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Examining the dominating contributors in the mass collaboration of Wikipedia

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The 19th ITS Biennial Conference 2012

“Moving Forward with Future Technologies: Opening a Platform for All”

18 - 21 November 2012, Thailand

**Examining the dominating contributors in
the mass collaboration of Wikipedia**

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Introduction

The mass collaborative environment on the Internet is currently undergoing a rapidly developing yet critical period. Wikipedia, as one of the successful cases of mass collaboration, has been a topic of discussion for its innovative product generated by millions of participants. An illustration of its innovation is its policy that every article can be edited freely by anyone, without censor and immediately visible to the public after the edit. From this perspective, the participation in Wikipedia has been referred to as “mass collaboration” (Tapscott and Williams, 2006).

The distinctive attraction of Wikipedia lies in its openness to all participants and empowering them with the equal right to change the content and even direction. In keeping with such a philosophy, the policy reads “If a rule prevents you from improving or maintaining Wikipedia, ignore it”¹ and all changes in the rules have to be agreed upon by consensus. The openness of Wikipedia’s edit policy fostered a nourishing environment for the articles in Wikipedia to grow exponentially since its establishment. Given the success of Wikipedia, an interesting but basic questions that what the power distribution among participants is will be asked: does Wikipedia have leading participants? Does every participant share equal right to affect the content of Wikipedia? Does every participant contribute equally in Wikipedia?

In this paper, we want to define who the dominating participants are if they exist by examining the distribution of input towards the final products in Wikipedia. Such finding can clarify the power distribution in Wikipedia, can find the most powerful group in Wikipedia. More importantly, such finding can help us to measure the democratic organization in Wikipedia. Based on data from the last decade, participants are assigned to different groups in order to illustrate the pattern of distribution in Wikipedia. We divide participants in different groups by accounting for their number of edits and their administration status. Data visualization shows that different groups own their distinct trend from 2001 to 2010, and display some shift in their occupied percentage of edits. Finally, we summarise the shift hypothesis and discuss who dominates Wikipedia based on the number of edits, which is a quantitative measure of their contribution.

The related research

¹ http://en.wikipedia.org/wiki/Wikipedia:What_%22Ignore_all_rules%22_means

In the past decade, Wikipedia has experienced a rapid growth rate, which was believed to be a result of “mass collaboration” (Tapscott and Williams, 2006) from millions of volunteers. Researchers have not only recognized the overall importance of mass collaboration, but have also investigated mass collaboration from different angles (Benkler, 2006, Surowiecki, 2004, Tapscott and Williams, 2006). The point of “mass collaboration” (Tapscott and Williams, 2006) or “wisdom of crowd” (Surowiecki, 2004) has been considered controversial by experienced Wikipedia participants, which emphasize the power from collaboration by crowd and indicate the interesting question of the organizational model. Basically, there is the correlation between the quality of products created by “crowd” and the amount of such “crowd”. The quality of mass collaboration was defined by the number of participants in some studies (Kittur et al., 2008, Kittur and Kraut, 2010, Kittur et al., 2009). Such correlation has been further noted as the primary characteristic of Wikipedia – mass collaboration, and also referred to as “the wisdom of mobs”, and “swarm intelligence”, which describes the process whereby millions of individual users each make contributions and out of this emerges a coherent body of work (Swartz, 2004). Although the amount of participants in mass collaboration has been researched, the organizational model of how such participants work together need more examination.

The freedom and the collaborative mode of participation in Wikipedia has sparked intense scholarly interest, because it not only demonstrates that Wikipedia has created a new means of working together (Surowiecki, 2004), but more significantly, it indicates that this model may dismiss the necessity of authority or expertise (Hippel, 2006). If all participants work at the same level, and the number of participants directly defines the outcome of the project, this would overthrow the traditional organizational structure, which relies on authority and specialists for quality control. If such a hypothesis is true, mass collaboration may present a new model of working organization where the quantity of participants could directly affect the quality of products.

Wikipedia claims that all participants are equal on the platform (Ayer, 2008, p.57). According to Wikipedia’s policy, the openness and freedom of participation is the primary factor which fostered its speedy development (Almeida et al., 2007, Arazy et al., 2006, Reagle, 2010). Such a strategy of offering everyone including anonymous participants equal rights to edit has been questioned by many studies (Denning et al., 2005, Sanger, 2009), but it has also been confirmed by others to be a most useful and

valuable working mechanism (Anthony, 2005; Surowiecky, 2005). In fact, these studies not only advocate the equal rights editing policy, but they also suggest that every participant in this mechanism should be offered the equal right to influence the final product, which defines the basic principle of mass collaboration.

However, the different opinion came from Jimmy Wales, the founder of Wikipedia. He claimed on his blog that the majority of the total contributions to Wikipedia came from a small group of participants, citing the statistics from December 2004, which showed that 2.5% of the registered participants on the site made half of the total edits (Wales, 2005b). Based on this result, Wikipedia has developed tools and features to meet the demand of this small group of people (Reagle, 2010).

This argument has been developed by Kittur et al by the “shift” theory (Kittur et al., 2007a). Their study claimed that the small group of participants who made the majority of the edits was replaced by an increasing number of participants who each made only a small number of edits in the certain time point. His study indicated a shift where the outcome of a marked growth of low-edit-number participants is better than an effect of high-edit participants leaving or reducing their activities. However, there are a number of concerns regarding to the data that this study is based on. This might bring in questions on the accuracy of their results and consequently the justness of the “shift” theory. The test database came from the history dumps generated on 2nd July 2006, which could be considered small, especially given Wikipedia’s growth. In his work, Kittur claimed that there was a shift in 2004 where the “crowd” contributors took over editing the majority of the content in Wikipedia from the “elites” to the “crowd” contributors. However such a conclusion is debatable since the basis of their analysis came from only six years of data culminating in the middle of 2006. Thus, their claim that such a trajectory will continue in the future bears even more questions. Nevertheless, this research was the first study to discover the possible shift of dominating participants and the first time to use the amount of edits to identify the “important contributors”, which we learnt from.

