographical Obstacles to Collaboration

Earlier research into asynchronous collaboration found that distance could disrupt collaborative work [2, 31, 32, 54]. Various calls the “distance penalty” [28] or the “distance matters’ problem” [51], these issues continue to challenge organizations and researchers. O’Leary and Mortensen describe both communication and performance problems in virtual teams whose members are in remote locations [41].

Gittelman provides a nuanced view of both advantages and disadvantages in citation outcomes (not processes) for biotechnology teams in different spatial configurations [19], suggesting that some of the issues with geographical distance may be concerned with awareness of the work of others. Gittelman’s theme of differential effects of distance was pursued by Birnholtz and colleagues, who dimensionalized some of the distance and difference effects and showed comparative advantages and disadvantages [5]. Other complexities were introduced by Jovanović, who examined the contributions of *local* proximity to *global* competitiveness [28].

In a more analytic vein, Espinosa and colleagues proposed five types of team boundaries: geographical, functional, temporal (see also [15]), identity, and organizational [16]. We examine three of those boundary concepts in this paper – geographical, identity, and organizational boundaries – as they affect the asynchronous collaboration practice of crowdfunding.

Homophily

To pursue the concept of identity that was introduced by Espinosa and colleagues [16], we consider two social theories: homophily theory and social identity theory.

Homophily theory has a long history stretching (in the West) back to Greek philosophers of antiquity [37]. The core of the idea is that people prefer people who are similar to themselves – “birds of a feather flock together” (e.g., [35]). Different causal mechanisms have been proposed, such as Byrne’s attraction paradigm [9] and Turner’s theory of self-categorization [49]. Applications of these core theories have led to predictions of collaboration based on similarity, including online collaborations. Chang et al. examined how work-related similarity and familiarity affected wiki-based collaborations [10], and Weinberg et al. studied similar phenomena in weblog usage [52]. For more examples, see the detailed review by McPherson et al. [37].

Social Identity Theory

A second, convergent explanation comes from social identity theory. This theory was proposed to explore the balance between individual characteristics and social context (or memberships) in influencing an individual’s behavior [48]. Applications of the theory have been broad.

In this paper, we are concerned with how the theory can inform the likelihood to collaborate.

The concept of *ingroup favoritism* describes preferential treatment that an individual or a group may give to people perceived as similar to them – i.e., people who share common identity attributes [48]. In this paper, we consider the three dimensions as being reflections of shared (low-difference) or unshared (high-difference) attributes, specifically regarding location, organizational structure, and group or team membership. We soften the concept of favoritism a bit, to focus on how shared attributes may or may not increase the likelihood of providing support to a colleague's project.

The most common treatments of social identity theory have emphasized conflicts of identities. Lampinen and colleagues described issues of the co-presence of multiple social groups within the experience of one user in social networking environments [34]. They recommended better tools for managing (i.e., selectively separating) these different social identities. Ding et al. advocated the use of social context displays to help to manage membership in multiple groups [13].

In-group vs. out-group phenomena may be thought of as two aspects of the same underlying phenomenon – described in these cases by social identity theory. In-group favoritism is, as it were, the “positive”, collaborative aspect of “negative”, conflictual out-group bias. Bradner and Mark examined in-group favoritism within the context of social identity theory, finding an initial advantage for people who share geography; however, that advantage rapidly faded with increased familiarity [7]. Farnham and Churchill examined social identity as a determinant of sharing personal information online [17]. For a detailed review and theorizing about social identity and social capital, see Jiang and Carroll [27].

Faceted Homophily and/or Identity

To work with derived predictions of these theories, we need a vocabulary to consider the components of homophily or identity in organizations. From a more critical perspective, Farnham and Churchill explicitly questioned concepts of unitary identity, and documented the everyday practices through which people “facet” their identities for different social groups [17]. Similarly, in studies of homophily, several researchers have proposed a dimensionalized or multiplex [37] approach, conceiving of additive types of homophily such as “network ties” [51], “features” [12], or “dimensions” [37] of homophily (see also earlier studies of Blau [6] and Fischer [18]). Again within the context of homophily studies, Chang et al. combined theoretical vocabularies in their “social identity dimensions” of homophily [10].

Thus, both theory traditions have involved, in part, an analytic approach in which different influences of homophily or social identity have been identified, analyzed,

and compared. For this paper, we adopt Farnham's and Churchill's concept of “facets” [17] and we apply the “team boundaries” concept of Espinosa et al. [16] (described above) in terms of a “geographical facet,” a “structural (i.e., working-group) facet,” and an “organizational facet” of employees' homophilous tendencies or social identities in organizations. For simplicity, we will refer to these as “identity facets” in this paper.

