Motivating participation in online innovation communities

Mercedes Paulini*, Mary Lou Maher and Paul Murty

Faculty of Architecture, Design and Planning,
The University of Sydney,
148 City Rd., Chippendale, 2120, Australia
E-mail: mercedes.paulini@gmail.com
E-mail: marylou.maher@sydney.edu.au
E-mail: paul.murty@sydney.edu.au
*Corresponding author

Abstract: Understanding what motivates participation in online innovation communities is now a high priority given the recent interest in crowdsourcing as an approach to increasing diversity and creativity in innovation. This article reports on the results of a survey of participants in an online innovation community to characterise and find correlations between motivation and participation styles. An analysis of the survey results show: the majority of participants were contributors or collaborators, not readers or leaders; reasons for joining collective innovation communities can be different to the reason for continuing to participate; primary motivations for participation are fun and challenge; intrinsic motivations rated higher than extrinsic; and the participants that are passionate about the online community are either new members, < one month, or long standing members, > six months.

Keywords: collaborative design; online innovation communities; product design; collective intelligence.

Reference to this paper should be made as follows: Paulini, M., Maher, M.L. and Murty, P. (2014) 'Motivating participation in online innovation communities', *Int. J. Web Based Communities*, Vol. 10, No. 1, pp.94–114.

Biographical notes: Mercedes Paulini holds a PhD in Collective Intelligence in Online Innovation Communities and consults to industry on developing business strategies using crowdsourcing and co-creation for innovation.

Mary Lou Maher is the Chair of the Department of Software and Information Systems at the University of North Carolina Charlotte and an Honorary Professor of Design Computing at the University of Sydney. She was formerly a Program Director at the US National Science Foundation and Professor and co-Director of the Key Centre of Design Computing and Cognition at the University of Sydney. For more information see http://maryloumaher.net.

Paul Murty is an Architect and Honorary Associate at The University of Sydney. His research interests are associated with design thinking and the psychology of conceptual discovery. Topics of particular interest include the role of insight and qualitative aspects of design discovery experiences among individuals and groups.

1 Introduction

The internet makes it possible for socially diverse and geographically distributed populations to connect and collaborate on complex, global projects. Collective innovation is a type of collective intelligence that occurs when universally distributed, open communities collaborate to design or create innovative products or solutions. Online innovation communities work across many domains including science (Fold.it; InnoCentive.com); gaming (ilovebees.com; World of Warcraft); software design (TopCoder.com); combined gaming/graphic/software design (Second Life); product design (Quirky.com); architectural design (OpeningDesign.com; StudioWikitecture.com); and designing solutions for global problems (OpenIDEO.com; OpenPlanetIdeas.com).

Building, mediating and sustaining community engagement is essential to the success of crowdsourcing platforms (Nov et al., 2010a). The success of 'open source' innovation, initially for software but increasingly across different domains, has led to the intense scrutiny of open innovation practice, in particular the motivations of individuals. Antin and Cheshire (2010) wrote "if active user participation is an explicit goal for designers, accurately characterising users' motivations, behaviours, and knowledge is essential". The success of group intelligence systems lies with their ability to attract people to participate and contribute and support them in continuing to participate and contribute.

A model of community-contributed design is found at Quirky.com, a platform for social product design where the community collaborates and competes to influence the design of a physical artefact with a goal to manufacture. Members can participate in a range of ways: by submitting ideas for projects, voting on which idea is developed, providing constructive criticism, voicing support and influencing the design or marketing of a product. Individuals who have significantly influenced the development of that product receive a percentage of the profits from the sale of the product. The Quirky community is surveyed in this research.

2 Research context: motivation and online communities

Motivation in collective intelligence can be described as the force that brings about, regulates and sustains the continued involvement of members in communities. Motivation theories are widely used to explain human behaviour and provide a framework with which to explore why people participate in online communities. While the literature on motivation theories is extensive, here we focus on those theories or studies that contribute to understanding online communities. A review of empirical literature on motivation in online communities is provided in Kosonen (2009), where online communities are defined as: technology-mediated virtual spaces supporting ongoing social interaction among people who share an interest in a certain subject or practice.

According to *Uses and gratifications theory*, the reason people select and use particular media is to obtain satisfaction from having their needs, interests or goals fulfilled (Stafford, 2008). Much can be gained from being part of a group, including: information exchange, help with achieving goals, entertainment and searching for friendship (Lakhani and Wolf, 2003). These elements are available to online

communities, but do not reflect the entire range of reasons why people participate in particular online communities.

2.1 Changing participation styles over time

According to the socio-cultural theory of motivation, the formation of motivation is an interdependent function between the individual and the environment (Walker et al., 2010). To an individual participating in an online platform, the online community forms the social world, whether it is comprised of individuals, software agents or a combination of real and artificial entities. *Co-regulation* occurs when members influence the community's goals, values and standards in return, resulting in motivations changing over time. Studies of online communities have supported this interpretation, for example, Lampe et al. (2010) found motivations that originally attracted members to a community appear to change over the course of participation. Change may occur as a result of gratifications sought becoming gratifications obtained, or they may evolve as a result of changing participation styles and/or increased contribution leading to stronger social ties and a greater sense of belonging to the community. The reader-to-leader framework (Preece and Schneiderman, 2009) describes the varying degrees of participant involvement in online communities, from those with passive to very active roles. In a study on Wikipedia, Antin and Cheshire (2010) made a case that 'readers' should also be considered valued participants due to their likelihood of moving towards more active participation.

2.2 Intrinsic and extrinsic motivations

Many studies of online communities divide motivation into internal and social (Lampe et al., 2010), intrinsic and extrinsic or internal and external factors that impel and induce action (Hars and Ou, 2002; Bitzer et al., 2007; Ye and Kishida, 2003; Ke and Zhang, 2010). All of these studies distinguish impelling forces in the psychology of the individual from forces originating outside the individual.

Lepper et al. (1973) demonstrated the interaction between intrinsic and extrinsic motivations in a study where children were allocated to one of three groups:

1 those who agreed to draw in order to receive a reward

2 those who agreed to draw and received the same reward, but had no knowledge of the reward until after the task was completed

3 those who engaged in the activity but neither expected nor received the reward.

Children who expected a reward subsequently showed diminished interest in the task and produced a poorer quality of drawing for the task. Those who received the reward without expecting it subsequently showed the same or slightly elevated levels of interest. Those who did not expect or receive the award did not show a difference in interest. These findings suggest online communities may provide ongoing motivation and achieve better outcomes if they encourage intrinsic motivations while providing unexpected rewards.

