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Understanding Organization and Open Source Community Relations through the Attraction-Selection-Attrition Model

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ABSTRACT
Organizations increasingly engage with open source communities. Extant research identified the benefits to organizations for engaging with open source and documented how open source communities operate to accommodate organizational engagement. The complexities involved in what attracts organizations to specific communities, how they choose to engage, and how subsequently the organizational-communal engagement shapes the community and organization are not yet well understood. In this paper, we explore how the Attraction-Selection-Attrition Model supports the study of how communities attract, retain, and lose members, and how these aspects relate to organizational-communal engagement between organizations and open source communities. This conceptual paper provides an introduction to the ASA model, having briefly outlined the lack of research connecting ASA and open source communities. Following this, the paper outlines how existing research related to the ASA model may be effectively related to existing open source research, resulting in several questions for future research.

Author Keywords
Open Collaboration Research; Open Source Community; Organizational-Communal Engagement; Attraction-Selection-Attrition model.

ACM Classification Keywords
D.2.9 Management: Programming teams; H.5.3 Group and Organization Interfaces: Collaborative computing; K.6.1 Project and People Management: Life cycle, Staffing; K.7.2 Organizations.

INTRODUCTION
Open source communities have grown in numbers and formed a maturing open source ecosystem. Two examples demonstrate the current size of the ecosystem, SourceForge, a long-standing platform for open source communities, hosts more than 430,000 communities [49] and GitHub, the largest platform for open source communities, hosts more than 62 million communities [27]. In 2015, the total economic value of only 18 such open source communities exceeded 5 billion US dollars [36]. Organizations increasingly leverage open source [2], as doing so reduces the total cost of ownership [15], creates new opportunities to generate and share innovation [29], supports standards development [40,41], breaks vendor lock-in [6], and increases the access to a large talent pool [18]. In addition, organizations increasingly rely on open source software to provide them with solutions and new products [31].

To fully leverage open source development, organizations must engage with the community in the co-creation of software that benefits all who have an interest [3]. Organizations engage with open source communities through their employees who build up a reputation within the community and represent organizational interests to the community [14,23]. This organizational-communal engagement changes how open source communities operate, evolve, and govern themselves while also ensuring long-term sustainability [4,17,18,25]. However, a majority of open source communities fail to attract a significant number of contributors to sustainably release quality software and are abandoned [48]. This leads to our research question:

> *What are evident complexities involved in attracting and retaining contributors, especially from organizations, to open source communities?*

This paper responds to a call by Crowston and Fagnot [10] and proposes how the ASA model [46] can be used to understand the complexities in open source community engagements. This is an essay that makes predictions from theory in order to motivate future work. The following sections have three purposes. First, a short review regarding open source software and its communities is provided. Second, we outline how organizations and open source communities are known to interact. Finally, we apply the ASA model lens and develop research questions. We conclude with directions for future research informed by the ASA model.

BACKGROUND: ORGANIZATIONAL-COMMUNAL ENGAGEMENTS
Open source software is written by individual people who devote their time and efforts to developing new software. Together, they form the open source community via a

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network of volunteers and employees. Over time, open source communities can become highly organized platforms for strategic innovation. As open source has become an increasingly important part of organizational innovation, open source communities may now include organizational involvement in actively shaping the governance, strategic direction, and technology development of these communities [35]. Within an open source community, different roles are evident as members use, contribute to, and maintain the associated software [32]. The users are the largest group, but are usually passive in terms of development and are therefore perceived as outside of the community [7]. However, users play an essential role in adoption and diffusion of open source software because they download, use, and talk about the software [7].

In addition to the users, community members include contributors and maintainers – these groups may be both volunteers and organizational employees at the same time. Contributors report bugs, suggest features, and contribute code. Maintainers make changes to the software, respond to contributors and their code change suggestions, which they then decide to incorporate or not – giving contributors a means to contribute to the improvement and co-creation of the open software. Based on the people involved, the social structure [11] and governance [16] can be very different between communities and include a mix of various governance styles [24].