Examining Identity Facets in Crowdfunding

Internet Crowdfunding

We will use these concepts based on homophily theory and social identity theory, to predict collaborations in crowdfunding. Crowdfunding on the Internet has become a driving force for innovation. Among more than 200 crowdfunding sites [33], some sites have in excess of half a billion US dollars in play [29].

At sites like Kickstarter [29] and Indiegogo [26], the high-level sequence of activity is as follows (see [37] for a more detailed analysis):

- A *proposer* creates a description of a project for which s/he is requesting funding. The project description includes a “pitch” or assertion-of-value/likelihood-of-success, optional rewards (benefits) offered to investors, and (crucially) the target amount of funds and the timetable for receiving those funds.
- An *investor* may read the project description and decide to pledge money to the project.
- If the project receives the specified amount of funding from investors, within the specified amount of time, then the project is considered “successful” (in raising funds), and the investors' pledged money is committed to the project. The proposer is then responsible for managing and completing the project – including delivering the rewards to investors.

Researchers in economics and business have studied the crowdfunding phenomenon, attributing three main motivations for people to invest: return on investment, access to new resources or products, and/or charitable giving [19,33, 43], as well as recognition of the utility of the project [23]. Several researchers mention additional social aspects, such as enhanced self-esteem and public recognition [43], and informal collaborations among proposers []. However, there is general agreement that research into crowdfunding is in the very early stages [4,38]. It is not yet clear, for example, how important are factors such as shared location [1,38] or active social ties [38]. Some of these active research questions mirror the CSCW and CHI concerns about whether “distance matters” [42].

Enterprise Crowdfunding and iFundIT

Researchers have begun to explore crowdfunding as an *Intranet* phenomenon, conducted inside a company's firewall [39]. We adopted a similar strategy for a campaign

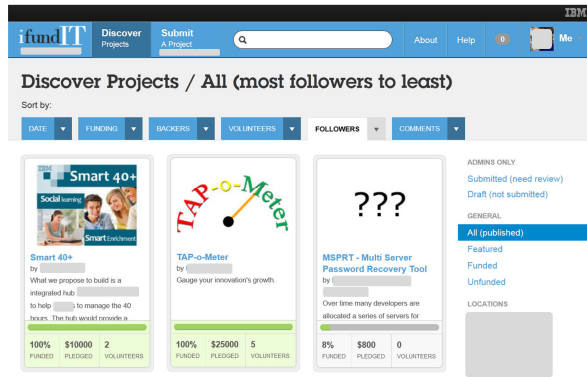


Figure 1. The page for browsing projects that had been submitted to iFundIT. Names and certain other details have been obscured for employee anonymity.

called iFundIT, which organized a crowdfunding trial for a 5500-person IT organization within IBM. The IT department in this company is strongly virtualized, with employees in more than 25 countries. Some employees work entirely from home, seeing co-workers on a face-to-face basis only once or twice a year.

As is true for all crowdfunding initiatives [4,19,22,25,39,43], participation in iFundIT was voluntary and opt-in. Any member of the IT organization could propose a project at the iFundIT Intranet site (Figure 1). 302 members of the IT organization volunteered to act in the role of investor. Each investor received a personal budget of \$US2000 to spend on other employees’ proposals. The rules for managing this personal budget were as follows:

- The money could be spent only within iFundIT.
- Any unspent money would be forfeit at the conclusion of the trial.
- If an investor took on the dual role of proposing a project, s/he was prevented from pledging any funds to her/his own project.
- Unlike the Internet crowdfunding models, investments were limited to the target amount of funding. (The

motivation for this restriction was to fund as many projects as possible.)

All employees of IBM had access to the iFundIT site. Possible actions included volunteering, commenting, sharing/recommending, liking, following, and viewing (see Table 1 for definitions). Two additional actions were restricted to members of the IT organization:

- Proposing a project – Could be done by any member of the IT organization.
- Investing in a project – Could be done only by members of the IT organization who had registered as investors.

The iFundIT site was run for a one-month period during early 2013, with a total budget of \$US150,000. The campaign was closed when that budget was exhausted on successful projects.

Unlike the two published studies of organizational crowdfunding in co-located groups [39,44], nearly all promotional activities were conducted online. The IT organization publicized the entire trial vigorously through email campaigns. Some of the proposers sent email to potential investors, with mixed results: Some investors were interested, while other investors complained about “spam messages.” See [19,21,33,39] for other reports on proposal-promotion in crowdfunding.