Intrinsic motivation, which is essentially internal, is described by Nov et al. (2010b) as inherent satisfaction from an activity. Rewards associated with intrinsic motivations include:

1 the fun associated with participating

2 personal challenge

3 competition and other means of social comparison and reputation building (Hertel et al., 2003).

Studies that draw on intrinsic motivational theory (Deci, 1975), and community identification (Hars and Ou, 2002), include the hope of future rewards as a pertinent motivation, describing contributions to online communities as a form of investment with rewards including:

1 the possibility of future revenues arising from support services

2 building 'human capital' through education, training and learning which can lead to a better portfolio of work and improved job opportunities

3 peer recognition through feedback which leads to increased efforts to contribute.

Extrinsic motivation, associated with external forces, is described by *self-determination theory* as lying somewhere along a continuum between controlled and autonomous regulations (Deci and Ryan, 1985). This framework was applied to a study examining how extrinsic motivation affects participation in open source software design (Roberts et al., 2006). Findings from this study indicated that internal and external motivations might interact; for example, extrinsic motivations actually enhanced intrinsic motivations. Specifically, an extrinsic incentive such as paying for contributions increases the amount of contribution and thus raises a member's status in the community, which supports an intrinsic incentive. This process can boost, regulate and maintain a member's interest in doing a task, thus assisting with the self-regulation of motivation.

In a self-regulatory system described in Sansone and Smith (2000), extrinsic drivers influence intrinsic motivation and interest-enhancing strategies predict continued contribution and participation. Sansone and Smith conclude that intrinsic and extrinsic mechanisms alone are insufficient and the system must provide the right kind of performance feedback to increase motivation. Others argue that certain motivations can help sustain interest and a range of incentives is best for supporting continued participation as not all motivations affect participation equally or in the same way (Roberts et al., 2006).

3 Categories of motivation incentivising collective innovation communities

There are many ways to classify the spectrum of influences that motivate individuals. Two that describe community involvement are discussed here.

High-level motivations that lead people to participate in collective intelligence systems, introduced in Malone et al. (2009), are:

1 Money – The promise of financial gain, either with an immediate reward or a delayed reward, such as when participation leads to the enhancement of career goals.

2 Love – Enjoyment of the activity, the ability to socialise and ideological reasons for contributing.

3 Glory – Recognition received from peers and the community.

Recent collective intelligence systems rely on Love and Glory far more than traditional organisations, which have placed greater emphasis on Money as an incentive. Financial gain is not the only reward online communities offer: points and tokens are also widely used.

Motivations for volunteering identified in Clary et al. (1998) are:

1 Values – Personal reasons such as altruism.

2 Understanding – To permit new learning experiences, and the chance to exercise knowledge, skills and abilities.

3 Social – To have relationships with others.

4 Career – Benefits relating to one's profession.

5 Protective – Ego defence, reducing guilt over being more fortunate than others or to allay personal problems, escape from negative feelings.

6 Enhancement – For personal development, enhancing positive affect.

To these classes of motivation, Nov (2007) added the additional categories of fun and ideology (these terms are not defined) for his study of a crowdsourcing community (Wikipedia). This classification has also been used in research of motivation in open software development (Zhang and Feng, 2006).

3.1 Defining motivation

This paper develops eight categories of motivation drawn from the literature and modified to better understand the motivation to participation in online collective innovation: ideology, challenge, career, social, fun, reward, recognition and requirement. The categories are inclusive of intrinsic and extrinsic rewards and are expressed in terms that are easy for online participants to understand. Some of these categories align with those described by Clary et al. (1998) and Nov (2007), for example: ideology relates to Clary's and Nov's categories of values and enhancement, while challenge relates to understanding. Malone et al.'s (2009) categories of money, love and glory are also found in these categories: reward is associated with money, social, fun, and ideology are categories associated with Malone et al.'s definition of love and recognition is associated with glory.

Since innovation communities often include professional designers as well as amateurs, the motivation categories described here include those that describe the motivation of a designer selected to participate as well as non-designers whose participation may be entirely informal and voluntary. A new category, Requirement, has been introduced to describe this motivation.

3.1.1 Ideology – to further a cause or act according to a personal or ethical principle

This includes participation for altruistic and other reasons such as personal beliefs and a sense of personal efficacy: what Clary et al. (1998) refers to as enhancement. Altruism is an innate desire to enhance the welfare of others at some cost to oneself and is widely thought to be a reason for participation in online communities (see Rafaeli and Ariel,

2008). Research has shown that altruism does not rate as highly as expected (Hars and Ou, 2002) and is seldom the sole reason for participation. Antoniadis and Le Grand (2009) suggest seemingly altruistic behaviours do not necessarily arise from altruistic intentions. Kollock (1999) proposes that 'literal altruism' is a rare phenomenon and three alternate motivations for contribution to online communities are:

1 *a sense of efficacy*, performing altruistic acts for the express motivation of fulfilling a sense of self

2 *attachment or commitment*, contributing to a community when personal and collective outcomes are merged or balanced (Rafaeli and Ariel, 2008)

3 *anticipated reciprocity*, the expectation that at some future point help or information is provided in return for past contribution.

Rheingold (1993) describes a 'gifting economy' as interaction without any expectation of direct or immediate return. Rafaeli and Ariel (2008) found members assist those who have contributed in the past and avoid those who never give.

3.1.2 Challenge – to obtain a sense of personal achievement through acquiring additional knowledge or skill

Clary et al. (1998) and Nov (2007) describe understanding as the opportunity to learn new things and exercise knowledge, skills and abilities that might otherwise go unpractised, while Nov et al. (2010b) use *self development* to mean participation for the opportunity to learn new things. Rafaeli et al. (2005) show strong motivators are: 'learning new things' and 'intellectual challenge'. Challenge ranked second highest (to human capital) in Hars and Ou's study on programmers. Franke and Shah (2003) note that challenge, mental stimulation, control, curiosity and fantasy are elements prevalent in innovation-related activities. Lakhani and Wolf (2005) also found that intellectual stimulation was a strong motivator for project participation among open source software developers. Nov's study on Wikipedia contributors found Understanding to be a motivation of average proliferation in their sample.

