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The Impact of Membership Overlap on Growth: An Ecological Competition View of Online Groups

Xiaoqing Wang
Department of Decision and Information Technologies, Robert H. Smith School of Business, University of Maryland, College Park, Maryland 20742, xiaoqingw@gmail.com

Brian S. Butler
College of Information Studies, University of Maryland, College Park, Maryland 20742, bsbutler@umd.edu

Yuqing Ren
Carlson School of Management, University of Minnesota, Minneapolis, Minnesota 55455, chingren@umn.edu

The dominant narrative of the Internet has been one of unconstrained growth, abundance, and plenitude. It is in this context that new forms of organizing, such as online groups, have emerged. However, the same factors that underlie the utopian narrative of Internet life also give rise to numerous online groups, many of which fail to attract participants or to provide significant value. This suggests that despite the potential transformative nature of modern information technology, issues of scarcity, competition, and context may remain critical to the performance and functioning of online groups. In this paper, we draw from organizational ecology theories to develop an ecological view of online groups to explain how overlapping membership among online groups causes intergroup competition for member attention and affects a group's ability to grow. Hypotheses regarding the effects of group size, age, and membership overlap on growth are proposed and tested with data from a 64-month, longitudinal sample of 240 online discussion groups. The analysis shows that sharing members with other groups reduced future growth rates, suggesting that membership overlap puts competitive pressure on online groups. Our results also suggest that, compared with smaller and younger groups, larger and older groups experience greater difficulty in growing their membership. In addition, larger groups were more vulnerable to competitive pressure than smaller groups: larger groups experienced greater difficulty in growing their membership than smaller groups as competition intensified. Overall, our findings show how an abundance of opportunities afforded by technologies can create scarcity in user time and effort, which increases competitive pressure on online groups. Our ecological view extends organizational ecology theory to new organizational forms online and highlights the importance of studying the competitive environment of online groups.

Key words: online groups; organizational ecology; competition; membership overlap; online communities
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Introduction

Information and communication technologies have enabled novel forms of collective action and the self-organization of large and distributed collaborative groups (Sproull and Kiesler 1991). Online groups, for instance, provide virtual spaces where globally distributed people can interact around a shared purpose (Rheingold 2000, Sproull and Arriaga 2007). Individuals join online groups to exchange information, to interact with like-minded others, and to organize and participate in collaborative work or collective action (Sproull and Arriaga 2007). Businesses use online groups to build brand loyalty (Porter and Donthu 2008), facilitate peer-to-peer customer support (Jeppesen and Frederiksen 2006), and foster knowledge sharing and collaboration among their employees (Constant et al. 1996). Development of Internet technologies has significantly reduced the costs of creating online groups on various platforms, ranging from traditional discussion forums and mailing lists to social networking systems and wikis. With these technologies, online groups of software developers, Wikipedia editors, and problem solvers have successfully produced widely used software (Lee and Cole 2003), millions of online encyclopedia articles (Kane 2011), and innovative solutions to problems faced by businesses and nonprofit organizations (Jeppesen and Lakhani 2010). Online groups have the potential to create highly beneficial outcomes by bringing together people in ways that were previously difficult or impossible.

The proliferation of online groups, although benefiting society in many ways, has also created tension for Internet users, who must allocate their time and attention among the many groups that appeal to their interests and passions. According to a Pew Internet report, the growth of online users has slowed down over the last few years (Pew Research Center 2008), whereas the number of Internet offerings—sites to visit and groups to join—has grown exponentially. Internet users, therefore, need to choose where to spend their limited time and effort. A report by Nielsen also showed that the growth in online social networking sites and blogs has taken time away from other Internet outlets, such as search, general interest portals and communities, and email (Nielsen 2009), an indication that online users' time and attention have become increasingly scarce resources. Online groups may face increasing pressure to compete for human time and attention, and yet the existing literature has little to say about how intergroup competition is likely to affect online groups.

We propose that competition among online groups will affect them in ways that are analogous to the impact of competition among traditional organizations for resources, such as raw materials, clients, and labor (Hannan and Freeman 1977). Organizational ecology theories suggest that when resources in the environment are scarce and the number of organizations tapping into these resources increases, resources acquired by one organization become unavailable to others, reducing their performance and chances of survival. An individual's time is a scarce and limited resource: time spent in one activity (e.g., child care) takes away time from another activity (e.g., work) (Becker 1965). When several online groups rely on the participation of the same members, i.e., they have *membership overlap*, the members' time spent in one online group (e.g., a Facebook group for a political cause) takes time away from another group (e.g., a Wikipedia project on U.S. politics), potentially reducing the performance of both groups.

At the same time, it is unclear whether insights from organizational ecology theories regarding resource competition apply directly to competition among online groups. Compared to traditional, off-line organizations, online groups rely more on member contribution than physical or financial resources to succeed. Being online enables groups to recruit members from many geographic locations, greatly increasing the pool of available people. Online groups also have more permeable boundaries, more fluid membership, lower participation barriers, and fewer switching costs, which provides opportunities for members to simultaneously participate in multiple groups (Dahlander and Frederiksen 2012). Although these differences may create a resource-rich environment for online groups, they may also make online groups more vulnerable to intergroup competition, because members can join and exit groups easily. Consequently, it is unclear whether organizational ecology theories of resource competition generalize to online groups. For example, how does membership overlap with other online groups affect group growth? How do group characteristics such as size and age affect growth? Do the effects of membership overlap vary in groups with different characteristics?

In this paper, we draw from organizational ecology theories of resource competition (Hannan and Freeman 1977) to explain the effects of membership overlap, group size, and age on the growth of online groups. In doing so, our work makes three contributions. First, our study contributes new insights to understanding online groups, which are a new form of organizing on the Internet. Most studies on online groups have focused on either individual motivations, perceptions, and behaviors (Bagozzi and Dholakia 2006, Butler et al. 2007, Jeppesen and Frederiksen 2006, Moon and Sproull 2008, Nambisan and Baron 2010, Wasko and Faraj 2005) or the structure, culture, and dynamics within these groups (Faraj et al. 2011, Faraj and Johnson 2011, Stewart and Gosain 2006). Some research has identified the characteristics of individuals who perform better than others in online groups (Dahlander and Frederiksen 2012, Jeppesen and Lakhani 2010). Only a few have attended to the environment within which an online group exists (Grewal et al. 2006, Gu et al. 2007). This paper adds to the literature that considers the external environment of online groups by showing that, like traditional organizations, online groups are subject to competitive pressure in their ecological environment. Organizations interested in creating and hosting these online groups must consider both internal design and the impact of the larger system of groups. For individuals and businesses interested in hosting online groups, our results provide practical guidance on how to position groups to minimize the impact of competition.

Second, we extend and adapt organizational ecology theories to new organizational forms online. Studies of traditional organizations, such as hotels and credit unions, have shown that size, age, and overlap density with other organizations affect organizational performance, failure, and growth (Barron et al. 1994, Carroll and Hannan 2000, Ingram and Inman 1996). Our study considers whether the same variables have effects on online groups that are similar to those experienced by traditional organizations competing for resources. By examining these questions, our study seeks to address whether online groups are truly novel organizational forms or whether, despite the potentially emancipating aspects of modern information technology, the change of context—moving from off-line to online—does not change the fundamental principles that govern the interdependencies among social and organizational entities.

Third, this work studies a mature population of online groups. Whereas much is made of the novelty of the Internet and associated technologies, many of the most prominent examples of online platforms are well-developed, mature social systems. Wikipedia was founded in 2001. SourceForge.net, a platform for open source projects, was started in 1999. InnoCentive, a commonly referenced example of crowdsourcing, began in 1998. All online platforms eventually mature.

Although mature populations are not always the focus of online group research, understanding their dynamics and interdependencies is of theoretical and practical significance for those interested in online groups. Moreover, organizational ecology theories suggest that competition is most important when there are already many organizations in a population. Focusing on a mature population with many online groups—Usenet between 1999 and 2005—allows us to characterize the effects of intergroup competition when they are most likely to matter.