The relationship of the researchers to the IT organization was that of provider and client. We created the software to run iFundIT. Promotion of the iFundIT Intranet site and program was performed by project management staff within the IT organization. As researchers, we were free to request information from iFundIT participants. We made such requests, for the email surveys reported in this paper. However, members of the IT organization were free to decline our requests. Our data are therefore less complete than some industry studies that operate within Research departments, because many participants were spending their limited time on submitting their idea and the funding process.

Action	Definition	Events	Participants
Propose	Create project proposal and “publish” it for action(s) by others*	55	43
Invest	Pledge money to a project**	572	178
Volunteer	Offer to help on a project	70	58
Comment	Comment on a project	165	81
Share	Tell other people about a project	59	23
Like	Indicate preference for a project	251	193
Follow	Register to receive notifications about a project	684	262
View	Navigate to a description of a project	9616	521
Total		11472	521

Table 1. Number of events and of participants for each major type of action. * Proposing was limited to members of the IT organization. ** Investing was limited to members of the IT organization who had registered as investors. All other actions were available to any employee of IBM.

Research Hypotheses

We propose three research hypotheses that are directly derived from the preceding discussion of identity facets [17] and team boundaries [15]:

RH1: Collaborations (investments) will be associated with geographical similarities (proposer and supporter from the same country).

RH2: Collaborations (investments) will be associated with working-group similarities (proposer and supporter from the same group).

RH3: Collaborations (investments) will be associated with company-division similarities (proposer and support from the same company division).

Research has also shown the importance of prior social relationships (strong and weak ties) as the basis for collaborations, both in HCI in general [5,8,10,27,34,36,53] and also in Internet crowdfunding [1]. That is, people are more likely to help friends than strangers (see [37] for review). We therefore propose a fourth research hypothesis:

RH4: Collaborations (investments) will be associated with prior relationships among proposers and supporters.

METHOD

Participants

The primary participants were members of the larger, 5500-person IT organization. Participants worked in diverse job titles, from tester to vice president, in a total of 29 countries. Users spanned a range of hierarchical levels in the organization's hierarchy.

Datasets

Data for our analyses came from two major sources, and one supplementary source. Quantitative analyses are based on action logs recorded in the iFundIT server, and on social-network surveys sent to project proposers. Qualitative analyses are based on email surveys to iFundIT participants. Quantitative analyses were further clarified with data from the IBM's internal employee profile service, which provided information about each employee's country, division (formal organizational structure), and working group.

Action Logs

The iFundIT website recorded each user action on the site, including proposing, investing, volunteering, commenting, sharing, liking, following, and viewing. The log contained a total of 11,472 of these events that were performed by 572 employees.¹

¹ An additional 853 events were excluded from the analysis. These events took place "invisibly" from the perspective most employees – e.g., editing a proposal before it was

Social-Network Surveys to Proposers

A total of 43 employees proposed projects; most proposed only one project, but a few people proposed as many as five distinct projects. We created a personalized social-network survey for each proposer (and for each project, as needed), asking about the relationship of the proposer to each of her/his supporters (investors or volunteers). We asked proposers to indicate one or more relationship categories for each supporter. Of the 43 proposers, 28 provided complete responses to the survey (covering a total of 36 proposals). Our effective return rate was thus 65% of the proposers or 84% of the proposals.

Investor/Volunteer Surveys

We emailed brief questions to all of the users who had engaged in certain classes of actions. For this paper, we report on the email surveys that we sent to investors and volunteers (148 investors, 40 volunteers, and 30 employees who had both invested and volunteered).

In the email survey, we asked employees to describe their motivations to invest or volunteer, and their relationship to the project proposers. Responses were in free-form text. We received responses from 63 employees (36% response rate).

Profiles Service

We supplemented the above records with data from IBM's employee-profile service. This service allowed us to extract, for each employee:

- **Country**
- **Division:** Division was the formal, hierarchical organization structure in which the employee was recorded by IBM.
- **Group:** Group or team was the active, collaborative body in which the employee did much of her his work. Groups and teams were typically medium-to-large structures that spanned countries and divisions.
- **Reporting structure:** The hierarchical path or "org chart" that provided the official "chain of management" from the employee to the Chief Executive Officer (CEO) of IBM.

RESULTS

We begin by describing how we analyzed each of the datasets. We proceed with a high-level introduction to the patterns of investing, derived from the action logs. We then perform χ^2 analyses of several factors that could influence

"published" for view, noting that a proposal had achieved its target funding level, and various administrative tasks, such as approving a project for view by employees. We hope to report on the process of creating and editing proposals, and negotiating for their acceptance, in a future paper.