3.1.3 Career – participation that may lead to an advance in one's career

Career is intentionally defined here in a general manner to allow for personal interpretation. Clary et al. (1998) also defines career loosely: "career-related benefits …". This definition includes the statements (that volunteering): help(s) me get my foot in the door at a place I would like to work; make(s) new contacts that might help my business or career; allows me to explore different career options; will help me succeed in my chosen profession; experience will look good on my resume; and maintaining career-relevant skills. Nov (2007) defines career as: an opportunity to achieve job-related benefits such as preparing for a new career or maintaining career-relevant skills. A survey statement reflects this: "I can make new contacts that might help my business or career". Although Nov expected career to be a significant motivator due to the community signalling career-relevant skills, it was not found to rank highly. Findings in studies of open source software have been inconsistent as to whether career is an incentive. Hertel et al. (2003) find career is a strong motivation for open source developers to join a

community, but diminishes as they learn with time these expectations are not always easily met.

3.1.4 Social – the desire to have a shared experience with others

Clary et al. (1998) suggests individuals participate because friends participate or people close to them want them to participate. Nov (2007) suggests participation in Wikipedia is to allow people the chance to be with their friends. An example survey question reads: "people I'm close to want me to write/edit in Wikipedia". Many authors writing prior to the widespread emergence of the social web around the year 2006, take the view that real-world peers influence online participation. These social pressures are behind sites like Facebook, which rely on real-world relationships to build a network; however, there are social reasons other than peer pressure for which people may join an online community: such as the social support to develop a niche hobby, described in Ridings et al. (2002). A definition based on friendship may be why Nov found Socialto be a weak motivator of Wikipedians. Lampe et al. (2010) define social as maintaining interpersonal connectivity, social enhancement and social belonging and found the action of creating an account and becoming a member of an online community was preceded by social enhancement motivations and a feeling of importance to the community. According to social theory, the need for belonging to a specific community is strongly linked to enhancing personal identity and is a major reason why people seek out niche communities.

3.1.5 Fun – participation for entertainment, enjoyment, excitement, relief from other experiences, or simply furnishing or structuring the passage of time

Fun has almost consistently been found to be one of the strongest motivators in studies of online contributions for: online photo sharing (Nov et al., 2010b); product development (Franke and Shah, 2003); Wikipedia (Rafaeli et al., 2005); and online innovation communities (Antikainen and Väätäjä, 2008). Hars and Ou (2002) grouped 'fun' and 'enjoyment' with other intrinsic motivations but found that external factors had a greater weight in their study of open source software developers. Frey et al. (2011) found that enjoyment had a positive and significant correlation with the number of contributions made.

3.1.6 Reward – to receive tangible returns such as money, points in a game, a gift or voucher

Rafaeli et al. (2007) found that higher-paid and better-tipped responders on Google Answers were more likely to participate and contribute, but later (Rafaeli and Ariel, 2008) found this effect was mitigated by social factors. Lakhani and Wolf (2005) also show that paid contributors in open source software development dedicated more time to projects than volunteers and that being paid and feeling creative had a positive impact on effort. This goes against findings by Deci (1975), Thompson et al. (2002) and Rafaeli and Ariel (2008) that show extrinsic rewards have a negative impact on intrinsic motivations and therefore users who were never offered extrinsic rewards were more self-motivated; for example, Shaw et al. (2011) found that workers on a paid website were not motivated by financial rewards.

3.1.7 Recognition – to receive private or public acknowledgement

Recognition can take the form of enhancing one's reputation within a community, as reflected in a survey statement by Nov et al. (2010b): I post [photos]… to improve my reputation in the Flickr community; and Roberts et al. (2006): to enhance my reputation in the [open source software] community. The latter hypothesised that conflict existed between intrinsic motivations to participate and the motivation to enhance reputation through performing work to increase status. Findings showed that status motivations enhanced intrinsic motivations rather than diminished them. It seems likely that as an individual forms closer social ties to their community, recognition by peers becomes a stronger motivator.

3.1.8 Requirement – participation in response to a wish or command expressed personally

Requirement elicits a response reflecting external pressures, such as a professor or boss requesting participation. Requirement contrasts incentives of online communities with individual employed to participate in design teams.

4 Survey analysis of a collective design community

An online survey was presented to a collective innovation community to explore motivation and participation styles. The survey included questions and statements about the eight motivation categories described above and participation styles based on the Preece and Schniederman (2009) reader to leader framework.

4.1 Participants and population size

The survey was presented to quirky.com participants: quirky.com is an online innovation platform for product design. The Quirky community consists of customers and casual visitors who browse the site, a core membership who help develop projects, and hired staffs who work in-house. The survey was administered on the Quirky forum where the core membership discusses issues relating to the projects.

Community success can be measured in terms of the number of online creative collaborations completed, as described by Luther et al. (2010). Quirky has a relatively high number of completed collaborative projects: one per week for over three years. The size of the quirky population is unknown. Information provided on the Quirky site at the time of writing[1] placed the number of active members at around 1,700 per day or 6,500 per week. Of the active member population, 50 members completed the survey ($N = 50$).

As with many surveys of a sociological nature, it is not always possible to obtain a large sample size from the population. Others have reported similarly small sample sizes, for example, two frequently cited research studies had a sample size of 49 (Antikainen and Väätäjä, 2008) and 79 (Hars and Ou, 2002). Engman (2011) addresses this common problem and provides a review of models for significance testing, concluding that reporting statistical significance has little value for sociological research and that survey research is particularly susceptible to the fallacy of applying significance tests to non-random samples. The data here has been reported in the context of an exploratory

study of online innovation communities and the findings report on results that are likely to be indicators of larger trends.

4.2 Survey method

Standardised questionnaires are a recognised methodology for assimilating responses about individuals' knowledge, beliefs, attitudes and behaviour in an objective manner. Surveys are the predominant method of assessing the motivations of online communities (see Hars and Ou, 2002; Hertel et al., 2003; Oreg and Nov, 2008; Ke and Zhang, 2010; Nov, 2007; Antin and Cheshire, 2010; Frey et al., 2011; Antikainen and Väätäjä, 2010; Nov et al., 2010b; Lampe et al., 2010).

A three-part questionnaire was advertised on Quirky's community forum. The survey was conducted online and responses were only recorded if all questions were completed. Statistical methods used to analyse the results involved calculating the mean and standard deviation of statements; collapsing five-point Likert responses to the categories of 'agree', 'neutral' and 'disagree'; reversing negatively scaled items; using pivot tables to cross-tabulate dimensions of the data; and creating a multinomial logistic model from the data to assess the relevance of particular statements on predicting the role of members according to the reader to leader framework. While statistical significance is difficult to establish, this article reports on a survey tool that is theoretically derived.