The rest of this paper is organized as follows. In the next section, we review the organizational ecology literature; discuss how the literature may apply to online groups; and propose hypotheses about how member overlap density, group size, and group age jointly affect online group growth. In the Methods section, we describe the data set gathered from 240 Usenet groups and the measures constructed to test the hypotheses. We then present our analysis, results, and a discussion of the theoretical and practical implications of the findings.

Theory and Hypotheses

Organizational Ecology Literature

Organizations need resources to survive and grow. Organizational ecology theories suggest that organizations depend on their environment for these resources. This dependence requires organizations to simultaneously coexist and compete with other organizations. When a new population of organizations emerges, the existence of similar organizations provides legitimacy and opportunities for organizations to learn from each other (Aldrich and Ruef 2006). The coexistence of similar organizations increases their survival rate and decreases their failure rate. At the same time, dependence on common, limited resources in the same population or environment (land, physical materials, labor, customers, etc.) can lead to competition among these organizations (Carroll and Hannan 1989, Hannan and Freeman 1977). When resources are scarce, there is an upper bound to the number of organizations an environment can support, known as its carrying capacity (Popielarz and Neal 2007). Competing with many organizations for limited resources decreases an organization's likelihood of success or survival. Under these conditions, the growth of one organization limits the growth of others.

The extent to which two organizations rely on common resources depends on the degree to which their niches overlap. A niche in organizational ecology refers to the location of an organization or a population of organizations in a multidimensional space, defined by the resources that the organization or population needs to survive (Hannan and Freeman 1977, McPherson 1983, McPherson et al. 2001). For instance, book publishers, newspaper publishers, and cardboard container firms all compete for the same paper supplies; hence, they share a niche. In contrast, regional restaurant chains may occupy different niches if they rely on facilities in distinct, nonoverlapping geographic areas. Most early studies in organizational ecology were conducted at the population level, assuming that organizations in the same population occupied the same niche and thus required the same resources. These studies considered *population density*—the number of organizations in a population—as a proxy for the number of organizations competing for common resources, and they examined its effect on the founding and failure rate within the population. Other work suggested that organizations in the same population could occupy different niches. For instance, daycare centers that provide services for infants and those that provide services for toddlers require different staff and facility resources and do not directly compete with one another (Baum and Singh 1994). These studies were conducted at the organization or niche level, and they focused on *overlap density*, which is the number of organizations with overlapping niches as the focal organization weighted by the extent of niche overlap between them. The more organizations in the same niche or occupying overlapping niches, the higher the demand for common resources.

The impact of either population density or overlap density on organizational performance depends on the relative strength of the beneficial and competitive effects of coexistence. Prior work suggests that the benefits of coexistence, such as learning and legitimacy, decrease, and the effects of competition increase as more organizations enter a niche or as population or overlap density increases (Aldrich and Ruef 2006). Therefore, population or overlap density has a curvilinear effect on organizational performance: when a population is emerging and density is low, the benefits of coexistence will outweigh the negative effects of competition, so a marginal increase in density leads to higher performance. When a population is mature and density is high, the effects of competition dominate those of coexistence, and increasing density leads to lower performance (Kuilman and Li 2006).

When resources are limited, organizations in the same environment differ in their ability to survive, succeed, and grow. Most existing research has found that large organizations have an advantage over small ones. Large organizations tend to survive longer not only because they have more resources and external ties (Bercovitz and Mitchell 2007) but also because they are better able to acquire additional resources as needed. Consistent with this view, most studies have shown a positive effect of size on organizational survival and a negative effect of size on failure, which implies a "liability of smallness" (Freeman et al. 1983, p. 692).

Existing literature also suggests several possible effects of an organization's age, after size is controlled for (Hannan 1998, Kitts 2009). Some studies show a "liability of newness" effect (Freeman et al. 1983): new organizations are more likely to fail because they do not have as many resources and capabilities to compete with others. Other studies suggest a "liability of adolescence" effect: the risk of failing increases initially and then decreases later as organizations mature (Bruderl and Schussler 1990, Fichman and Levinthal 1991). Further studies suggest a "liability of aging" effect: old organizations' resources and capabilities decline over time, and they are more subject to inertia, making them more vulnerable to changes in the environment (Kitts 2009, Sorensen and Stuart 2000). One way to reconcile these seemingly contradictory findings is to consider the coexistence of these effects at different stages of an organization's life: the liability of newness effect may dominate in early stages of an organization's development, whereas the liability of aging effect may dominate in mature stages (Kitts 2009). Overall, organizational ecology theories focus on an organization's need to acquire scarce resources from its environment to explain how characteristics of the organization (such as size and age) and those of its environment (such as density of competing organizations) combine to affect its performance and survival.

Online Groups, Membership Resources, and Organizational Ecology

On one level, online groups are comparable to organizations in terms of being "goal-directed, boundary-maintaining, and socially constructed systems of human activity" (Aldrich and Ruef 2006, p. 4). They are often organized around a common purpose (e.g., Google groups about pets or Wikipedia projects) (Sproull and Arriaga 2007). Online group infrastructures provide boundary-maintaining mechanisms to distinguish members from nonmembers and sometimes limit group content to its members (Butler and Wang 2012). Like traditional organizations, participants' activities shape and are shaped by the purpose, norms, and values of online groups (Stewart and Gosain 2006). Hence, it is reasonable to expect that organizational theories, including organizational ecology theories, might be applicable for explaining the nature and consequences of interdependencies among online groups.

At the same time, online groups differ from traditional organizations in several regards, which may be at odds with the fundamental assumption of resource competition in organizational ecology. To support operations and survive, traditional organizations must acquire and use a variety of resources, such as physical assets, natural resources, labor, and financial capital (Bercovitz and Mitchell 2007). Online groups lack the physical facilities, legal standing, and formal relationships of traditional organizations, and thus their resource needs are lower. With the development of new technologies and platforms, an online group can be created and managed with little or no investment in computer hardware or software and access to scarce capital, materials, and labor, and it is less likely to be affected by competition for those resources. However, online groups remain dependent on their environment for resources that are critical to their success and survival. Their most valuable resources are members' time and effort (Butler 2001). Volunteer leaders promote groups, manage infrastructure, and facilitate interaction among participants (Butler et al. 2007). Members provide information, answers, and social support for one another (Kollock and Smith 1999), and they bring passion to their groups that drives participation and contribution (Faraj et al. 2011). Without members' time and effort, online groups would not continue to exist and function. Thus, although online groups may have less need for traditional organizational resources, they remain dependent on their environment for the critical resource of members.

A second way that online groups may differ from traditional organizations is with respect to resource scarcity. Traditional organizations operate under the constraint of scarcity. Many of the critical resources a traditional organization may depend on are limited, including financial capital, physical facilities, raw materials, and skilled employees (Hannan and Freeman 1977). As a result, organizations are forced to compete with others in need of those same resources. In contrast, the environments in which online groups operate provide access to a seemingly abundant population of users. Global reach, relatively low costs, and ease of use all contribute to a dramatic increase in the number of people available to participate in online groups. Moreover, member resources are not exclusive in online environments. Typically, resources acquired by one organization are no longer available to others. A location used by one hotel cannot be used by another hotel at the same time. A technical expert employed by one firm is not available to advise a competing organization. Resource exclusivity creates competitive pressure that affects the performance and survival of organizations. However, in online groups, membership is rarely exclusive. Membership in online groups is often open and fluid (Faraj et al. 2011). It is common for people to participate in multiple groups to meet different needs (Dahlander and Frederiksen 2012). A cancer patient, for example, may join one group to access information on his or her condition and another group to socialize (Shaw et al. 2000). A musician may visit multiple online groups to try out new ideas and receive feedback from a large and diverse audience (Dahlander and Frederiksen 2012). Together, the reduction in geographic and economic constraints and the lack of resource exclusivity online create a resource-rich environment in which online groups can potentially exist without concern for limits on the availability of potential participants.

