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Peer impressions in open source organizations: A survey

Amiangshu Bosu[a], Jeffrey Carver[a,*], Rosanna Guadagno[b], Blake Bassett[e], Debra McCallum[c], Lorin Hochstein[d]

[a] Department of Computer Science, University of Alabama, Tuscaloosa, AL, USA
[b] National Science Foundation, Arlington, VA, USA
[c] Institute for Social Science Research, University of Alabama, Tuscaloosa, AL, USA
[d] SendGrid Labs, Providence, RI, USA
[e] Department of Computer Science, University of Illinois Urbana-Champaign, Champaign, IL, USA

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ABSTRACT

In virtual organizations, such as Open Source Software (OSS) communities, we expect that the impressions members have about each other play an important role in fostering effective collaboration. However, there is little empirical evidence about how peer impressions form and change in virtual organizations. This paper reports the results from a survey designed to understand the peer impression formation process among OSS participants in terms of perceived expertise, trustworthiness, productivity, experiences collaborating, and other factors that make collaboration easy or difficult. While the majority of survey respondents reported positive experiences, a non-trivial fraction had negative experiences. In particular, volunteer participants were more likely to report negative experiences than participants who were paid. The results showed that factors related to a person's project contribution (e.g., quality and understandability of committed codes, important design related decisions, and critical fixes made) were more important than factors related to work style or personal traits. Although OSS participants are very task focused, the respondents believed that meeting their peers in person is beneficial for forming peer impressions. Having an appropriate impression of one's OSS peers is crucial, but the impression formation process is complicated and different from the process in traditional organizations.

1. Introduction

Many expert developers devote a significant amount of effort to Open Source Software (OSS) projects. Because many of those participants are not directly compensated, their participation must be motivated by other factors. Previous empirical research found that OSS participants are motivated by the prospects of enhancing their reputation and by being identified with a particular OSS community. According to Raymond (1999): "The 'utility function' Linux hackers are maximizing is not classically economic, but is the intangible of their own ego satisfaction and reputation among other hackers." Reputation among one's peers is the only available measure of competitive success (Raymond, 1998) and the main source of power (Evans and Wolf, 2005) in OSS communities. Furthermore, the participants' desire to maintain a good reputation among their peers is a major motivation for voluntarily devoting effort to an OSS project (Gutwin et al., 2004). The level of dedication a participant has for the OSS project is strongly related to peer recognition (Xu and Jones, 2010). Therefore, gaining and maintaining reputation is a key factor in keeping an OSS project on track (Markus et al., 2000). When a participant is well recognized within the OSS community, his or her peers regard the participant's project related opinions more carefully (Gacek and Arief, 2004).

Because gaining peer recognition is a major motivation for OSS participants and it influences OSS projects greatly, it is important to understand the peer recognition process within OSS communities. We define **peer recognition** as: *the acknowledgement of a person's merits or status by his or her peers*. Before a person can acknowledge the merits or status of a peer s/he must be aware of those merits or status. Therefore, it is important to understand how peers form opinions of each other in OSS communities. There is a large body of research on peer recognition in the Psychology literature, where researchers use the term "impression formation" to describe the same concept. According to Kenny (1994), *peer impression* is "the judgements that a person, called the perceiver, makes about another person, called the target, where the target is a real person". The formation of interpersonal impression primarily depends upon how well the perceiver is acquainted with the target and upon the

* Corresponding author. Tel.: +1 205 348-9829.
E-mail addresses: asbosu@ua.edu (A. Bosu), carver@cs.ua.edu (J. Carver), rguadagn@nsf.gov (R. Guadagno), rbasset2@illinois.edu (B. Bassett), dmccallu@ua.edu (D. McCallum), lorin.hochstien@sendgrid.com (L. Hochstein).

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personality traits of those two individuals. Similarly, Moore (2007) defined impression formation as: "the process by which individuals perceive, organize, and ultimately integrate information to form unified and coherent situated impressions of others".

Generally, members of OSS communities are geographically distributed, rarely or never meet face-to-face (FTF), and collaborate using text-based tools over the Internet, i.e. computer-mediated-communication (CMC) (Guadagno and Cialdini, 2005; Jarvenpaa and Leidner, 1998). Research has shown a marked difference between FTF and CMC regardless of the purpose. Specifically, McKenna and Bargh (2000) propose four domains in which social interaction via CMC differs from other more conventional interaction media: relative anonymity, reduced importance of physical appearance, attenuation of physical distance, and greater control over the time and pace of interactions. Due to those differences, the impression formation process between OSS participants is different than the impression formation process between co-located project participants. However, there is a lack of knowledge about the impression formation between the participants of OSS projects (Marlow et al., 2013).