4.3 Survey design

The survey consisted of three sections, participation questions, interaction statements, and motivation statements.

The participation questions were designed to separate respondents into participant-types based on the reader-to-leader framework (Preece and Schneiderman, 2009). This first part to the survey comprised four questions relating to the usage of the site including:

1 frequency of contribution

2 number of hours spent on the site weekly

3 length of membership

4 primary use of the site.

The first two questions (frequency and hours spent on the site) were derived from the effort levels in a survey on open source programmers by Hars and Ou (2002) and were included to enable comparison between involvement level and participation style. The format for answers to the first three questions involved five grouped radio buttons with mutually exclusive answers. The fourth question was a self-assessment of the primary style of participation. Six categories were presented in a mutually exclusive drop-down bar. Their contents represented the six readers to leader participation styles:

a reader

b contributor

c regular contributor

d collaborator

e regular collaborator

f leader.

The interaction part of the survey comprised 28 statements. Participants were asked to indicate the extent to which they agreed or disagreed with each statement along a five-point Likert scale. The first 12 statements were derived from four participation styles: reader; contributor; collaborator and leader. The next 16 statements related to the eight motivations: two statements for each motivation, worded differently and spaced apart to allow for comparison and checking for reliability.

The eight categories of motivation were presented with their concise definitions (Maher et al., 2010), in addition to 16 other statements: two statements for each category. The 1st of these paired statements assessed whether the respondent originally joined the site for the named motivation while the 2nd statement assessed whether they continued to participate for that same reason. A five-point Likert scale was used to describe responses.

5 Results

The survey collected a rich dataset, of which four areas were selected for analysis: 5.1 describes the characteristics of the population and gives an impression of site usage; 5.2 identifies which motivation categories were significant in the sampled population; 5.3 shows changes in motivation over time; and 5.4 describes the results and an interpretation of the questions about participant type according to the Reader to Leader framework.

5.1 Characterising the sample population

Half the sampled population had been participants on the site for over six months; and just over half (52%) spend between 5 and 20 hours per week on the site. On average, the more recently a member had joined, the less time they spent on the site per week compared to long-standing members.

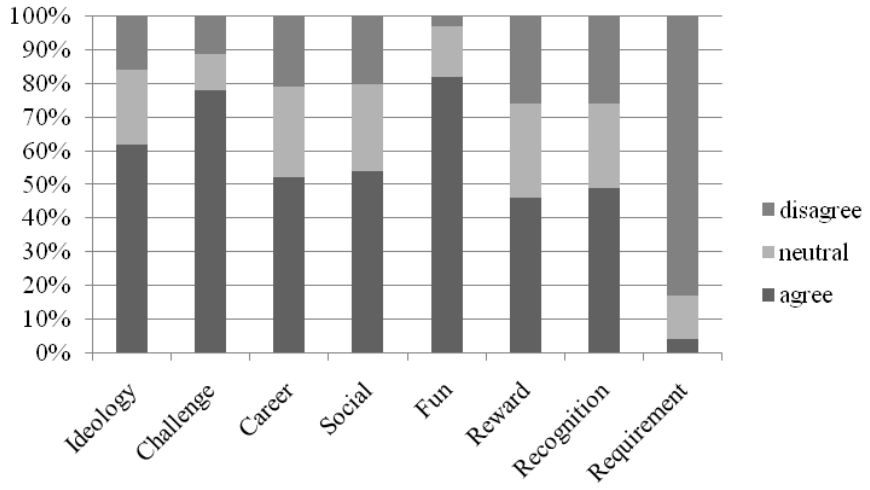
To determine which respondents had high engagement, the rate of contribution was cross-tabulated with hours spent participating per week. Over half of the community sampled (56%), spends over five hours on the site per week, posting at least once a day.

Generally, there was a high level of agreement for the statement "I feel passionate about the site/projects" across participant types, except where membership was between one to six months.

5.2 Analysis of self-reported reasons for participating

A comparison of responses to motivation categories are shown in Figure 1. The data in Figure 1 was calculated by averaging the responses for the two interaction statement questions for each motivation and the related self-assessment question for the current reason for participating. To compare Likert value responses, 5 (strongly agree) and 4 (agree) were grouped to provide a measure of agreement in the sample. Similarly, 1 (strongly disagree) and 2 (disagree) were grouped to provide a measure of disagreement in the sample.

Figure 1 Comparing responses to motivations



Responses to motivation categories showed the highest agreement is 'Fun' with 82% of the sample population. The second highest is 'Challenge' with 78% of the sample population. The third highest is 'Ideology' with 62%. By far the lowest, at only 4% is the 'Requirement' category.

The highest agreement lies in the interaction statement that relates to the motivation of fun: *contributing to this site/project is fun*. 86% agreed, 6% disagreed and 8% remained neutral to the statement. The second highest set of agreement lies in the interaction statement relating to challenge: *participating in the site/project gives me a feeling of competence*. 82% agreed, 8% disagreed, 10% were neutral. The third highest was for career: *experience from this site/project helps me improve my skills*: 78% agreed, 8% disagreed, 12% were neutral.

Analysis of each motivation for participation is presented in Table 1. Table 1 compares responses for the sample population and the 30% of the population who are long-standing, frequent users. Participation for Fun scored the highest (mean = 3.97 and 4.09) and this consistency was reflected in the standard deviation (SD = .815 and .733). Challenge also rated highly (mean = 3.73 and 4), particularly amongst long standing frequent users (SD = 0.962 and 0.853). Contrasting, but of equal interest is the self-reported requirement motivation, which has the lowest means (mean = 1.57 and 1.22) and lowest standard deviations (SD = .849 and .517). This shows requirement was not a strongly motivating factor for the population, however the low standard deviation for long standing frequent users suggest some members of this subset of the population found requirement to be a strong reason for participation. Long-standing frequent users were found to differ from the sample population in the levels of agreement of their motivations; they have a higher agreement for all categories except career and requirement. Recognition has a mean of 3.82 (SD = 0.614) compared to the population mean of 3.32 (SD = 1.012).