Low traditional resource needs, potentially global reach, and a lack of exclusive membership all have the potential to reduce the competitive pressures faced by online groups. As a result, it may be argued that online groups will not be affected by competition for scarce resources. However, each of these factors also has the potential to contribute to competition. Although communication technologies can significantly increase the number of accessible people, the population of online users will not grow forever. The number of new users coming onto the Internet has been declining in recent years (Pew Research Center 2008). At the same time, the number of new sites, services, and activities available online has drastically increased, causing individuals to drop out of some services (Nielsen 2009). These trends suggest that the number of individuals available to join any particular system or type of activity is not likely to be unbounded. As platforms like Facebook and Twitter emerge, older platforms like MySpace have seen stagnant growth or even decline (MacMillan 2009). Thus, whether at the level of the entire online user population or within particular platforms, online groups are still subject to constraints on the number of available participants. Even if the global population of Internet users continues to grow, when individuals can join multiple groups, resource scarcity and competition remain present at a finer level. Online groups require time and energy from engaged participants to remain viable and successful (Butler 2001), and individuals' time, energy, and attention is limited (Becker 1965). For each individual, time spent in one group takes away time that could be spent contributing to another group. Low setup costs and a lack of physical constraints mean that the population of online group "shells" can easily increase. Global reach means that individuals can choose from groups created anywhere in the world. As the available groups increase and the demand from multiple groups exceeds the finite time and effort that individuals have to spend on online groups, users may terminate their affiliations with some groups with little or no direct costs. The same factors that create the impression of abundance and unfettered growth in online environments have the potential to create scarcity and competitive pressures analogous to those experienced by traditional organizations. Therefore, it is necessary to carefully consider if, and how, competition for members' time and effort factors into the ability of an online group to survive and grow.

An Ecological View of Online Groups

Applying organizational ecology theory to the online context, we propose an ecological view of online groups to examine the presence and implications of intergroup competition for member resources. Although many online group studies have considered how individual motivations and other characteristics affect individual willingness to participate in online groups (Bagozzi and Dholakia 2006, Wasko and Faraj 2005), little or no attention has been given to an online group's environment and how it affects the performance of the group. Online groups, like organizations, do not exist in a vacuum. They must acquire members from the pool of potential participants in the larger environment to sustain their day-to-day activities. Organizational ecology provides a potentially useful basis for explaining relationships between an online group's environment and its performance. Table 1 summarizes how we map core concepts of organizational ecology in the context of online groups.

Table 1 Mapping Organizational Ecology Constructs in the Context of Online Groups

Constructs	Manifestations
Environment	Other online groups, relationships among the groups, and people with different interests
Population	Set of online groups with a similar technology platform (e.g., Usenet or Facebook groups)
Resources	Members and their time and effort
Niche overlap	Membership overlap among online groups within a population
Overlap density	Number of other online groups in a population that share common members with a focal group
Performance	Membership growth

Studies in organizational ecology have examined many outcomes of resource competition including bankruptcy (Barron et al. 1994), performance and growth (Carroll and Hannan 2000), alliance strategy (Nam et al. 2010), and, most commonly, founding and failure rates (Barron et al. 1994, Dowell and Swaminathan 2000). Because of their status as legal entities, organizations often have clearly defined creation and termination events. Furthermore, because of their heavy reliance on physical and financial resources, traditional organizations typically experience a clear break in operations when they run out of these resources. Unlike traditional organizations, failure of online groups is rarely clearly defined. Because the expense of maintaining a virtual space is minimal, it is common for an online group to continue to exist as a technical structure long after it has ceased functioning as a meaningful social entity. Although membership growth (or decline) may not be equated with success in all online contexts, continued decrease in membership significantly affects the activities of any group regardless of its intended goals and purposes. Thus, although it may be possible in some contexts to identify termination events, measures of growth and decline in membership are more generalizable indicators of the health of online groups than measures of online group "deaths."

Characterizing the effects of an online group's competitive context requires identification of competing groups. One common approach in the organizational ecology literature is to characterize a competitive environment in terms of the firms that share a common organizational form, such as hotels (Ingram and Inman 1996), day-care centers (Baum and Singh 1994), or credit unions (Barron 1999), within a geographic region. Online groups are created on particular technological platforms (e.g., Usenet, Facebook, Wikipedia). These platforms affect the form of the groups and the interconnections among them (Butler and Wang 2012). As such, groups created on the same platform, such as Usenet newsgroups or Wikipedia projects, can be seen as constituting identifiable populations of online groups.

However, population-level analysis is of limited utility for explaining outcomes at the group level. Particular organizations are rarely subject to competitive pressure from every firm in a given population. The number of organizations in a population requiring mutually exclusive resources may have no effect or even a positive effect on a particular organization (Baum and Singh 1994). Therefore, organizational ecology researchers have used overlap density to characterize an organization's competitive environment (Barnett and McKendrick 2004, Baum and Singh 1994, Podolny et al. 1996). Overlap density refers to the number of other organizations in a population that share a resource niche with the focal firm (Baum and Singh 1994). Overlap density is weighted by the extent of niche overlap between two organizations: the number of organizations that rely on 100% of the same resources as the focal organization is directly counted, and the number of organizations that rely on only some of the same resources is weighted by the extent to which their niches overlap with the focal firm. For example, an organization that shares 100% of its resources with firm A and 50% with firm B has an overlap density of $1 + 0.5 = 1.5$. Defined in this way, overlap density reflects the level of competition for the resources that a focal firm needs.

Consistent with the organizational ecology literature, we define *member overlap density* as the number of online groups in a population that share members with a focal group, weighted by the degree of membership overlap between each pair of groups. Membership overlap may be a result of multiple groups having similar content or purposes (e.g., three groups focusing on car purchasing) or a result of people's diverse interests (e.g., the same person participating in both a parenting group and a technical support group). As noted above, the most critical resource for online groups are members' time and effort. Online groups with membership overlap depend on the same resource: the shared members' time and effort. The extent to which two groups share members reflects the extent of their niche overlap. Hence, member overlap density provides a measure of the intensity of competition for member attention that a focal group faces.

Organizational ecology theories suggest that resource competition will be most prevalent when a population is mature and density is high (Aldrich and Ruef 2006). Although online groups may face competition for members at all times, the impact of intergroup competition will likely be most significant in large, mature populations where there are already many well-established online groups. Therefore, in the next section we develop a series of hypotheses regarding resource competition in the context of a mature population of online groups.

Research Hypotheses

Member Overlap Density and Membership Growth. Organizational ecology theories predict a negative effect of density on organizational performance and survival in mature populations. In a well-established population, density, or the number of organizations requiring common resources, is already high, and resources are scarce. The competition effect of density dominates its positive effect, and therefore, increasing density hinders survival and growth (Carroll and Hannan 2000). There is abundant evidence in the organizational literature that supports this competitive effect. For example, Podolny et al. (1996) found that the number of semiconductor companies relying on the same patents as a focal company reduced the growth of the company. Similarly, Baum and Singh (1994) found competitive effects among day-care centers that accept children of similar ages. Competition for scarce resources is often believed to be the reason behind industrial declines (Ruef 2004).

Member overlap density is expected to have similar effects on online groups' growth. In a mature population of online groups, the population is crowded and resources are scarce. Online groups with overlapping niches would need to compete for members' limited time and attention, as members affiliated with multiple groups struggle to allocate their efforts among them. At this time, increasing overlap density makes it more difficult for any particular online group to retain existing members and to recruit new participants (McPherson and Rotolo 1996). Thus, we expect a negative effect of member overlap density on the growth of online groups in mature populations.

Hypothesis 1 (H1). *Member overlap density is negatively associated with subsequent membership growth in a mature population of online groups.*

Organizational ecology suggests that the effect of density is nonlinear as a population develops. Legitimacy increases and competition intensifies when density increases (Hannan and Freeman 1977). Together, these effects account for the curvilinear effect of density on organizational performance found in studies of traditional organizations (see Nickel and Fuentes 2004 for a review). For instance, Barron et al. (1994) found an inverse U-shaped relationship between the local density of New York City credit unions and their growth rate. Dowell and Swaminathan (2000) also found that the density of American bicycle producers first reduced, and then increased, firm mortality rates. For mature populations, it is the second portion of the inverted U shape, in which density decreases organizational performance at an increasing rate, which is relevant. In mature populations of online groups, we expect the negative effects of overlap density on growth to increase as more groups share members with the focal group. As member overlap density increases, competition between a focal group and the other member-sharing groups may become fiercer and have larger negative effects on growth. The initial set of groups that compete for members with the focal group would have a small, negative impact on group growth. Additional groups sharing members with a focal group are expected to reduce growth more than the initial ones.