To better understand the formation and evolution of peer impressions in distributed OSS teams, we surveyed a broad spectrum of OSS participants to discover: (1) how different forms of peer impressions develop in OSS communities, (2) the factors that affect the impression formation process, (3) how peer impressions evolve, and (4) the opinions of OSS participants about those peer impressions. In this study, we primarily focused on five dimensions of peer impressions: (1) productivity, (2) competency, (3) easy or difficult to work with, (4) perceived expertise, and (5) trustworthiness.

The remainder of the paper is organized as follows. Section 2 presents the research questions and hypotheses for the survey. Section 3 describes the survey design. Section 4 explains the data analysis process. Section 5 discusses the respondent demographics. Section 6 presents the results relative to the research questions and hypotheses. Section 7 explains the threats to validity of the survey. Finally, Section 8 concludes the paper.

2. Research questions and hypotheses

Our study of the literature on reputation, communication and collaboration in OSS communities, identified eight important topics that can provide insight into the peer impression process in OSS communities. For five of those topics, the literature presented enough evidence to pose definite hypotheses. For the other three topics, we simply pose research questions, which may lead to hypotheses for future study. This section provides a brief discussion of the literature to motivate each of the five hypotheses and three research questions.

2.1. Experiences working with other participants

The 'craftsmanship model' states that the pure joy of developing software is a major motivation for OSS participants (Raymond, 1998). Studies have identified the most important reasons why developers contribute to OSS projects to be: enjoyment, learning benefits (Hars and Ou, 2002; Lakhani and Wolf, 2005), and positive experiences from participation (Xu and Jones, 2010). Conversely, if an OSS participant's experiences are continually negative, he or she will eventually leave the project (Von Krogh et al., 2003). Therefore, we expect that participants in successful OSS projects will have positive experiences. Even so, it is likely that some OSS participants will have negative experiences. To better understand impression formation, it is important to understand the OSS participants' experiences working with their peers and what factors affect those experiences. Therefore, we pose the following research question:

RQ1: What positive and negative experiences do OSS participants have while working with their peers?

2.2. Perceived expertise

An OSS community member gains reputation primarily based upon his or her consistent high quality contributions (Raymond, 1998). Most OSS activities are highly knowledge-intensive and require a certain level of expertise (Von Krogh et al., 2003). Therefore, an OSS participant displays expertise through his or her contributions to the project. The impression that people have about another person's expertise affects whether they trust that person's opinions (Moorman et al., 1993). This finding is true both on and off line (Cialdini, 2008; Guadagno and Cialdini, 2005). The interaction between perceived expertise and interpersonal interaction leads to the following hypothesis:

H1: An OSS participant considers his or her impression of a peer's expertise an important factor affecting their interactions with that peer.

2.3. Trust

Psychological research has demonstrated the importance of trust in establishing online relationships (Green, 2007). Similarly, research on team performance suggests that a virtual team needs a solid foundation of mutual trust to enable effective collaboration (Jarvenpaa and Leidner, 1998; Holton, 2001; Peters and Manz, 2007). Virtual teams cannot be effective without trust, because individual members are not willing to take the risk that a team member will act in his or her own self-interest, rather than the interest of the team (Zand, 1972). Because OSS teams are a prime example of virtual, online communities, we can hypothesize the following:

H2: An OSS participant considers his or her level of trust of a peer important when interacting with that peer.

2.4. Losing mutual trust

OSS participants are quite diverse relative to age, race, nationality, and educational background (Ghosh et al., 2002; Lakhani and Wolf, 2005). The participants also have diverse skills and interests. The diversity often causes conflicts (Jensen and Scacchi, 2005), which may result in lost trust. Again, one participant may be very enthusiastic but not as competent as another participant. Hence, his/her repeated failures may cause the project owners to lose confidence in him/her. There may be other reasons that OSS participants lose mutual trust. Because the literature did not provide enough evidence to hypothesize the most important factors, this research question seeks to identify those factors.

RQ2: Which factors influence OSS participants to lose trust in their peers?

2.5. Meeting in person

Most OSS community members are geographically distributed, rarely or never meet in person, and coordinate primarily via text-based communication tools (e.g., mailing list, Internet Relay Chat (IRC), repositories, and wikis). Because those communication tools cannot capture facial expressions and body language, it may be difficult to understand and interpret the tone of the communication (Peters and Manz, 2007). In addition, research has shown that virtual teams who use FTF meetings for team building and solving complex issues were more effective than teams that did not use FTF meetings (Maznevski and Chudoba, 2000).