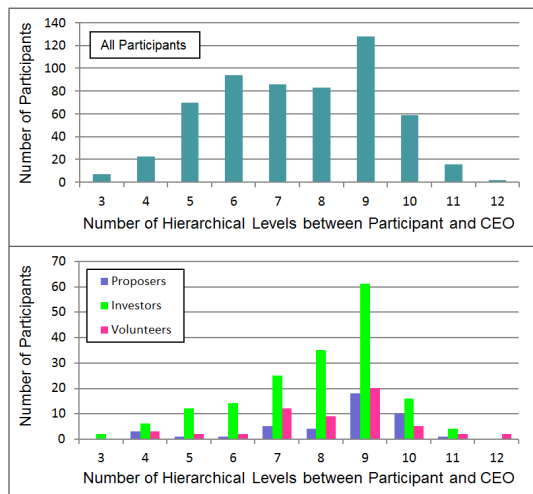


Figure 2. Frequency distribution of number of hierarchical steps (distance) between each participant and the head of the company. Top: All participants. Bottom: Principal participants (Proposers, Investors, and Volunteers).

those patterns (RH1, RH2, and RH3), and we supplement those statistical analyses with employees’ statements from the email surveys.

Action Logs

As noted above, Table 1 contains information about the eight core actions in iFundIT, along with a count of the number of times each action occurred, and the number of employees who engaged in each action. Each employee could engage in multiple instances and multiple types of actions. Most actions were available to any employee in IBM. The exceptions were proposing and investing. Proposing was restricted to members of the IT organization. Investing was restricted to the 302 members of the IT organization who had registered as investors.

Social-Network Surveys to Proposers

We counted the number of types of relationships to supporters, as reported by proposers.

Email Surveys to Investors and Volunteers

We performed a limited grounded theory analysis [11] on the free-text responses to the email surveys from investors and volunteers, summarized in Table 2. For these limited purposes, a single analyst iteratively assigned open codes, axial codes, and some dimensional codes (note that, because of the amount of labor involved, coding by a single analyst is the norm in grounded theory method [11,40]). Four categories emerged initially – *interest* in the project, *value* of the project, *relationship* to the proposer, and *awareness* of other stakeholders.

A core aspect of grounded theory method is constant comparison of data with the emerging theory, and the

<p>Value of the proposal. Why was this proposal interesting? Why was it worth funding?</p> <ul style="list-style-type: none"> * Indicators of probable success. Why does the investor or volunteer have confidence in this project? <p>Personal value. What is the direct personal benefit of the project to the investor/volunteer?</p> <p>Neglected areas. What is the promise of the proposal to solve long-standing problems that have not achieved a sufficient priority level for formal organizational funding?</p>
<p>* Beneficiaries. Who is likely to benefit from this proposal?</p> <ul style="list-style-type: none"> * Clients/customers * Teams * Company divisions * Entire company
<p>* Relationship with proposer. Did the investor/volunteer have a personal or organizational relationship with the proposer? (no subcategories)</p>
<p>* Awareness of other stakeholders / interested parties. Who else would be interested in the project? Why? How should s/he be notified? Is s/he a potential supporter? (no subcategories)</p>

Table 2. Categories and subcategories from the grounded theory method analysis of email surveys. In this paper, we make selective use of categories marked with asterisks.

evolution of both coding categories and theory as a result of these comparisons [11]. Over successive iterations of coding and theorizing, the simple *value* category became a dimension with its own subcategories, and the *awareness* category also became a dimension with sub-categories (Table 2). Because participants indicated a very nuanced view of who would be helped by each project, we combined earlier tentative sub-categories into a new top-level category of *beneficiary* as a combination of an organization-oriented sub-category of *value* and an advocacy-oriented sub-category of *awareness*.

Table 2 provides a summary of the coding categories and subcategories. For this paper, we do not report a full grounded theory analysis. Rather, we use these categories in combination with the quantitative results, to address the Research Hypotheses developed above. This limited use of grounded theory method, for interpretation of qualitative data as part of a convergent analysis with other types of data, is an established approach in CSCW and HCI [40].

Patterns of Action across Organizational Levels

Who was performing the actions? The company directory supported a programmatic look-up of each employee’s reporting relationships. For a standardized metric of comparison, we followed the example of [3], and calculated the number of hierarchical levels between each employee and the chief executive officer of IBM. The range was 3-12 hierarchical levels away from the CEO, with the majority of

Outcome	Countries	Working Groups	Divisions
Success	8.30	6.6	6.40
Failure	4.63	4.11	4.14
All	5.44	4.67	4.64

Table 3. Per-project results for mean number of countries, of working groups, and of divisions. All success-failure differences were significant at $p < .001$, using t-tests.