Hypothesis 2 (H2). *Member overlap density reduces subsequent membership growth at an increasing rate in a mature population of online groups.*

Group Size and Membership Growth. Organizational researchers have often argued that large organizations have an advantage over small ones when they compete in the same environment because they have more resources, more efficient routines, better external relationships (Bercovitz and Mitchell 2007), and better ability to attract additional resources such as skilled labor and capital (Audia and Greve 2006). In their study of the population of hard disk drive manufacturers, Barnett and McKendrick (2004) found that large manufacturers were less likely to fail than small ones. Similarly, Ranger-Moore (1997) observed that large life insurance companies were less likely to fail than small ones. However, others have pointed out that large organizations may have more difficulty growing than small ones because they have less room and motivation to grow (Greve 2008). Large organizations may have reached an optimum size that minimizes costs (Barron et al. 1994), or they may find it difficult to adapt to their environments and grow (Barron 1999). Reflecting on these conflicting arguments, organizational studies to date have shown mixed results on the relationship between size and growth rates. Some have found a negative relationship (Barron et al. 1994, Greve 2008), some have found a positive relationship (Banaszak-Holl 1991), and others have found no significant relationship between them (Bottazzi et al. 2002).

Both the advantages and disadvantages of being large may manifest in the context of online groups. Large online groups have more member resources and as a result can offer more content, making them potentially more attractive to current and potential participants than small groups (Butler 2001). Larger online groups also are more likely to be able to find volunteer leaders to perform administrative work, such as mentoring new members, reinforcing norms, and maintaining infrastructure (Butler et al. 2007), all of which would facilitate the functioning of a group. However, large online groups also suffer from social loafing problems (Kraut 2003), which reduce participants' motivation to contribute. For example, Jones et al. (2004) found that large Usenet groups have lower response-to-post ratios than small ones. Online groups may also have an optimum size beyond which growth would slow. Above a certain point, continued growth of online groups creates information overload that can outweigh the marginal resource benefit of adding additional participants (Raban et al. 2010). As an online group grows, members can become overwhelmed by both the amount of information and the number of members and thus be more likely to leave. These effects are reflected in efforts made by some online groups to limit the joining of new members (Shirky 2003) and the practice of creating subgroups when an online group grows too large (Kim 2000). Therefore, although size provides some benefits for the functioning of online groups, we expect its effect on membership growth to be negative. We posit the following.

Hypothesis 3 (H3). *Group size is negatively associated with subsequent membership growth in online groups.*

Few studies in organizational ecology have considered the interaction between organizational demographics and overlap density. However, competitive pressure does not affect all organizations equally (Barron 1999) and may have a differential effect on online groups as well. As Barron (1999) argued, when the number of organizations in a population increases and competition intensifies, it should be more difficult for all organizations to obtain new resources and grow. Large organizations may face a greater challenge than smaller ones if they find it difficult to adapt. His analysis showed that density reduces the growth rate of large organizations more so than the growth rate of small organizations. Following Barron (1999), we expect that large online groups would suffer more in growth than small ones when they share members with many other groups, partially because they are already close to or beyond their optimal levels and partially because of their loose social structure and connections among members. According to McPherson et al. (1992), membership turnover in voluntary groups is negatively associated with the number and strength of network connections within the group. Large groups, both online and off-line, typically have more diverse composition and less cohesive networks than small groups. Members who are loosely connected to a group are more likely to leave when they are distracted by content from or connections with other groups. As a result, large online groups are more likely to lose members to other groups when they share members with many other groups. Therefore, we posit the following.

Hypothesis 4 (H4). *Member overlap density has greater negative effects on subsequent growth of larger online groups than on subsequent growth of smaller online groups.*

Group Age and Membership Growth. The existing literature suggests that in a mature population, age would reduce the performance of an organization at an increasing rate. A mature population has many well-established organizations that have accumulated resources and capabilities by establishing connections with the environment and developing a stable internal structure (Stinchcombe 1965). Those very capabilities, routines, and structures may become outdated over time, and it is often more difficult for old organizations to adjust and adapt to environmental changes than it is for young ones (Thornhill and Amit 2003). When that happens, old organizations are more likely to decline than young ones (Freeman et al. 1983), and their vulnerabilities increase over time. Even among the newer organizations in the population, the difficulty of establishing internal structures and building relationships is reduced because the organizational form in a mature population is already established and legitimate. Therefore, the negative effect of aging should dominate its positive effect in a mature population.

Age may have similar effects on online groups as on off-line organizations. In a mature population of online groups, more groups are old and well established and are therefore subject to the negative consequences of aging (Sorensen and Stuart 2000). The fast member turnover in online groups may make it difficult for groups to retain the capabilities that they have developed like traditional off-line organizations do (Faraj et al. 2011). Even when the norms, values, and policies of an online group are retained, they may become obsolete as the group ages, making older groups less able to maintain growth than newer ones. The older an online group is, the more they may suffer from their inflexibility. Thus, we expect that the effect of online group age on membership growth within a mature population will be negative, and that group age reduces membership growth at an increasing rate.

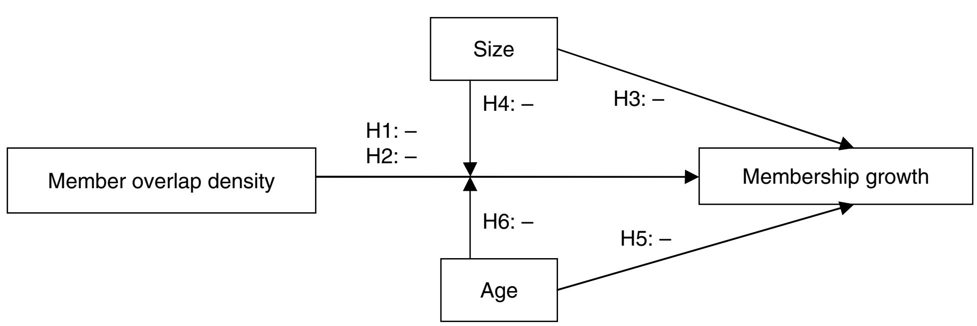
Hypothesis 5 (H5). *Group age is negatively associated with membership growth in a mature population of online groups, and it reduces membership growth at an increasing rate.*

As with the moderating effect of size, we hypothesize that group age moderates the effects of member overlap density on membership growth. In theory, the moderating effects could either exacerbate or alleviate the negative effects of member overlap density. Old online groups are likely to have more committed members and more established networks among members, which buffers the groups from competitive pressure. At the same time, old online groups are likely to have members who are burned out from past participation (Cress et al. 1997) or who no longer need benefits from the group, thus exacerbating the effects of competition. Here, we follow Barron's (1999) argument that any disadvantage older groups have, compared to younger groups, will be exaggerated as competition intensifies. Because we expect age to have a negative effect on membership growth in mature online groups, we posit the following.

Hypothesis 6 (H6). *Member overlap density has greater negative effects on the growth of older online groups than on the growth of younger online groups in a mature population.*

Figure 1 illustrates our complete research model. For a mature population of online groups, we expect member overlap density to reduce membership growth at an increasing rate. We expect large and old online groups to have slower growth than smaller and younger groups, and we expect that group age reduces membership growth at an increasing rate. We also expect large and old groups to be more vulnerable to competition from membership overlap than small and young groups. Together, these arguments present an ecological theory of online groups in terms of how intergroup competition for members interacts with online group characteristics to affect growth.