Table 1 Analysis of user's reasons for participating

	Sampled population		*Long-standing, frequent users*[1]	
	Mean	*SD*	*Mean*	*SD*
Ideology	3.25	0.130	3.64	0.883
Challenge	*3.73*	*0.962*	*4*	*0.853*
Career	3.31	1.123	3.22	1.085
Social	3.41	0.950	3.6	0.863
Fun	*3.97*	*0.815*	*4.09*	*0.733*
Reward	3.29	1.314	3.31	1.222
Recognition	*3.32*	*1.012*	*3.82*	*0.614*
Requirement	1.51	0.849	1.22	0.517

Note: [1]Those who joined over a year ago and contribute for ten or more hours a week.

5.3 Analysis of changing motivations over time

To determine whether motivations for participating in the site had changed since joining, members were asked to rate eight motivations at the time of completing the survey and to reflect on their motivations when joining the site. Likert responses were compared in order to measure whether there was a loss, gain or no change in reported motivation levels; see Table 2. A reported loss in motivation does not necessarily mean individuals have completely lost that motivation since the calculation includes a move from 'strongly agreed' (a 5 on the scale) to 'agreed' (4), from 'neutral' (3) to a 'disagree' (2), or from 'disagree' (2) to 'strongly disagree' (1).

Table 2 Percentage of members reporting loss, gain and no change in motivation since joining

Length of membership	*% of members*	*Ideology*	*Challenge*	*Career*	*Social*	*Fun*	*Reward*	*Recognition*	*Requirement*
< 6 months	Loss	20	16	8	32	24	24	28	24
	Gain	12	24	24	8	24	8	12	8
	No change	64	40	64	52	40	48	36	60
> 6 months	Loss	28	12	20	68	24	44	12	16
	Gain	24	52	36	16	36	16	32	8
	No change	48	36	44	16	40	40	56	76

The values in Table 2 can be expressed as a loss to gain ratio. Table 2 indicates that for the segment of the community with a membership under six months, the greatest gain is for career at 8:24 (1:3), meaning that even though some members did not report that career was a strong motivation at the time of joining, they reported it had gained. Reward

and requirement motivations have an inverse effect with a loss to gain ratio of 3:1. In this case, individuals may have joined with the expectation that they would earn significant money, only to find those expectations were not met, or perhaps found that over time their motivation based on reward and requirement had decreased. The largest loss is for the social motivation at 4:1, indicating that although members may have joined for social reasons, it did not remain a strong motivation.

For those with a membership over six months, the greatest loss to gain ratio is for the social motivation at 17:4, followed by reward at 11:4. This reflects similar trends for members under six months. The largest gain is for challenge at 3:13, followed by recognition at 3:8. This suggests long-standing members are likely to be motivated by the feeling of competence, accomplishment and of being noticed for their efforts.

The previous Section 5.2 described fun as the most significant motivation across the population. That this motivation does not show marked losses or gains indicates it is a fairly stable motivator that remains important to members regardless of their length of membership. Ideology remained a mostly stable motivation with 64% of members with memberships under six months and 48% of members with memberships over six months reporting no change.

A summary of lost motivations and gained motivations is shown in Table 3. This differs to Table 2 as the responses were polarised before being translated into the table format. Responses involving a neutral selection were discounted as they may reflect individuals who were undecided or unsure about how they felt. Only those responses that crossed over from a 1 or 2 (disagreed) to a 4 or 5 (agreed), or vice versa, were included.

Table 3 Lost and gained motivations for length of membership

Length of membership	*%*	*Ideology*	*Challenge*	*Career*	*Social*	*Fun*	*Reward*	*Recognition*	*Requirement*
< 6 months	Lost	4	8	4	8	0	16	12	8
	Gained	4	12	24	8	16	4	8	8
> 6 months	Lost	12	8	0	24	4	16	0	0
	Gained	8	20	12	4	12	4	0	0

Table 3 indicates that regardless of the length of membership, the community gained more than they lost of the motivations for challenge, career and to a lesser extent, fun. This suggests the three motivations may not have been seen as important at the time of joining by a proportion of the population, but were later found to have become important.

Almost a quarter of the population over six months, at 24%, lost the social incentives. This finding is heightened when compared with Table 2, which shows 68% reported some decrease in Social motivation. Considering Quirky emphasises its social nature across the site and even in the website title ‘quirky | social product development’, this decrease shows members’ expectations about social incentives suffered a dramatic drop over time.

5.4 Defining participation by participation types – assessing the reader to leader framework

The reader to leader framework (Preece and Shneiderman, 2009) consists of four distinct participation types: reader, contributor, collaborator and leader. When presented with the survey, subjects were asked to self-nominate a participation type. Their answers to the subsequent 12 interactions statements were compared to assess the ability of those questions in capturing the type of participation.

A discrete choice model with ordered logistic regression revealed which questions had power to predict self-reported user type. The sampled population consisted of 2% readers, 42% collaborators, 52% contributors and 4% leaders. Of the 46 statements put to participants, the statements with power to predict self-reported user type are:

- I notice when certain members post on different forums or comment.
- I recognise a useful forum post or comment when I see one.
- I become engaged in discussion and follow up on my posts.
- I sometimes make friendly, social comments that do not strictly relate to the project.
- I encourage people to participate and mediate disputes.
- I like to sum up the points raised on a forum in my own post.
- I like to contribute to what I think is a noble cause.
- I deeply enjoy helping others - even if I have to make sacrifices.
- I originally joined this site for ideological reasons.
- Participating in the site/project gives me a feeling of accomplishment.
- Participating in the site/project gives me a feeling of competence.
- I continue to participate to be challenged.
- Experience from this site/project helps me improve my skills.
- I originally joined this site for social reasons.
- I continue to participate so I can make money from it.
- How many hours a week do you spend on this site/project?

6 Analysis and discussion

An analysis of the results considers:

1 user types

2 strength of incentives

3 changes in motivation over time.

Those who responded to the survey were core members of the community; the vast majority identified with either the contributor or collaborator user type. Regression analysis showed two of the three statements used by Preece and Schneiderman (2009) to describe readers applied more generally to this community. They were:

a I notice when certain members post on different forums or comment.

b I recognise a useful forum post or comment when I see one.

These statements are not unique to Quirky readers, as most contributors and collaborators also notice forum progress during participation.

Leaders were described as: promoting participation, taking responsibility when problems occur, mediating disputes, upholding policies and dealing with legal challenges (Preece and Schneiderman, 2009). Quirky provides a hybrid design process where many aspects of Leadership are addressed by the site and do not require members to adopt the role.