Facet	Number (%) Same	Number (%) Different
Country	202 (35%)	370 (65%)
Group	158 (28%)	414 (72%)
Division	227 (40%)	345 (60%)

Table 4. Counts and (percentages) of investors who pledged to proposers from the same and different facets (country, working group, or division).

participants between 5 and 9 levels from the CEO (see Figure 2, Top). Participation was well-spread across levels in the organizational hierarchy.

We also looked at the “principal” actions – the ones that directly impact the success of each project, namely proposing, investing, and volunteering (Figure 2, Bottom). There was a tendency for those principal actions to occur at lower levels in the organizational hierarchy, as contrasted with all actions. This pattern of results is similar to the “grassroots” concept in other employee innovation reports [3, 39]. However, this tendency could not be tested statistically, because of a lack of independence – i.e., each individual might engage in zero, one, two... or all of these actions.

Social Patterns of Investing

RH1, RH2, and RH3 address commonalities in the social relationships among proposers and their supporters (investors, volunteers, and so on), as predicted from homophily theory and social identity theory. From the log data, we used each project as a connection-point between proposers and supporters. In the next step, we removed the project from the representation, leaving simple person-to-person ties. We could then analyze in terms of persons, and in terms of the type of action that connected those persons (e.g., investment relationships as contrasted with volunteer relationships).

First, we note that investment support for each project was relatively wide-spread. In Table 3, we aggregate the identity facets of investors on a per-project basis. The mean number of countries per project was 5.44; the mean number of working groups per project was 4.67; and the mean number of organizational divisions per project was 4.64. These figures were higher for successful projects, in part because more people invested in those projects. Differences between successful vs. unsuccessful projects were highly significant for all three identity facets (country, working group, and organizational division).

Next, we examined whether projects were supported by investors from the same country as their proposer, or the same working group, or the same division. Table 4

summarizes these results, showing that investors supported project proposed by people with the same identity facets, and also with different identity facets.

For further insight, we turned to formal statistical analyses. For each pair of proposer-and-supporter, we coded the pair along the identity-facets of country, group, and division. Each coded attribute was binary – i.e., the proposer and supporter were from the *same* or *different* country, *same* or *different* group, and *same* or *different* division. Across these three binary dimensions, there were eight possible configurations (same-same-same, same-same-different, etc.). We conducted χ^2 analyses to assess the effects of the three identity facets.

First, we established the expected values for the analysis. To do this, we made pairs of each proposer with all investors (7654 pairs from 43 proposers \times 178 investors). We performed the *same-different* analysis on each of the three identity facets, and used the percentages from this summary of all the data as the expected values. Our second step was to perform the *same-different* analysis on each pair of proposers with their actual investors (572 pairs). Our χ^2 analyses were based on a comparison of the expected-value percentages (from the 7654 pairs) vs. the obtained percentages (from the 572 actual pairs).

For all three identity facets, there were more actual proposer-investor pairs, than expected by chance (Country: $\chi^2(1) = 190.45$, $p < .001$; Group $\chi^2(1) = 236.27$, $p < .001$; Division: $\chi^2(1) = 71.33$, $p < .001$).² Figure 3A-C shows these effects graphically. Because the expected values were different, depending on the 7654 pairs, we plot the *percentage of expected value* for each bar in Figure 3. Bars that are greater than 100% show unexpectedly *high* counts investments among the 572 proposer-investor pairs. All of these bars are for the *same* pairs (same Country, same Group, or same Division, respectively).

All two-way interactions were also significant (Country*Group: $\chi^2(3) = 424.13$, $p < .001$; Country*Division: $\chi^2(3) = 210.57$, $p < .001$; Group*Division: $\chi^2(3) = 236.27$, $p < .001$).³ As shown in Figure 3D-F, all of these

² The stated p values for all χ^2 analyses include a Bonferroni correction for repeated testing, because the same people were involved in multiple analyses.

³ In a conventional χ^2 analysis, expected values are derived from the primary data table (for our analysis, that would be the 572 actual pairs of proposer-investor). The degrees of freedom for an interaction term would be 1. However, in our case, the test of the significance of the interaction term is based on the comparison of expected values from the 7654 pairs, vs. the observed values from the 572 pairs. For this reason, the degrees of freedom for testing each of the two-way interactions is 3, and the degrees of freedom for testing the threeway interaction is 7.