Figure 1 Research Model and Hypotheses



Methods

Data

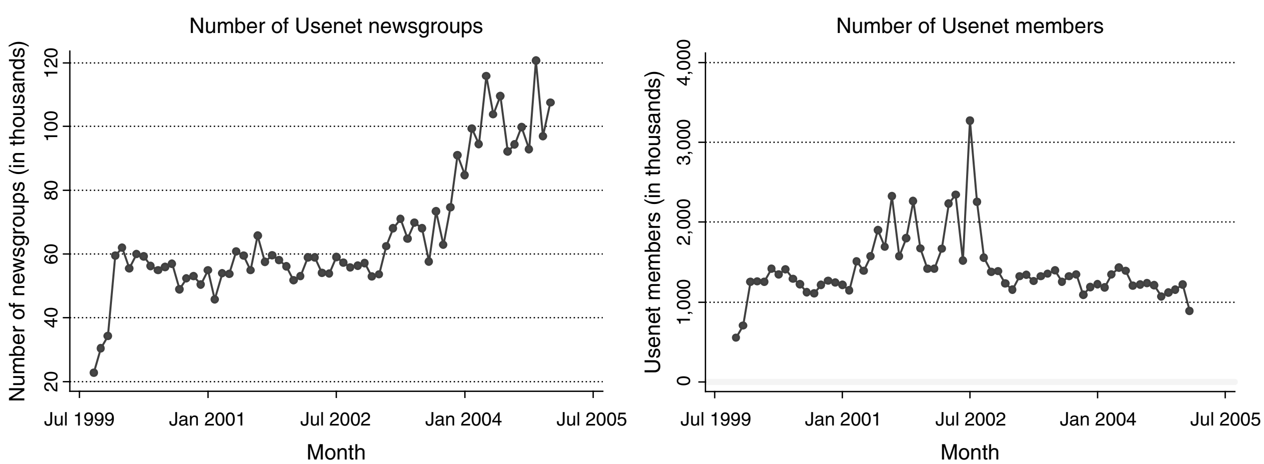
We tested the proposed hypotheses in the context of Usenet newsgroups. First developed in 1979, Usenet is a text-based, peer-to-peer Internet communication infrastructure that hosts online discussion groups called newsgroups (Kollock and Smith 1999). In the early days, one needed a newsreader application to access Usenet messages, just as one needed an email client to access emails and an Internet relay chat (IRC) client to participate in IRC chat. In 2001, Google acquired the largest Usenet archive service, Deja.com, and enabled browsing and posting to Usenet newsgroups through the Web on Google Groups. Usenet was one of the oldest and most important communication channels in the 1990s, together with email, discussion lists, and IRC chat (Kollock and Smith 1999). It hosted Tim Berners-Lee's announcement of the first World Wide Web project and the birth of the Linux open source software project. Our data show that as of 2005, there were approximately 189,000 Usenet newsgroups and over 9 million participants who had contributed to at least one Usenet newsgroup. Because of its unique technology and early popularity, Usenet constitutes a distinct, mature population of online discussion groups.

Figure 2 shows the number of newsgroups and Usenet members during our studied period. The number of newsgroups in Usenet has increased, especially during the second half of the studied period (Figure 2, left), suggesting an increasing demand for active participants. However, the number of Usenet members (Figure 2, right) has been declining since 2002, probably as a result of competition from other interactive platforms (Herring 2004) such as Web-based discussion forums and social networking sites. These trends are consistent with our characterization of Usenet as a mature population, within which a growing number of online groups compete for increasingly scarce member resources. As such, Usenet is an appropriate setting to study the impact of competition on online groups within a mature population.

We collected data on Usenet newsgroups from the Microsoft Netscan database (Smith 2005). The Netscan system collected information about Usenet newsgroups, their members, and message activities starting in September 1999. In Usenet, there is no formal requirement to sign up to become members of a group—thus no strict sense of "membership." Individuals become visible only when they post messages. Lurkers who read messages without posting remain invisible. We define members of a Usenet newsgroup as participants who post messages to the group, and we use this definition to measure our key constructs, such as group size, member overlap density, and growth rate.

We used several criteria to select the sample from the Netscan database. Adapting the classification in Ridings and Gefen (2004), we first drew a stratified random sample of 400 newsgroups covering four broad topics: hobby, technology, issue discussion, and health support. Examples of the sampled newsgroups include alt.pets.ferrets (hobby), microsoft.public.security (technology), talk.politics (issue), and alt.support.diabetes (health). Then, based on our observation of typical activities in Usenet, we removed groups with an average of fewer than 20 posts per month to exclude groups that never attracted enough member participation to be viable. After reviewing group descriptions and message content in the Google Groups archive (http://groups.google.com), we further excluded groups that were mostly spam, announcements, or not English based. Our final sample includes 240 newsgroups with 107 hobby groups, 64 technology groups, 38 issue discussion groups, and 31 health support groups. We obtained monthly activity data for these groups and their members from the Netscan database and retrieved their starting months from the Google Groups archive. To test the hypotheses, we constructed a panel data set for the 240 newsgroups over 64 months from October 1999

Figure 2 Number of Usenet Newsgroups (Left) and Number of Members (Right) from October 1999 to January 2005



to January 2005. A few groups started after October 1999, and they have fewer than 64 observations in the data set. The final data set includes 14,929 group-month observations.

Measures

Growth Rate. Following the method in Podolny et al. (1996), we measured each newsgroup's monthly membership growth by dividing the total number of active members in the current month (month t) by the total number of active members in the previous month (month $t-1$). On the rare occasions when there was no activity, and thus no active members in a month t, the growth rate in month $t+1$ was set to be equal to the number of active members in month $t+1$. The calculated growth rate ranged from 0 to 316. Because this variable was highly skewed, we took the natural log to improve its normality. To ensure that results were not unduly influenced by highly transient participants, we also constructed an alternative measure of growth rate by counting the number of core members (instead of all members), defined as members who had posted a total of at least 11 messages in the group. We used 11 messages as the threshold because only 20% of newsgroup participants posted 11 messages or more during their lifetime in their groups. Analysis of the growth of core members yielded similar results to the analysis of the growth of all members. Thus, we report the results with the growth rate of all members in the paper.

Member Overlap Density. Prior work suggested that both the number of organizations in a niche and the degree of niche overlap affect the intensity of competition (Barnett and McKendrick 2004, Baum and Singh 1994, Podolny et al. 1996). Following prior studies in organizational ecology, we constructed a weighted measure of member overlap density to account for both the number of newsgroups that shared members with a focal group and the degree of membership overlap between the focal group and the other groups. Online group membership can change quickly as members move in and out of groups. Therefore, we measured member overlap density at a monthly interval.

We considered two newsgroups as sharing a member if the member posted at least one unique message in both of the newsgroups in a given month. Individuals who only cross-posted messages (i.e., did not post a unique messages in multiple groups) were not considered to be shared members. Posters who participated in more than 150 groups in a month were excluded because they were most likely software systems rather than individuals. For each of the newsgroups in our sample, we identified all other newsgroups in the Netscan database that shared at least one member with it in a month, including the newsgroups that were not in the sample. We then counted the number of members that the focal group shared with each of them. The degree of membership overlap between the focal group i and another group j in month t was calculated as the number of shared members between the two groups divided by the total number of posters in the focal group i in that month. *Member overlap density* was then calculated as the sum of the degree of membership overlap between the focal group and each of the other groups with which it shares members. For example, if a newsgroup shares 10% of its members with one group and 15% of its members with another, its member overlap density is calculated as $0.1+0.15=0.25$. The higher the number is, the higher the competitive pressure the focal group faces from other groups:

$$\textit{Member overlap density}_{it} = \sum_{j=1}^{J} \frac{\#\textit{SharedMembers}_{ijt}}{\#\textit{Members}_{it}}.$$

Group Size. We measured a newsgroup's size as the total number of active members who posted at least one message to the group in a given month. Sizes of organizations have been measured in many ways, including sales, scope, assets, capacity (e.g., storage capacity of wineries or room counts of hotels), scale of operations (e.g., number of subscribers of telephone companies or assets of life insurance companies), and number of employees (Barron et al. 1994, Bercovitz and Mitchell 2007). Because online groups acquire resources through their active member base, we measured group size as the total number of its members (Butler 2001). As we mentioned earlier, people who read messages without posting were not considered a member and were thus not counted in this measure of group size.