Preece and Schneiderman (2009) describe leaders as having a coherent online identity that usually matches their real identity, however, it was observed on the forums that most members used their real names on the site. Disclosure of identity is less likely to be a feature of leader user types and more a reflection on the changing nature of online participation. Definitions of normative privacy are changing; where in the past people preferred anonymity and created aliases, now disparate services are unified under one identity such as a Facebook or Google account. Quirky offers users the option of signing in from Facebook, which has its own measures in place to encourage people to use a single, consistent and 'real' identity. Sites adopt this method of facilitating user accounts to avoid the vandalism, bullying and inappropriate communication that often accompanies anonymous membership. Working under a real identity means online contributions can count toward real world opportunities, for example, experience gained online could be used towards a job application, and career motivations would have greater significance.

Results indicate the strongest motivation is fun with 82% of the sampled population motivated by this category. This supports other findings, i.e., a study of Wikipedians found fun and ideology ranked highest (Nov, 2007); a study of three open innovation communities showed challenge and fun ranked highest (Antikainen and Väätäjä, 2008). In this study, fun appeared to remain stable throughout membership and was rarely a lost motivation.

Despite the strength of fun, over-emphasis on this incentive can severely limit participation (Wang and Fesenmaier, 2001). A significant proportion of the population participated for a sense of achievement through acquiring knowledge or skill (challenge); for the purpose of contributing to a larger cause (ideology); and because it may lead to an advance in their career (career). Antikainen and Väätäjä (2008) propose that multiple and varying types of motivation are required to attract and commit people to participate, as members may have multiple, simultaneous goals behind participating.

Collective design differs from team design in that members generally participate of their own volition. Despite this, there were a small number of users (6%) who felt they were required to participate. The statements did not clarify whether requirement was extrinsic (e.g., a friend asking them to support their idea) or intrinsic (e.g., if they viewed their participation as crucial to an ongoing project).

The results indicate intrinsic motivations (challenge, fun, recognition, and ideology) were more highly rated than extrinsic motivations (career, reward, and requirement). Hars and Ou's (2002) study on open source software programmers also showed internal motivations rated highly. Cultures of participation, such as Quirky, are described as relying on intrinsic motivations, e.g., the sense and experience of joint creativity, common purpose and mutual support (Fischer, 2011). In Deci (1975) and Lepper et al. (1973) extrinsic motivations were shown to produce a detrimental effect: subjects paid to play with a puzzle later played with it less and reported less interest than those without the financial incentive. Performance was worst when the reward was insubstantial, even worse than when no reward was offered. This is because insufficient extrinsic motivation overrides the effects of the task's intrinsic incentives (Gneezy and Rustichini, 2000). It appears likely that focusing on how paltry the reward is in relation to the effort expended, shifts focus away from intrinsic motivations such as the enjoyment of feeling challenged or having fun completing the task. In an experiment on Amazon Mechanical Turkers, task accuracy was higher when work was produced for a low financial return when that work was said to be for a non-profit organisation (Rogstadius et al., 2011). It appears likely that contextualising the work as non-profit appealed to users' internal, ideological motivations. The data reported in Table 2 revealed ideology was a stable motivation that did not show much loss or gain over time.

Motivation has been described as involving self-regulation of interest in a task by using internal motivations to boost external motivations and *vice versa* in a continuous cycle (Sansone and Smith, 2000). When reported motivations at the time of joining were compared with current motivations, losses was mostly revealed in extrinsic motivations, indicating that extrinsic reasons for joining were not as durable as intrinsic reasons. Although extrinsic motivations may be the reason individuals decide to *participate* in task, it may not be the reason they *engage* with a task. While a site may initially appeal to external motivations such as Reward, it may more easily convince visitors to join; however, early experiences of participation may appeal more to intrinsic motivations and override extrinsic ones, thus promoting continued participation.

The Quirky site offers members a variety of rewards for participation. The most heavily promoted incentive is financial reward, which is tied to the percentage of influence a member gains across projects. The total influence across the site is shown in the members' profile and summarised in a report showing available reward balance and points earned. Members with influence are depicted on each project page, which promotes a sense of co-ownership of the product (potentially reinforcing many motivations, particularly recognition). High earners are featured prominently on the site along with their income, which can act to reinforce their recognition motivation. This can also serve to inform other members of what is possible to achieve and motivate them to achieve greater recognition. Despite the overt emphasis on financial incentives, the 'Reward' motivation had the greatest discrepancy in responses (highest standard deviation of 1.240). It is proposed that offering a combination of monetary and non-monetary incentives may improve the degree of engagement involved with participation. Non-monetary incentives include praise, attention, grades, prizes, awards, honour-roll lists, public recognition and privileges (Antikainen and Väätäjä, 2010). In this study recognition (the desire to receive private or public acknowledgement) has been separated from reward (she desire to receive tangible rewards including money, points in a game, a gift or voucher). Almost half the population was motivated by recognition.

The greatest changes in motivation were for: challenge, career and fun which increased; and social and reward which decreased. Walker et al. (2010) described what they call the socio-cultural influence on motivation, suggesting the community has an effect on shaping individual incentives over time. Members might have reported changes in motivation because of the evolving socio-cultural context.

The primary reason for joining Quirky was social: the desire to have shared experiences with others. Over the course of participation the self-reported rating of this incentive decreased for most members. Members may have reported a decrease because the incentive was satisfied by the system and no longer represented a desired outcome.

Results indicate that long-standing members spent more time on the site per week than members who joined recently. This is particularly interesting because it can suggest two things: either members' participation rates increase over time, or individuals with lower participation rates cease their involvement over time. Long-standing members were particularly motivated by challenge and recognition. The meritocratic nature of online communities means individuals are initially given equal opportunities to demonstrate merit and treated accordingly. Public recognition for past work is a mechanism for establishing credibility, giving weight to future contributions and respect by others – forming a reputation economy to advance capable individuals. Results suggest challenge and recognition were not strong reasons for joining the site, but developed sometime during membership. Online collective innovation sites can reinforce Recognition through mechanisms such as visualisations of member status, badges and special privileges. Complexities of design problems provide the mental engagement required for challenge. Quirky members can work across a range of product designs, each presenting unique problems to overcome.