All open source communities together form the open source ecosystem. Within this complex open source ecosystem, foundations (e.g., Apache Foundation, Linux Foundation, or Mozilla Foundation) have emerged to provide order for select communities [42]. Each foundation is a steward of open source communities and provides communities with professional, managerial, financial, and legal support [42]. One important aspect that foundations provide is the brokerage of competing interests that can emerge in organizational-communal engagements [37].

Organizational-communal engagement is defined as the engagement of organizational members (often employees) in an open source community [23]. Studies have found that a majority of work in open source communities comes from paid employees [2,38,42]. These engagements require adjustments in organizational processes to sustain the relationship with open source communities and advanced the professional and strategic evolution of communities [17,18,33].

Once an organization establishes an organizational-communal relationship, the collaboration between the organization and the open source community is manifested in the interaction between community members and organizational employees [22]. Some communities may exist exclusively of organizational employees who are all paid to participate in the software development process. Organizations may use an open source community to solve an organizational need with or without contributing back to the community [12]. When contributing back, organizations have to respect the norms and values of the community [17] and devote personnel to work in the community, thereby influencing the community [14]. In response to these developments, open source practices are becoming increasingly professional and typical for organizational innovation efforts [23]. The stabilizing effect is evident in communities strategically planning development efforts, deliberately conducting analysis and design, and following a whole-product approach [18].

PRELIMINARY REVIEW OF THE LITERATURE

We conducted a literature review to identify to what extent the existing research had applied the ASA model in open source research. We used the search terms "Attraction-Selection-Attrition", "ASA Framework", and "ASA Model" in the ACM Digital Library, AIS eLibrary, Academic Search Complete (EBSCOhost), and ProQuest Social Science Premium Collection to find peer-reviewed full-text articles. The list of potential articles was furthermore reviewed by examining the title of each article. If the title indicated a possible connection with open source research, for example containing terms "online communities" or "open source software development", then the abstract was reviewed for more information. If the abstract confirmed that a paper related to open source research, we read the full paper and included it in our paper.

This review identified only four papers in this area: Butler et al. [5] applied the ASA model to online communities but not to open source communities specifically. Crowston and Fagnot [10] list the ASA model in their future research suggestions. Subsequently, two papers applied the ASA model in assessing the impact of person-organization fit on turnover in open source communities [8,45]. These works focused on individual contributors with limited application to organizational members.

Rationale for the Paper

The suitability of the Attraction-Selection-Attrition model for the study of open source communities and organizational-communal engagement is supported by previous research [5,8,10,45,46]. Butler at al. [5] applied the tenets of the ASA model to fit online communities and validated the theory through simulation. However, the ASA model has not been applied to the study of the relationship between organizations and open source communities. We propose that the ASA is a good model to study attraction, selection, and attribution in open source communities, but also the nature of organizational-communal engagements as these are built on "member relationships, ideologies, and influences" [23:15].

Our paper builds on organizational-communal engagement to explore the complexities involved with attracting and retaining contributors in this increasingly common partnership. In doing so, we follow Weber's [56] idea that "the open source software process is a real-world, researchable example of a community and a knowledge production process that has been fundamentally changed, or

created in significant ways, by Internet technology. Understanding the open source process can generate new perspectives on very old and essential problems of social coordination" [56:2]. As such, we outline the ASA model as a theoretical framework for the study of organization and open source community relations, contributing to the work on organizational participation in open innovation communities [26,44].

FRAMING: ATTRACTION-SELECTION-ATTRITION (ASA) MODEL

The theoretical frame applied in this study of how organizations and open communities relate to one another is the Attraction-Selection-Attrition model from Schneider [46]. Crowston and Fagnot [10] recommended using the ASA model to study the complex mechanisms in open source communities because contributors may be motivated to join and remain in a community when their personal ideologies align with the perspective and ethos of the community, rather than software related motivations. Following we introduce the ASA model.