Group Age. We measured group age as the number of years that have elapsed since a group's creation. For a group created in September 1999, its age was coded as 1 from September 2000, 2 from September 2001, and so on. The Netscan database began collecting data in September 1999 and did not have starting-month data for newsgroups created before then. For groups created prior to September 1999, we used the month when they first appeared in the Google Groups archive as the starting month.

Control Variables. We controlled for the average level of participation and message complexity in a newsgroup in a given month. *Average level of participation* was calculated as the total number of messages divided by the total number of members posting to the newsgroup in a month. *Message complexity* was calculated as the average number of lines in a message in a newsgroup in a given month. We also included three dummies to control for the topic of a group: technology, health support, and issue discussion, with hobby groups as the base case. Finally, we controlled for the overall member scarcity in Usenet with the variable *Usenet membership size*, the total number of Usenet posters in a given month.

Table 2 Descriptive Statistics of Main Variables ($N = 14,929$)

Variables (untransformed)	Mean	Median	Std. dev.	Min	Max
Growth rate (percentage)	16.20	−0.40	3.55	−100	31,500.00
Member overlap density	7.56	5.58	6.76	0	64.10
Group size (members)	209.21	120.00	287.20	0	4,546.00
Group age (years)	7.01	7.00	3.28	0	18.00
Level of participation	4.34	2.85	4.40	0	70.98
Message complexity (lines)	47.49	33.00	91.07	0	4,979.00
Usenet membership size	1,433,137	1,322,355	395,937.50	702,089	3,273,088

Analysis and Results

Table 2 displays the descriptive statistics. Most of the variables were highly skewed except for *group age* and *group type* dummies. Therefore, we listed both the mean and median of the variables. During the studied period, Usenet had 702,089 to over 3 million users a month, with a median of 1.3 million users a month. Median level of participation in the sampled newsgroups was 2.85 messages per member per month, and the median message length was 33 lines. Group size ranged from 0 (when a newsgroup had no activity for a month) to over 4,000 members with a median of 120. Group age ranged from 0 to 18 years, with an average age of 7 years. It was common for newsgroups to share members. The median of member overlap density was 5.58, equivalent to sharing all members with 5.58 other Usenet groups. Figure 3 shows the average of member overlap density and group size across the 240 newsgroups in our sample. During the studied period, member overlap density increased while group size decreased. Newsgroups in our sample had a median membership decline of about 0.4% each month, equivalent to an overall decline of approximately 21% over the five-year period. Changes in membership occurred gradually, with few extreme changes from month to month. We found 87 observations with a monthly growth rate larger than 5. Sensitivity analysis suggested that excluding these observations does not change our results, and we reported the analysis with all observations included.

We applied a natural-log transformation to all variables except *group age* and *group type* to improve their normality. Before transforming, a small value, 0.1, was added to the values of the variables. All independent variables except for *group age* and *group type* were lagged for one month to examine their effects on the growth rate in the subsequent month. The independent variables were mean centered before creating the interaction terms. Table 3 shows the correlations among the transformed variables. Multicollinearity analysis showed that the variance inflation factors (VIFs) for the independent variables were below 3, well within the generally acceptable ranges (Hair et al. 1998). Therefore, multicollinearity was not a concern for this analysis.

To test the proposed hypotheses, we estimated a longitudinal and multilevel model using the xtmixed procedure in Stata (Rabe-Hesketh and Skrondal 2005), predicting growth rate as a function of member overlap density and group age and size and controlling for overall Usenet membership size, group type, and the group's levels of participation and message complexity. The mixed effect model takes into account the multilevel structure of our panel data, with multiple observations over time nested within each newsgroup. It also allows both fixed and random effects and provides more flexibility in specifying a model. Newsgroup IDs were

Figure 3 Average Member Overlap Density (Left) and Average Group Size (Right) for the 240 Newsgroups from October 1999 to January 2005

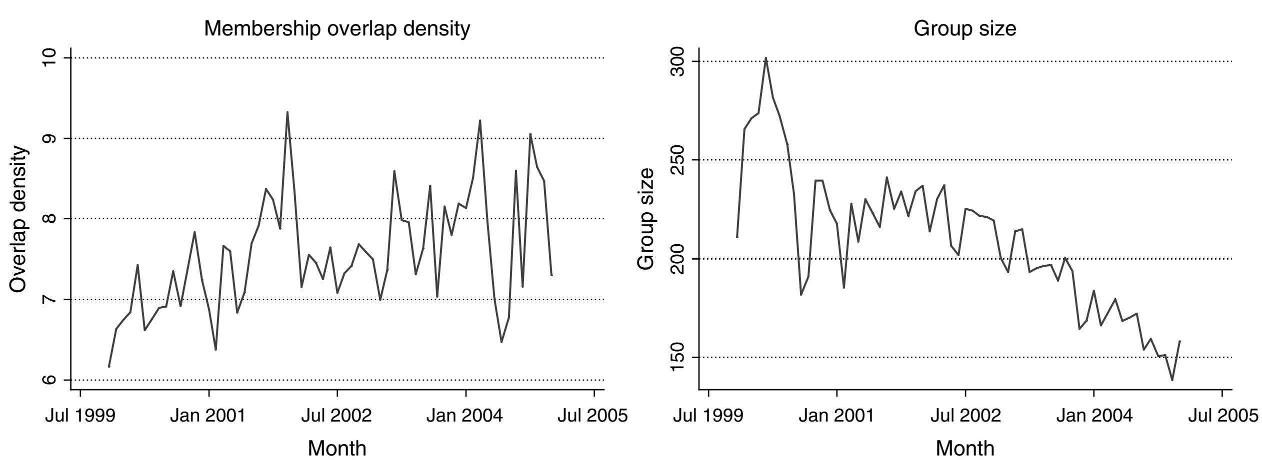


Table 3 Correlations

Variables	1	2	3	4	5	6	7
1 *Growth rate*	1						
2 *Member overlap density*	−0.073*	1					
3 *Group size*	−0.197*	0.044*	1				
4 *Group age*	−0.028*	0.174*	0.235*	1			
5 *Level of participation*	−0.076*	0.088*	0.562*	0.141*	1		
6 *Message complexity*	−0.099*	0.322*	0.096*	0.191*	0.116*	1	
7 *Usenet membership size*	0.016	0.028*	0.051*	−0.05*	0.012	−0.067*	1

Note. $N = 14{,}929$.
*Correlation significant at $p < 0.05$.

included in the model as random effects to control for unobserved newsgroup heterogeneity. Examining the distribution of the residuals suggested that there might be outliers in the sample. We ran sensitivity analysis without the outliers, and the results remained unchanged. We therefore report the results with all observations included. Because our data set was clustered within newsgroups, the homogeneity of variance assumption was likely violated. We specified the mixed effect model to estimate a unique variance component for each newsgroup. Therefore, heteroskedacity is not likely a concern. We also ran the most conservative fixed effect models with standard errors robust to newsgroup clustering. The results remained largely the same: that is, the main effect of group age became insignificant, but all other results remained the same. Our results from the mixed effect model are thus robust to heteroskedacity, and we report them in Table 4.

We ran three hierarchical models to test the hypotheses. The first model included all control variables; the second model included the controls plus group size, age, and member overlap density; and the third model included the squared term of overlap density and group age and the interactions between overlap density and group size and age. Mixed effect models do not produce R-squared, and thus we calculated estimated R-squared manually following Xu (2003). Model 1 had poor model fit and explained only about 1.6% of the variance in membership growth. Model 2 explained 12.6% of the variance, and Model 3 explained 13.9% of the variance. A chi-square test examining the difference between the deviance statistics (−2 log-likelihood) across the three models suggested that adding group size, age, member overlap density, and their squared terms and interactions significantly improved model fit at the 0.001 level (ΔDeviance = 1,042.3 between Models 1 and 2 and 97.5 between Models 2 and 3, respectively).