Online participation is not evenly distributed through a network. It has been found to reflect power laws such as Pareto distribution and Zipf's law of participation in an online community (see Rafaeli and Ariel, 2008; for examples). Quirky members had an uneven distribution for participation with 18% of members contributing the most often at over 20 hours a week, once a day or more. Members involved for under a month (new members) and those involved for over six months (long standing members) were more likely to report feeling passionate about the site/project than those between one and six months. It appears likely that the fluctuation in passion for the site between one and six months could arise because:

1 many new members are still experiencing their initial enthusiasm and willingness to 'make a go' of the site
2 the period between one and six months is where members' experience and familiarity with the site grows and where potentially many members abandon the site
3 while many long-standing members have motivations that align or have realigned towards the motivations supported by the system.

This hypothesis warrants further investigation to determine whether there is a window of opportunity when systems can boost and broaden their appeal to users in order to maintain and grow patronage.

7 Conclusions and significance

This paper presents eight categories of motivation for participants in online innovation communities. These categories formed the basis for a survey of participants in Quirky, an online, crowdsourced, product design organisation. The results of this survey, along with recent publications on motivation in online communities, lead to two main conclusions: The first conclusion, consistent with earlier studies, is that online communities are substantially driven by the intrinsic motivations such as fun and challenge (see Nov, 2007; for example). Extrinsic motivation, such as rewards, are a common first resort, to attract attention and to achieve quick results. This study shows that intrinsic motivators such as fun, challenge and social can be effective in sustaining long term user involvement. The second conclusion is that the strength of particular motivations is highly variable, from one to another and over time. Members of the community are more passionate about their participation when they are new to the site and when they are long standing members; however, positive responses to a statement about passion dropped between one and six months after joining. It also appears that individuals re-prioritise motivating factors at different times based on how well they are satisfied.

Considered together, the two conclusions lead to the proposal of the following design principles for encouraging individuals to join and to retain long-term engagement in online communities:

- aim to satisfy a range of motivations rather than any one in particular.
- avoid promoting extrinsic motivations, such as material reward, as the only reason for people to join or participate
- provide and promote intrinsic motivations, such as fun and challenge generally, starting with individuals yet to join, and continuing throughout membership
- consider the deployment of unexpected extrinsic rewards, such as prizes or bonuses, to stimulate interest
- utilise opportunities to facilitate and strengthen social ties, thereby adding incentives for participation
- regularly assess and fine-tune the motivational approach, being sensitive to changes between deciding to join, the first six-month of membership and longer term participation

This study serves as a gateway for framing further research on motivating collective innovation communities. Future research can augment and extend these findings by the following initiatives:

- Further exploration of the ability to predict participation styles, with a view to achieving greater and more explicit predictive capability.
- Seeking a more detailed understanding of the roles members assume, their contributions to the design process and how motivations may differ between participant types.

- The implementation of a longitudinal study, of data collected at multiple points in time, could reveal changes of motivations for participation over time, more accurately than subjects' long term recollections of earlier motives.
- Insights from this research can be used as a basis for both commercial and academic studies. For example, site developers or administrators may choose to employ or further develop the survey described here to assess the strengths, weaknesses of their platform model and its interactions with their community.

Acknowledgements

The authors would like to thank Danielle Merrett for her help with the data modelling.

References

Antikainen, M. and Väätäjä, H. (2008) 'Innovating is fun: motivations to participate in online open innovation communities', in Huizingh, K.R.E., Torkkeli, M., Conn, S. and Bitran, I. (Eds.): *Proceedings of the First ISPIM Innovation Symposium Singapore: Managing Innovation in a Connected World*, Singapore, 14–17 December.

Antikainen, M. and Väätäjä, H. (2010) 'Rewarding in open innovation communities – how to motivate members', *Int. Journal of Entrepreneurship and Innovation Management (IJEIM)*, Vol. 11, No. 4, pp.440–456.

Antin, J. and Cheshire, C. (2010) 'Readers are not free-riders: reading as a form of participation on Wikipedia', in *Proceedings of the ACM 2009 Conference on Computer Supported Cooperative Work*, Savannah, GA.

Antoniadis, P. and Le Grand, B. (2009) 'Self-organised virtual communities: bridging the gap between web-based communities and P2P systems', *Int. J. Web Based Communities*, Vol. 5, No. 2, pp.179–194.

Bitzer, J., Schrettl, W. and Schröder, P.J.H. (2007) 'Intrinsic motivation in open source software development', *Journal of Comparative Economics*, Vol. 35, pp.160–169.

Clary, E., Snyder, M., Ridge, R., Copeland, J., Stukas, A., Haugen, J. and Miene, P. (1998) 'Understanding and assessing the motivations of volunteers: a functional approach', *J. Personality and Social Psychology*, Vol. 74, No. 6, pp.1516–1530.

Deci, E. (1975) *Intrinsic Motivation*, Plenum Press, New York.

Deci, E.L. and Ryan, R.M. (1985) *Intrinsic Motivation and Self-Determination in Human Behavior*, Plenum, New York.

Engman, A. (2011) 'Is there life after $P < 0.05$? Statistical significance and quantitative sociology', *Qual. Quant.*, pp.1–14, Springer, Netherlands.

Fischer, G. (2011) 'Understanding, fostering and supporting cultures of participation', *ACM Interactions*, Vol. 18, No. 3, pp.42–53.

Franke, N. and Shah, S. (2003) 'How communities support innovative activities: an exploration of assistance and sharing among end-users', *Research Policy*, Vol. 32, pp.157–178.

Frey, K., Haag, S. and Schneider, V. (2011) 'The role of interests, abilities, and motivation in online idea contests', *Wirtschaftinformatik Proceedings 2011*, paper 71.

Gneezy, U. and Rustichini, A. (2000) 'Pay enough or don't pay at all', *The Quarterly Journal of Economics*, Vol. 115, pp.791–810, MIT Press.

Hars, A. and Ou, S. (2002) 'Working for free? Motivations of participating in open source projects', *Intern. J. of E-Commerce*, Vol. 6, No. 3, pp.25–39.

Hertel, G., Niedner, S. and Herrmann, S. (2003) 'Motivation of software developers in open source projects: an internet-based survey of contributors to the Linux Kernel', *Research Policy*, Vol. 32, No. 7, pp.1159–1177.

Ke, W. and Zhang, P. (2010) 'The effects of extrinsic motivations and satisfaction in open source software development', *Journal of the Association for Information Systems*, December, Vol. 11, No. 12, pp.704–808.

Kollock, P. (1999) 'The economics of online cooperation: gifts and public goods in cyberspace', in Smith, M. and Kollock, P. (Eds.): *Communities in Cyberspace*, Routledge, London.

Kosonen, M. (2009) 'Knowledge sharing in virtual communities – a review of the empirical research', *Int. J. Web Based Communities*, Vol. 5, No. 2, pp.144–163.