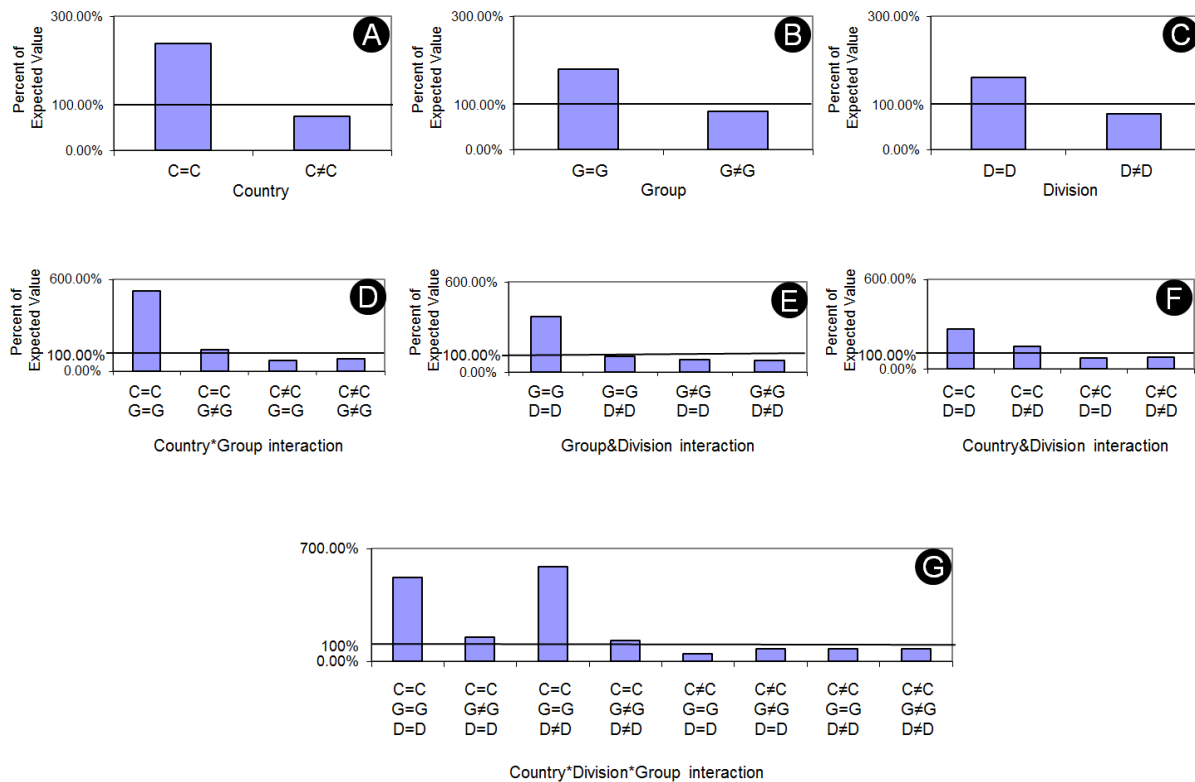


Figure 3. Same-different analyses by Country, Group, and Division. Each graph shows deviations from the expected value (100%). “C=C” is same country; “G=G” is same group; “D≠D” is different Division; and so on. A-C: Main effects. D-F: Two-way interactions. G: Three-way interactions. All results are significantly different from expected values at p<.001 or better.

interactions suggest a “super-additive” effect – i.e., having two attributes in common is significantly more powerful than the simple additive effects of one factor plus the other factor. The significant triple interaction ($\chi^2(7)= 426.02$, $p<.001$) shows a similar super-additive effect, but in this case the core of the phenomenon appears to involve Country and Group more than Division (Figure 3G).

The main effects support RH1 (Country), RH2 (Group), and RH3 (Division). In each case, having an attribute in common is associated with greater tendency for an investor to contribute to a proposer’s project. The interactions confirm these core phenomena, and suggest that one attribute of similarity may potentiate the effects of another attribute of similarity.

Responses from the email surveys were partially supportive of RH2 (Group):

My decision was based on... value/usefulness to IBM... ex team-membership (client services, Slovakia)

supporting my team was initially what dragged me in the process (transformation specialist, Slovakia)

There was also evidence of intended support for the user’s organization (RH3):

I finally decided to look at my work area / business unit, use the issues and gaps that I see in either directly in my work or in the area around me. (IT architect, Germany)

However, we found no remarks specifically about locality in the email surveys, and thus there was an absence of qualitative support for RH1 (geography).