Originally, the ASA model was proposed to understand how people shape organizations. The main proposition is that organizations seek out specific types of people with specific personality characteristics as well as suitable skills and abilities. According to the ASA model, both the organization and individuals jointly contribute to a probable fit. The attraction to an organization, selection from the pool of applicants, and attrition of employees are viewed as important predictors of the type of individuals, and hence collective characteristics of the community of people found in organizations [47]. The three ASA processes (i.e. attraction, selection, and attrition) limit the type of people that remain in an organization to shape it and these people tend to exhibit similar behavior due to their similarities [46]. Organizational culture is therefore protected and self-sustaining as a result of the ASA processes. Moreover, the framework suggests that in addition to predicting the kind of people found in organizations, interrelated processes define the "nature of the organization, its structures, processes, and culture" [47:748]. The shared goals of the organization and its members are what guides the attraction, selection, and attrition processes and in return, they affect the evolution of the shared goals [46]. Figure 1 depicts the ASA model.

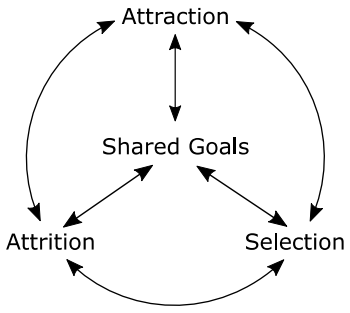


Figure 1. The Attraction-Selection-Attrition Model (adapted from Schneider [46]).

APPLYING THE ASA MODEL TO ORGANIZATIONAL-COMMUNAL ENGAGEMENTS

The next three sections unpack the three ASA processes. Previous open source research used the ASA model studying turnover of individual members in open source communities [8,45]. This paper posits that the ASA model can also be used for organizational members who are represented within the community through individual people (e.g. organizational employees). Each section introduces one process with regards to the original organizational environment for which the ASA model was developed. Then, we relate the process to organizational-communal engagements and identify points for future research but we purposefully refrain from pointed hypotheses, or propositions, and rather provide sample research questions with the intent to foster creativity and discussion on the subject.

Attraction

The first process in the ASA model is attraction. Not all potential candidates for employment will consider the organization attractive, which means attraction is an important consideration in the recruitment of new talent. In addition, known experts or project leaders may also be the source of attraction. Recruiting managers play an important role in terms of ensuring that they reach the right talent and attract them to apply for vacancies. Managers and usually future supervisors of new hire also pay attention to whether or not they can work with a candidate long-term and build the organization together.

As open source communities evolve and develop over time, their image, work culture, mission, or other signals become important attraction points for applicants and potential contributors. In short, the attractiveness of open source communities can play a key role in the recruitment of contributors and maintainers [20]. In the context of open source communities and organizational-communal engagement, attraction can revolve around two areas.

First, the attractiveness of open source communities and collaborations draws attention from members of the community and those outside those communities. How contributors may be attracted and retained has been examined in relation to open source communities [1,43,51,57]. Organizations collaborate through open source communities (even with their competitors) due to shared values that focus on the advancement of shared technologies and perceived benefits of these joint communal engagements [22]. However, other factors come into play as the following example demonstrates. From a community perspective, the user base is where potential new contributors can be attracted from [32]. Even when users are not participating in the development process or engaging with the community, silent users are of immense importance in these ecosystems [9]. We do not know how, why, and when these silent users decide to become active – and what role the specific community or their personal or shared perceptions of the community play in their decision-making. Another aspect relevant to attraction includes identifying attraction facilitators and

distractors as is evident in the fact that the structures of open source communities are highly diverse and heavily depend on the people in it [11].