Lakhani, K. and Wolf, R. (2005) 'Why hackers do what they do: understanding motivation and effort in free/open source software projects', in Feller, J., Fitzgerald, B., Hissam, S. and Lakhani, K. (Eds.): *Perspectives in Free and Open Source Software*, MIT Press, Cambridge and London.

Lakhani, K. and Wolf, R.G. (2003) *Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects*, MIT Sloan Working Paper No. 4425-03 [online] http://dx.doi.org/10.2139/ssrn.443040 (accessed March 2012).

Lampe, C., Wash, R., Velasquez, A. and Ozkaya, E. (2010) 'Motivations to participate in online communities', *CHI 2010*, Atlanta, Georgia, USA, 10–15 April, pp.1927–1936.

Lepper, M.R., Greene, D. and Nisbett, R.E. (1973) 'Undermining children's intrinsic interest with extrinsic: a test of the 'overjustification' hypothesis', *J. of Personality and Social Psychology*, Vol. 28, No. 1, pp.129–137.

Luther, K., Caine, K., Ziegler, K. and Bruckman, A. (2010) 'Why it works (when it works): success factors in online creative collaboration', *GROUP'10 Proceedings of the ACM Conference on Supporting Group Work*, ACM Press, New York, pp.1–10.

Maher, M.L., Paulini, M. and Murty, P. (2010) 'Scaling up: from individual design to collaborative design to collective design', in Gero, J.S. (Ed.): *Design Computing and Cognition '10*, pp.581–600, Springer.

Malone, T.W., Laubacher, R., and Dellarocas, C. (2009) *Harnessing Crowds: Mapping the Genome of Collective Intelligence*, MIT Sloan School Working paper 4732-09 [online] http://ssrn.com/abstract=1381502 (accessed January 2010).

Nov, O. (2007) 'What motivates Wikipedians?', *Communications of the ACM*, Vol. 50, No. 11, pp.60–64.

Nov, O., Anderson, D. and Arazy, O. (2010a) 'Volunteer computing: a model of factors determining contribution to community-based scientific research', *Proceedings of the 19th International World Wide Web Conference (WWW 2010)*, Raleigh, NC.

Nov, O., Naaman, M. and Ye, C. (2010b) 'Analysis of participation in an online photo sharing community: a multi-dimension perspective', *Journal of the American Society for Information Science and Technology*, Vol. 61, No. 3, pp.555–566.

Oreg, S. and Nov, O. (2008) 'Exploring motivations for contributing to open source initiatives: the roles of contribution context and personal values', *Computers in Human Behaviour*, Vol. 24, pp.2055–2073.

Preece, J. and Schneiderman, B. (2009) 'The reader-to-leader framework: motivating technology-mediated social participation', *AIS Transactions on Human-Computer Interaction*, Vol. 1, No. 1, pp.13–32.

Rafaeli, S. and Ariel, Y. (2008) 'Online motivational factors: Incentives for participation and contribution in Wikipedia', in Barak, A. (Ed.): *Psychological Aspects of Cyberspace: Theory, Research, Applications*, Cambridge University Press, Cambridge, UK.

Rafaeli, S., Ariel, Y. and Hayat, T. (2005) 'Wikipedia community: users' motivations and knowledge building', Presented at *Cyberculture 3rd Global Conference*, Prague, Czech Republic.

Rafaeli, S., Raban, D.R. and Ravid, G. (2007) 'How social motivation enhances economic activity and incentives in the Google Answers knowledge sharing market', *International Journal of Knowledge and Learning*, Vol. 3, pp.1–11.

Rheingold, H. (1993) *The Virtual Community* [online] http://www.rheingold.com/vc/book (accessed March 2012).

Ridings, C., Gefen, D. and Arinze, B. (2002) 'Some antecedents and effects of trust in virtual communities', *Journal of Strategic Information Systems*, Vol. 11, No. 3–4, pp.271–295.

Roberts, J.A., Hann, I-H. and Slaughter, S.A. (2006) 'Understanding the motivations, participation and performance of open source software developers: a longitudinal study of the Apache projects', *Management Science*, Vol. 52, No. 7, pp.984–999.

Rogstadius, J., Kostakos, V., Kittur, A., Smus, B., Laredo, J. and Vokovic, M. (2011) 'An assessment of intrinsic and extrinsic motivation on task performance in crowdsourcing markets', in *ICWSM*, The AAAI Press.

Sansone, C. and Smith, J.L. (2000) 'Interest and self-regulation: the relation between having to and wanting to', in Sansone, C. and Harackiewicz, J.M. (Eds.): *Intrinsic and Extrinsic Motivation*, pp.341–372, Academic Press, San Diego, CA.

Shaw, A.D., Horton, J.J. and Chen, D.L. (2011) 'Designing incentives for inexpert human raters', *CSCW '11*, pp.275–284.

Stafford, T.F. (2008) 'Social and usage-process motivations for consumer internet access', *Journal of Organizational and End User Computing*, Vol. 20, No. 3, pp.1–21.

Thompson, L.F., Meriac, J.P. and Cope, J.G. (2002) 'Motivating online performance: the influences of goal setting and Internet self-efficacy', *Social Science Computer Review*, Vol. 20, No. 2, pp.149–160.

Walker, R., Pressick-Kilborn, K., Sainsbury, E. and MacCallum, J. (2010) 'A sociocultural approach to motivation: a long time coming but here at last', in Urdan, T. and Karabenick, S. (Eds.): *Advances in Motivation and Achievement: The Next Decade of Research in Motivation and Achievement*, Vol 16b, pp.1–42, Emerald Group Publishing Ltd., Bingley, UK.

Wang, Y. and Fesenmaier, D.R. (2001) 'Assessing motivation of contribution in online communities: an empirical investigation of an online travel community', *Electronic Markets*, Vol. 13, No. 1, pp.33–45.

Ye, Y. and Kishida, K. (2003) 'Toward an understanding of the motivations of open source software developers', in *Proceedings of the 25th International Conference on Software Engineering*, pp.419–429.

Zhang, M. and Feng, Z. (2006) 'Intrinsic motivation of open content contributions: the case of Wikipedia', *Workshop on Information Systems and Economics (WISE)*, Chicago, Illinois.

Notes

1 Figure taken from the site's forum: http://aquirkyblog.com/2011/10/community-liaison-report-6/There is no precise record publicly available.