We now consider the last research hypothesis. The research literature on the importance of social ties, leads us to our hypothesis that people will be more likely to support proposers whom they know (RH4):

If I know the people in the project (IT architect, Mexico)

One volunteer noted that s/he decided to participate based on the skills of the people involved, again reflecting knowledge of other participants:

I knew I could act as a contributing member (consultant, US)

However, many investors reported that they did not have personal knowledge of the proposer:

I did not know anyone who had submitted a project (operations director, US)

Not advertisement or friendship (manager, China)

I did not look at 'friends/team members' as criterion for investment decisions (project support, Nederland)

These qualitative results suggest a weakness in RH4 (prior relationships should promote collaborations). The absence of a direct personal relationship between proposer and investor was confirmed quantitatively in the social network survey that we sent to proposers. In describing their relationships to their supporters (investors and/or volunteers), proposers reported that 70% of their supporters were people they did not know at the time of investing or volunteering.

As noted above, investors were also able to access personal profiles of the proposers, through direct links from their names to the profiles server. (Unfortunately, these access events took place outside of the scope of our server, and we were therefore unable to record them.) In this way, an investor was only two clicks away from rich information about a proposer, which could tell the investor about they shared an identity facet such as country, division, and/or group with the proposer. It may be that the perception of one or more shared identity-facets (RH1, RH2, RH3) was sufficient to overcome any deficit due to an absence of a personal relationship (RH4).

DISCUSSION

We began with the problem of *distance* articulated by Olson and Olson [42], Kraut [31], and others [2,5,7,15,16,28,30,41,51]. We proposed to reframe that problem in terms of *difference*, as a reflection of homophily theory [9,35,37,49] and social identity theory [17,48], inspired by the use of social identity theory by Bradner and Mark [7]. In this reframing, we conceived of several types of difference, each of which corresponded to one identity facet [17] of a person's role or identity in a workplace: a geographical identity facet (RH1), a group or team identity facet (RH2), and an organizational identity facet based on an organization's hierarchical "org-chart" (RH3). Using data from an experiment in enterprise crowdfunding, we showed that each type of difference performed as predicted in RH1, RH2, and RH3 – i.e., each identity facet was associated with increased collaboration (investment) in the crowdfunding paradigm.

We also considered a fourth Research Hypothesis, based on theories of social ties, that pre-existing social relationships should be associated with increased collaboration. To our surprise, there was little support for this prediction (RH4).

The remainder of this section considers the implications of these findings for theory and for design.

Implications for Theory

The "distance matters" hypothesis (based on [30,42,45]) would have predicted the results that we found for RH1 (geography). However, that hypothesis would not predict any influence of working group (RH2) or organizational

division (RH3). We found that all three research hypotheses were supported at $p < .001$ (Figure 3). Similarly, the "distance matters" hypothesis would not have predicted the super-additive interactions of Country*Group or Country*Division (Figure 3). In contrast with the distance-based explanation, we think there is a broader principle operating in our results.

According to both homophily theory and social identity theory, each shared identity facet should have strengthened the likelihood of collaboration (investment). The results in Figure 3 strongly support this prediction, as well as its more specific research hypotheses RH1, RH2, and RH3. We suggest that, in our results, consideration of *distance* as a contributing factor, should be reconsidered as one of multiple *differences* or *facets* in people's identities. The next steps in this research should examine mechanisms for these effects, including users' experiences and interpretations. Additional studies should explore when and how *distance* can be reduced to *difference*, and when *distance* is indeed the crucial determinant. This subsection considers some research directions.

Mechanisms

Jiang & Carroll proposed a model of social networking in which shared social identity gives rise to social ties, and in which both factors contribute to social capital [27]. In our case, we seem to have evidence of social capital (investments) without any antecedent social ties – at least for the 70% of investors who were unknown to their project proposers. It may be that social ties come after social capital (the act of investing).

However, it is also possible that investing takes place without any increase in reciprocated sociality. We will need to ask directly about how much investors have perceived about proposers, prior to investing. Would enhanced social awareness [13] be useful? We hope to clarify these relationship topics in future research.

Faceted Identities, Homophily, and Social Identity

In our analysis, we used three facets of workplace identity – country, working group, and organization (division), motivated in terms of homophily theory and social identity theory. Further work will be needed to find differentiating hypotheses and tests between these two theories.

A better understanding of these two theories may help us to discover additional personal attributes for studies of collaboration. We do not know whether these three identity facets are the most compelling social attributes for employees in the organization that we studied. Also, it is not clear whether these facets would be as compelling in other organizational cultures. The IT organization in IBM is highly distributed, and much of the work (and the managerial reporting) is both matrixed and virtualized. Would members of other entities, in other organizational cultures, experience their identities in the same ways?