Second, attraction not only applies to users but also contributors and maintainers in open communities. The motivations to become a developer ranges from intrinsic motivations such as wanting to have fun, to extrinsic motivation such as being paid to contribute as part of being a contractor or organizational employee [34]. However, we posit that the larger work context is also quite influential [13]. For example, new mentoring opportunities may also increase the attractiveness of open source community projects [54]. Yet, the role of organizational practices and factors within an open source community and their role in attracting organizational contributors to open source communities is a relatively understudied area [24].

RQ1: What rewards or incentives encourage a passive organizational user to become an active contributor to an open source community?

RQ2: What rewards and incentives attract organizations or employees working for commercial entities to contribute to open source community?

We propose that the attraction phase of the ASA model is a promising avenue to better understand contributor affiliations and attraction to communities, as well as the role of community ethos and reputation.

Selection

In the ASA model, the selection process is the choosing of job applicants for hire. Initially, the hiring decision is based on judgments about job applicants in terms of how well they fit with the organization and the job description [50]. Good communication can ensure that fit, cultural values, and performance expectations are clear to all parties involved in the selection process. Selection is, however, subject not just to what the employer does during the actual selection process (e.g., interviews, reference checks), but also subject to the experience of the applicant and new hire as both the employer and applicant have to decide whether they are a good fit for one another. Induction and socialization practices at the beginning of an appointment often help new hires decide if they will stay after the training or probation period.

Understanding selection in the context of open source communities, including members' self-selection to stay or withdraw from one community in order to engage with other communities, can build on and expand upon a recent body of research. Selection in open source community research has been shown to occur at the member who decides to engage or disengage with the community. Steinbacher et al. [53] examined barriers to onboarding in open source communities. These authors clustered barriers around several themes, including issues setting up workplaces, dependencies on platforms, source code issues, and library dependencies. Familiarity with these barriers plays an important role in easing the transition of new active contributors into the community, increasing the attractiveness to join. Similarly, selection is determined by the extent to which these barriers are addressed within a community. Indeed, Steinmacher et al. [53] concluded that two specific barriers required more research, particularly how new contributors find a task to start contributing to and how to set up a local workspace from which engagement can occur.

Further, selection can be a function of how organizations manage their processes and collaborations with open source communities. In turn, the degree to which collaborations are negotiated may also influence which employees volunteer or are selected by a manager to work on collaborative projects. Organizations have specific selection criteria for open source software including the specific software license terms, how easy it is to get help from the community, or how easy it is to contribute changes back to the community [31]. The adoption and actual use of open source software inside an organization are dependent on the level of management intervention, expectations of peers, and other facilitating conditions [19]. However, we know little about how these relationships emerge, how responsibilities are negotiated, and who selects whom and on what basis.

RQ3: What are the selection criteria for new contributors (individuals or organizations) to choose an open source community?

Finally, organizations choose their level of interaction [12] following some rationale to contribute to the open source software development and to participate in the community [3]. Past work suggests that opportunistic behavior in leveraging open source makes organizational employees more productive in software development [23]. Upon engaging with a community and depending on an open source software for its own products and operations, an organization has the choice to take on extra responsibilities in the community to preserve it and ensure that the valuable communal resource is maintained [23]. Therefore, the organizational-communal engagement involves a selection process that can impact both the open source community and the organizations. The mechanisms behind such engagement have yet to be understood, as success is likely to depend on the selection of people, communities, and collaborators.

RQ4: How does selection unfold in organizational-communal engagements?

Attrition

Attrition in organizations is related to issues such as mismatches in terms of expectations or skills the employee offers and what the job requires. Attrition may occur right after selection, during the first few days or weeks (e.g., during induction and socialization), or become likely when poor fit emerges over time, especially when the organization changes direction or focus. As a result of attrition, the workforce of organizations tends to become more

homogeneous over time [46]. That means, attrition (initiated by the employee or employer) ensures that the remaining employees are more likely to be similar to one another. This similarity may not, however, be desirable as it may also potentially reduce the diversity in terms of skills, thinking approaches, attitudes, values, and abilities within the organization. Attrition may, therefore, be an important indicator for whether attraction and selection to the organization worked, but also indicate that organizations fail to manage challenges effectively.