Table 4 Explaining Membership Growth

	Model 1: Control		Model 2: Main effect		Model 3: Interaction	
Intercept	−0.284	(0.223)	−1.368***	(0.214)	−1.502***	(0.215)
Support group	0.036***	(0.012)	−0.108*	(0.051)	−0.118*	(0.06)
Technology group	−0.013	(0.010)	0.028	(0.04)	0.041	(0.046)
Issue group	0.038***	(0.012)	0.012	(0.048)	0.043	(0.057)
Level of participation	−0.047***	(0.005)	0.096***	(0.01)	0.097***	(0.01)
Message complexity	−0.067***	(0.006)	0.013	(0.007)	−0.005	(0.007)
Usenet membership size	0.020	(0.016)	0.097***	(0.015)	0.106***	(0.015)
Member overlap density			−0.046***	(0.007)	−0.085***	(0.012)
Member overlap density^2			—	—	0.022***	(0.004)
Group size			−0.246***	(0.006)	−0.283***	(0.007)
Group age			−0.015***	(0.002)	−0.015***	(0.002)
Group age^2			—	—	−0.000	(0.000)
Member overlap density ∗ Size					−0.035***	(0.003)
Member overlap density ∗ Age					0.003	(0.002)
Member overlap density ∗ Support group					−0.070***	(0.019)
Member overlap density ∗ Technology group					0.042**	(0.016)
Member overlap density ∗ Issue group					−0.047*	(0.018)
Number of groups/Clusters	240		240		240	
% of variance explained (estimated) (%)	1.6		12.6		13.9	
Deviance (−2 ∗ Log likelihood)	18,524.1		17,481.8		17,384.3	
ΔDeviance			1,042.3***		97.5***	

Notes. $N = 14{,}929$. Standard errors are in parentheses.
***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

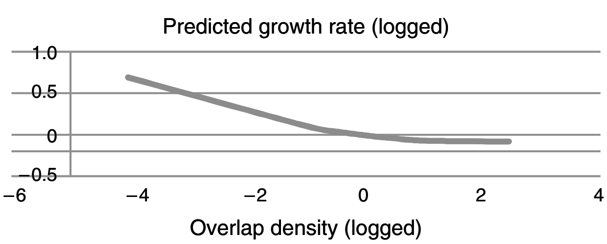
Effects of Member Overlap Density

Hypothesis 1 posits that member overlap density is negatively associated with growth, and it was supported. As shown in Model 2 in Table 4, the coefficient of member overlap density was negative and statistically significant ($\beta = -0.046, p < 0.001$). The coefficient suggests that a one-unit increase in member overlap density, or about a 13% increase from the mean ($7.56 \times 13\% = 1$), was associated with a 0.6% ($0.046 \times 13\%$) decline in membership in the subsequent month. This decline is equivalent to 1.5 times the median monthly membership decline rate (0.4%) in the sampled newsgroups. The one-unit increase in member overlap density could occur, for example, when a focal group shared all members with one additional group or shared 10% of its members with 10 other groups. This result showed that an online group's ability to grow can be hindered by sharing more members with more groups. Hypothesis 2 posits that member overlap density reduces growth at an increasing rate. It was not supported. In Model 3, the square term of member overlap density was positive and statistically significant ($\beta = 0.022, p < 0.001$), which means that member overlap density reduced growth rate at a decreasing rate. As shown in Figure 4, the overall effect of member overlap density remained negative in our sample, yet the negative effects became smaller as member overlap density increased.

Effects of Group Size, Age, and Their Interactions with Overlap Density

Hypothesis 3 posits that larger groups have slower growth rates, and Hypothesis 4 posits that member overlap density has a stronger negative effect on the growth rate of larger groups than of smaller ones. Our results supported both hypotheses. Model 2 showed that group size was negatively associated with growth rate ($\beta = -0.246$, $p < 0.001$). A 10% increase in group size was associated with a 2.46% decrease in growth rates. Model 3 showed a negative interaction between member overlap density and group size ($\beta = -0.035$, $p < 0.001$). This suggests that group size moderated the effect of member overlap density on growth rate: the decrease of growth rate from member overlap was greater in large groups than in small groups, suggesting that, compared with smaller groups, larger groups were more vulnerable and likely to lose members to competition.

Figure 4 **Predicted Relationship Between Member Overlap Density and Membership Growth**



Hypothesis 5 posits that older groups have slower growth rates and that group age reduces growth at an increasing rate. Hypothesis 6 posits that member overlap density has a stronger negative effect on growth rate for older groups than for younger ones. The results provided partial support for Hypothesis 5 but no support for Hypothesis 6. Model 2 showed that group age was negatively associated with growth rate ($\beta = -0.015$, $p < 0.001$). A one-year increase in a group's age was associated with a 1.5% decrease in growth rate. Model 3 showed that neither the square term of group age nor the interaction between member overlap density and group age was significant. This result suggests that the relationship between group age and membership growth was linear and that competition from sharing members with other groups had similar effects on older and younger groups.

Examination of the coefficients of the control variables yielded some interesting results. As shown in Model 3 of Table 4, there were significant interactions between group types and member overlap density. Using hobby groups as the base, sharing members with other groups caused greater decrease in the growth rates of health support groups ($\beta = -0.070, p < 0.001$) and issue discussion groups ($\beta = -0.047, p < 0.001$), yet a smaller decrease in the growth rate of technology groups ($\beta = 0.042, p < 0.01$). Compared with hobby groups, health support groups and issue discussion groups seemed to be more vulnerable to competitive pressure from sharing members with other groups, and technology groups were the least vulnerable among the four categories.

Discussion

We set out to study the effects of intergroup competition on the growth of online groups. Analysis of longitudinal data from 240 Usenet groups suggested that online groups, a new organizational form, were subject to the same competitive pressure in their environment as traditional organizations. Sharing members with other groups creates the need to compete for members' time and efforts, which decreases a group's ability to grow. Although the month-to-month change in membership appears to be small, when considered over the entire studied period of a group's lifetime, the changes can be substantial. Usenet groups in our sample experienced a median decline of group membership by 0.4% every month. Over a five-year period, that decrease is equivalent to about 21% of membership decline. Holding all else constant, every additional group with which the focal group shared all members further reduced its membership by 0.6%, a 150% increase from the median membership decline level. Over the course of a five-year period, an additional monthly decline of 0.6% amounts to an additional membership decline of about 31%, which is a substantial effect of which online group managers should take notice. In addition, we found that larger and older groups experienced greater difficulty in growing their membership. We also found the negative effects of competition were exacerbated by group size; larger groups were more likely to lose members than smaller groups in the face of intense competition. Overall, our study shows that competitive pressures in a mature online environment can have a significant impact on online groups' ability to grow.

Our study provides several new insights and raises important questions about online groups. Compared to previous studies that focused on the internal design and dynamics of online groups, our work advocates an ecological view and calls attention to the external environments of online groups and their effects on group performance. The ecological framework and the measure of member overlap density can be readily applied to online groups hosted on different technological platforms. As such, they provide a basis for assessing the level of competition felt by particular groups and the likely consequences of the competition on the group's ability to survive and succeed over the long term.

We also contribute to the organization science literature by testing and extending organizational ecology theories to a new context. The dominant narrative of online environments is one of abundance and unbounded access. More information is available to more people worldwide than ever before, and more people can participate in more online groups. In this context, online groups have emerged as a form of virtual organization with more fluid membership and permeable boundaries than traditional organizations. In spite of the emancipatory expectations of online environments, our findings demonstrate that ecological theories continue to apply in this new context. Online groups are subject to competitive pressure for critical resources just like traditional organizations, with a few caveats.

We found that in a mature population of online groups, member overlap density reduces growth at a decreasing rate. This finding differs from typical organizational ecology studies (Barron 1999) that predict that overlap density reduces growth at an increasing rate. Although it is clear that Usenet, with 20 years of history prior to the study, can be thought of as a mature population, our results raise questions about how long it takes a population of online groups to mature. Compared to traditional organizations, online groups primarily depend on members' time and effort to succeed. Competitive pressure may have greater and more immediate effects on online groups because of the low barriers involved in joining and exiting groups. As a result, a population of online groups may mature quickly. The age of the Usenet groups that we studied means that many members have already been facing conflicting demands from multiple groups, and the intensity of competition faced by Usenet groups is already high. As the population continues to grow, the intensity of competition may peak, and further membership overlap would have a decreasing impact on reducing membership growth. As a result, competition from a handful of groups significantly reduces membership growth, whereas competition from additional groups has a smaller impact. How these effects work in new populations and how quickly the negative impact of competition becomes dominant in other online settings remain interesting questions for future research.