More broadly, we do not yet know how “identity” and “identity facet” are experienced by the employees. For example, do employees perceive any aspect of shared identity facets as a generalized kind of “familiarity?” Or (in a different scenario) do employees strategize different types of shared identities? Prior work has focused (a) on boundaries and potential conflicts among facets of identity [17,34] and/or features of homophily [12,37,48], but also (b) on ways that commonalities can bring people together [7,27,37]. Crowdfunding tends to strengthen collaboration [19,39], so we hope to learn more about how homophily and shared identity can help people work together..

Comparing Sources of Identities

In this paper, we used a quasi-experimental design, analyzing the country, group, and division identity facets “as given” – i.e., as they occurred in the non-controlled voluntary participation of employees into our data sample. In this kind of setting, it is not meaningful to ask if group-identity is “more powerful” than geographical identity, because we have no apriori notion that we are comparing the same extent of diversity in each of those identity facets. It would be helpful to run more controlled studies (e.g., as in [41]), in which “measured” amounts of diversity in each identity facet could be formally compared.

Balancing Similarity and Diversity

The results in this paper have discussed identity in terms of the benefits of *similarity* i.e., people are more likely to collaborate if they have more identity-facets in common. However, other research has shown powerful benefits from combining diverse perspectives and knowledges into a single group or team to solve difficult problems [23,36] – theorized as heterophily [46]. How can we think about balancing these two necessary attributes that emerge when individuals join to collaborate?

Investors in Multiple Projects

The quantitative analyses in this paper were structured around individual projects. We examined links between a project proposer and all of her/his supporters. However, we also noted that 62% of the investors pledged money to two or more projects. These “poly-investors” may help to discover projects with conceptual overlap, or projects that can be combined into stronger configurations. Future studies should focus on how people choose multiple investments, and whether they consider each investment separately, or in some form of constructive or strategic combination.

Implications for Design

For Individuals: From Serendipity to Recommendation

Enterprise systems (including crowdfunding) are often embedded in a richer ecosystem of social media, including profile information about potential collaborators. For people to discover their commonalities, they may consult an online profile of a potential collaborator. How can we design richer profiles with information that encourages the

discovery of commonalities among potential collaboration partners? How can we structure these profiles to support ego-centric search – e.g., finding people who have (a) needed expertise and also (b) *identity facets in common with the searcher*? Previous research suggests ways to increase the richness of an individual’s online profile [14]. It might be useful to recommend collaboration partners, based on shared identity facets. We hope to move from serendipity to discovery to search to recommendation.

For Organizations: “Trending Commonalities?”

Subject to privacy protections, organizations want to know how their members are building connections and collaborations with one another. It may be worthwhile to perform privacy-preserving *aggregate* analyses to understand which forms of connection and shared identity show promise to support new collaborations.

For Internet Crowdfunding Sites

Our results show the importance of knowledge about other people on crowdfunding sites. Shared identity facets can help people to find collaborators – but only if they can discover those attributes in common. In our enterprise setting, employees could easily consult the internal profile service to explore one another’s’ attributes. We suggest that Internet crowdfunding sites explore profile capabilities, such as profiles that are internal to the crowdfunding site, but also links to existing social network services.

The ego-centric search capabilities (discussed in the preceding subsection) could be useful here, but there might be a need to search across multiple social network sites for relevant attributes. Recommendations would be similarly complex in an Internet setting, because of the need to aggregate data about individuals across social networking sites. Because people may not use the same ID at each Internet site, the crowdfunding site might need to ask proposers and investors to opt-in to an omnibus search/recommendation feature.

CONCLUSION AND CONTRIBUTION

In this paper, we followed the lead of [5,17] in applying homophily theory and social identity theory to CSCW – specifically to collaboration patterns in crowdfunding. Our work joins other CSCW/HCI reports in the “nascent” [4] study of crowdfunding [19,25,33,44]. As has happened with other major developments in social media, we hope to see HCI and CSCW research lead to major improvements for the broad public that is engaged in crowdfunding.

This paper makes several contributions. We join [7] in expanding our understanding of why “distance matters” through the analytic lens of homophily theory and social identity theory. We propose that distance may be reconsidered as one of several identity facets that can divide [7,17,34] but can also unite [10,12,52,53] people.

We show how shared identity facets are associated with increased collaboration (investments), even in the absence of prior social relationships. We also join others [7,17] in showing that faceted identities are important in CSCW and HCI – not only in the domain of social networking, but also in the performance of consequential work in organizations. Finally, we have proposed areas for further development of theory and method, and we have suggested how our research could lead to new features and technologies to enhance the experience and effectiveness of crowdfunding.

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