In the context of open source communities, managing and preventing attrition is critical [29]. Most open source software fails to attract a community and ends up being abandoned [48]. Only 20% of contributors will stay the course of a community and become long-term contributors [52]. Even seasoned members may leave if the community culture is destructive [28]. Indeed, attrition in open source communities is related to several issues, such as uncertainty about how to contribute effectively and continuously, insufficient access to support from the community, rejection of a contribution by the community, and a shift in organizational focus [52]. These findings explain why many open source communities employ their own codes of conduct [55] which is a response to such issues and reflects a more proactive approach to managing both offensive and destructive behavior of community members.

> RQ 5: Are the motives of voluntary developers leaving an open source community similar or different to the motives of paid volunteers or organizational employees?

Attrition can occur through the process of forking of open source software. When the community cannot agree over the future of the communal software, a part of the community may decide to continue development in a different direction from the base community [21]. Forking is a decision to leave the base community to resolve conflict with other community members. In the case of node.js, some community members wanted less organizational influence on the community and thus forked the software and set up a new governance structure [39]. Ultimately, the disagreement was overcome, the software development was reunited with the help of an open source foundation, and a shared governance was put in place [39]. The ability to leave an open source community while continuing with the development of the software, and potentially rejoining the community, is a feature not observed in organizations where employees that left cannot continue on a project that requires organizational resources. In contrast, open source communities can fork, survive, and thrive when a sponsoring organization ends its engagement [21]. This leads us to a final research question:

> RQ 6: How do forks evolve from organizational-communal engagements and are these forks different from fully volunteer driven forks?

FUTURE DIRECTIONS

The ASA model provides useful framing for the study of organizational-communal engagements. Attraction, selection, and attrition are iterative processes that reoccur over time and feed into one another. The effect of community member rotations in and out of communities may be one point of interest, as the persistence of such communities and their resilience to change tend to vary significantly over time. Schneider [46:443–444] proposed that "the processes and structures that emerge in an organization evolve from people meeting the daily demands associated with survival". In this regard, the ASA model can help in understanding the evolution of distinct open source communities as their members move between communities [32]. This is interesting as the same employee in one organization may work in and shape the collaboration of several open source communities. Community members that have built up a reputation within an open source community may be hired by a company that wants to engage with the community while the new employee continues to be a member of the same community.

Research can investigate the value and explanatory power of the ASA framework in the context of open source community engagement with organizations. In normal work environments, the ratio of applicants compared to job vacancies tends to be favoring careful selection. In open source communities, many community leaders are dependent on very few candidates. Attraction in open source may outweigh concerns of selection, in contrast to most recruitment situations. Further, collaborations between open source communities and organizations can be the result from unplanned but also pre arranged and strategic partnerships that are driven by mutual needs and opportunities [22].

More research is also needed to understand the role of inter-organizational relationships. It would be interesting to examine whether the ASA model can help with the interpretation of specific situations such as when organizations stake a claim in one OS community, potentially crowding out other organizations. This research would also help us to understand which attraction, selection, and attrition mechanisms operate and affect individuals vs. organizations in similar or different fashion. It would be interesting to explore the distribution of control that community members share and the perceived ability to manage the challenge – leading to voluntary or involuntary collaborations, discontinuation of projects, poor or excellent communication [16].

CONCLUSION

In this paper, we outlined the potential of the ASA model, in response to Crowston and Fagnot [10], and to identify starting points for new research directions and means to understand the relationships within organizational-communal engagements. The paper thus builds on the work by Schneider [46], and Butler et al [5]. It is our hope that the application of this model can contribute to our insight into

what drives behavior, communication, and cooperation between open source communities, their members, and organizations. Such research complements the research on open source software adoption and further promote our understanding of the open source community and its development over time.

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* All URLs in this document were checked on 2017-07-18