Our findings also suggest that large and old online groups have slower growth than small and young ones in a mature population. Although organizational ecology literature has seen mixed effects of organizational size and age on growth, we found that being large and being old were liabilities instead of advantages for the Usenet groups in our sample. Large online groups not only experienced slower growth than small groups overall but were also more vulnerable to competitive pressures from other groups. Online groups' dependence on the time and effort of members, coupled with their fluid membership and low switching costs, may have changed the implications of being big in this new context. For instance, members of large groups may find it difficult to forge strong connections with others yet easy to be overwhelmed with high traffic volume. Although we focused on growth as our dependent variable, the results were consistent with prior work that found a negative relationship between the size of an online group and its turnover rate (Butler 2001) as well as its responsiveness (Jones et al. 2004).

Meanwhile, we found that old online groups grew at a slower rate than young groups in a mature population. Members of old online groups may find the discussions getting repetitive and stale over time. As a result, they were more likely to leave, which made it hard for these groups to maintain and grow their memberships. However, we did not find a curvilinear effect of group age on growth rate. Group age also did not moderate the impact of member overlap density, suggesting that age did not make a group more or less vulnerable when there were many competitors in the environment. These findings may reflect the maturity of Usenet during the study time period, when most newsgroups in our sample were already well established and competition for member resources was high. Aging may play a bigger role in an online group's earlier stages of development. Whether and how the effect of age differs during the lifetime of online groups warrants future research.

Although we did not hypothesize the effects of group types, we found that, compared to hobby groups, health support groups and issue discussion groups were more sensitive to competitive pressure, whereas technology groups were less sensitive. Two differences between the group types might have caused these effects. First, technology groups are more information oriented, and members join to exchange and access information related to technologies. Health support groups, in comparison, are more socially oriented, and members of these groups join to make friends and seek social support from others (Ridings and Gefen 2004). Second, discussions in technology groups are shorter and often involve simpler exchanges such as questions and answers around a specific topic. In comparison, discussions in health support and issue groups tend to be longer and more interactive, with members engaging in emotional conversations and sometimes heated debates. Therefore, regular participation in health support and issue discussion groups requires greater investment in time and effort than other types of groups, making them more vulnerable to competition from external groups. This explanation is consistent with findings from research on voluntary associations, which show that organizations with higher demand for members' time and participation have shorter membership durations (Cress et al. 1997).

Practical Implications

As organizations increasingly leverage online groups for both internal operation and external relations, the online space will grow more crowded, and Internet users will have more options to choose from on where and how to spend their time (Yoo 2010). Understanding the implication of such crowdedness is critical to the design and maintenance of viable online groups. Given the number of groups that already exist on the Internet, it will become more difficult to build vibrant groups or communities from scratch. Businesses and individuals who are interested in launching online groups cannot only spend time and money crafting the internal design of the group. They must also consider the environment in which they will launch the groups. Our study suggests that carefully positioning a group in a niche market with less competition from other groups may increase the group's ability to grow and succeed. When competition is unavoidable, a clear statement of the group's purpose might serve to uniquely differentiate a focal group from other groups. Existing online groups, especially large groups and types of groups that are more vulnerable to competition, can monitor the extent of membership overlap with other groups in their environments as an index of competition.

The open nature of the Internet and the many platforms available to host online groups make preventing members from switching groups challenging. Online group designers, however, have the capability to manage the level of intergroup competition within a platform. Often, organizations create a system of online groups, rather than a single group, to achieve their purpose. For example, the Mozilla foundation's MozillaZine consists of 28 discussion boards dedicated to different Mozilla products and topics. Likewise, Inspired, a company that promotes online health discussion, currently hosts 193 online health support groups. Although open membership among groups within a system allows members to freely join and leave groups, such freedom may lead to a high level of membership overlap that is detrimental to the operation of individual groups. Within a system of online groups, designers may consider implementing policies or technical features that limit the number of groups a member can participate in simultaneously. They may also consider tools that would recommend a small set of groups that closely match a member's interests yet minimize intergroup competition. Meanwhile, online group designers may consider enacting policies that increase the costs of leaving or switching to other groups.

Limitations and Future Research

This study is subject to several limitations. First, we studied Usenet groups hosted on one of many technological platforms and examined the effects of membership overlap within the Usenet population. Future studies should attempt to replicate our study in other online contexts, such as Weblogs, electronic mailing lists, social networking sites, or open source and open content collaboration projects. We believe that our findings, such as the negative impact of membership overlap and the liability of being big and old, can be generalized to mature populations of online groups hosted on other platforms, although the magnitudes of the influence may vary. Our findings on the differential effects of membership overlap on groups of different types provide some hints about how intergroup competition may operate in other online contexts. For example, open source software groups that mainly involve technical exchanges may be less susceptible to the competitive pressure of sharing members with other groups than cancer support or social networking groups. These are interesting areas for future research.

Second, we studied Usenet groups in multiple topic domains without focusing on a particular topic. As a result, we treated two online groups as occupying the same niche if they shared a member, even if their predefined topics or purposes were different. Whereas organizational ecology research often focuses on organizations within a single industry, our approach is consistent with the principle of ecology theory in that it recognizes that resource niches may (or may not) coincide with the socially constructed identities of the organizations involved. In this regard, our work presents a small step towards understanding cross-population competition (Ruef 2000). Building on this, future research should examine the effects of membership overlap both within and across platforms of online groups.

This study focused on a mature population of online groups that was itself facing competition for resources.

Our studied period was at a time when many new platforms were becoming popular and began competing with Usenet groups for members. Because of this, we included the Usenet membership size variable to control for the effect of Usenet resource scarcity resulting from competition from other platforms. Future research should gather data on the complete life history of a whole population of online groups to fully understand the effects of overlap density, size, and age within populations.

Fourth, we examined growth rate as the online group performance outcome. We explored several alternative measures, such as member attraction, member retention, and the growth of core members, and found the results to be similar to the results for growth. Future research should examine a broader set of measures of group performance, such as members' satisfaction with a group, quality of contribution in a group, and the degree to which a group achieves its own purposes (e.g., to collaboratively develop software code or Wikipedia articles). Finally, whereas this study focuses on group-level dynamics, future work can investigate how group ecology may affect individual outcomes. Are all individuals affected by membership overlap equally, or do individual motivations and roles interact with group ecology to affect individual behaviors? Answers to these questions will help us better understand the ecology of online groups and learn how to reduce the potential negative effects of member competition.

Conclusion

Online groups play an increasingly important role in organizations and our society by improving individual and social life, generating innovative solutions for businesses, creating artifacts of lasting value for society, and enabling new forms of collective action. However, it takes more than a technical infrastructure to make an online group successful. How a group operates matters, group demographics matter, and in this paper we show that a group's external environment matters as well. Our work shows the theoretical and practical importance of studying the ecological environment and its impact on online groups. Only by recognizing the impact of potentially competing forces and by understanding how to cope with competition can businesses and individuals achieve their goals of building viable online groups.

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Xiaoqing Wang is an assistant professor in the Department of Decisions, Operations, and Information Technologies at the Robert H. Smith School of Business at the University of Maryland. She received her Ph.D. from the University of Pittsburgh. Her research interests include online communities, computer-supported collaborative work, and technology adoption and diffusion. Her work has appeared in the top information systems journals.

Brian S. Butler is an associate professor in the College of Information Studies and associate professor of Information Systems at the Robert H. Smith School of Business at the University of Maryland. His current work with online communities and social computing focuses on modeling the dynamic interplay between technology and organizing processes. His work has appeared in the leading information systems and management journals.

Yuqing Ren is an assistant professor of information and decision sciences at the Carlson School of Management at the University of Minnesota. She holds a Ph.D. from Carnegie Mellon University. Her areas of interest include online community design, distributed collaboration, knowledge management, and computational modeling of social and organizational systems. Her work has been published in the top organization and management science journals.