Based on the knowledge from previous literature, this paper aims to clarify whether the distribution of contribution changed in the course of the development of Wikipedia. Is it possible that Wikipedia has already become a more decentralized system where the majority of the content is contributed by a majority of participants instead of the established power law? If such a prediction could be validated, we

could further prove that the development of Wikipedia is based on mass collaboration; we would extend our knowledge in mass collaboration, and other web 2.0 applications.

Method

The data used in this research was generated from the free data dump “stub-meta-history” on 11th October 2010. The size of data is 13.8GB with 13% compression. This data set was imported into the Oracle 11 database management system for processing and analysis. The data set consists of information on every edit, including the edit time, the user ID of the editor and a summary of the content. In other words, we are able to inspect individual edit behaviour over time. The original data set includes 359,407,803 cases in total, among which 272,286,668 edits were created by 3,884,256 distinct registered participants and 87,121,135 edits were made anonymously. The first edit was made at 20:08 16th January 2001 and the last edit at 19:17, 11st October 2010. For the definition of administration in Wikipedia, we used the user status data dump downloaded from Wikipedia. From this data set, we collected the list of 1769 administrators.

Analysis

In order to evaluate who dominates Wikipedia in terms of participation, we will generate some graphical descriptions. The growth and fluctuation of the articles in Wikipedia illustrate that the change of contributions in Wikipedia is both dynamic and rapid. Based on this knowledge, we describe the percentage of contribution from different participant groups categorized by their number of edits. These results provide clues about who might dominate Wikipedia, and also address the question of whether Wikipedia is a process of mass collaboration or just a specific collaborative product made by a small group of elites. Finally, the section discusses whether the administration group has specific influence in editing Wikipedia.

Growth and fluctuation of Wikipedia

The number of articles in Wikipedia experienced a considerable growth, which demonstrates a great achievement of collaborative work. Figure 1 illustrates that the number of edits per month has been maintained at a steady level since it was first launched. From 2004 to 2007, this number experienced a sharp increase. In the years following 2007, the number maintained overall with some fluctuations of 5,000,000 edits per month.

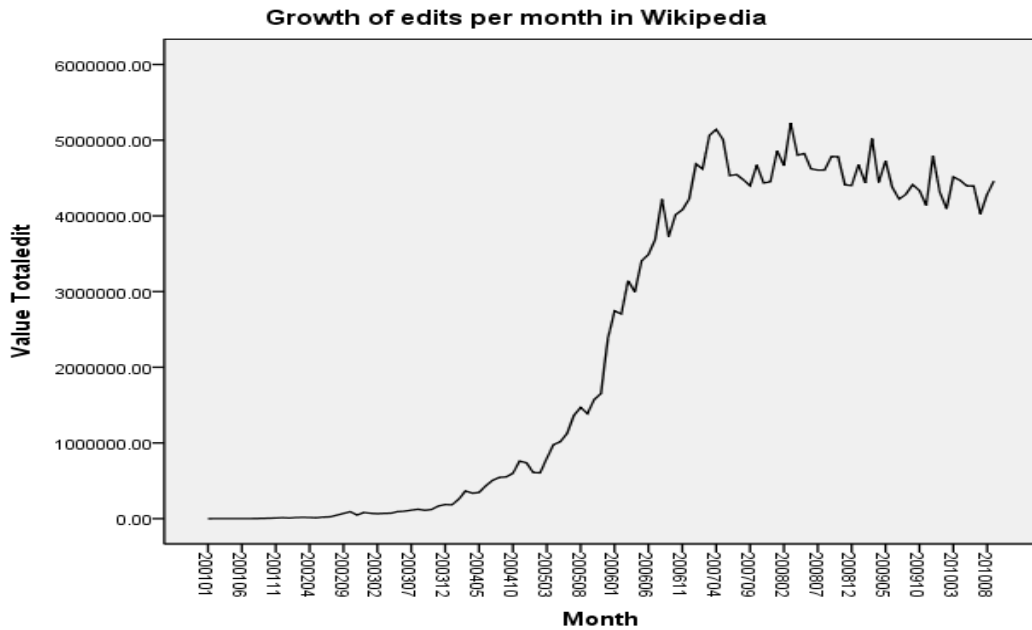


Figure 1 Growth of edits per month in Wikipedia

The number of active participants monthly is shown in Figure 2. According to our records, Wikipedia currently has 3,884,256 registered participants, but not everyone contributes all the time. The change in the number of participants appears similarly as the change in the number of monthly edits. After a steady period, the number of active participants who edited articles increased dramatically from 2004 to 2007. After this jump in active participation, the number of active participants fluctuated until mid-August, 2010. The shift from a stable horizontal growth to a sharp rise is not an exponential model. However, it suggests that Wikipedia experienced considerable development in the period between 2004 and 2007.

Based on the two observations above, we found that changes in the total number of edits per month and that in the total number of active participants have a similar trajectory, which could be described by the invariance-sharp rise-invariance model. It suggests that Wikipedia has attracted an increasing number of participations quantitatively within the specific period.

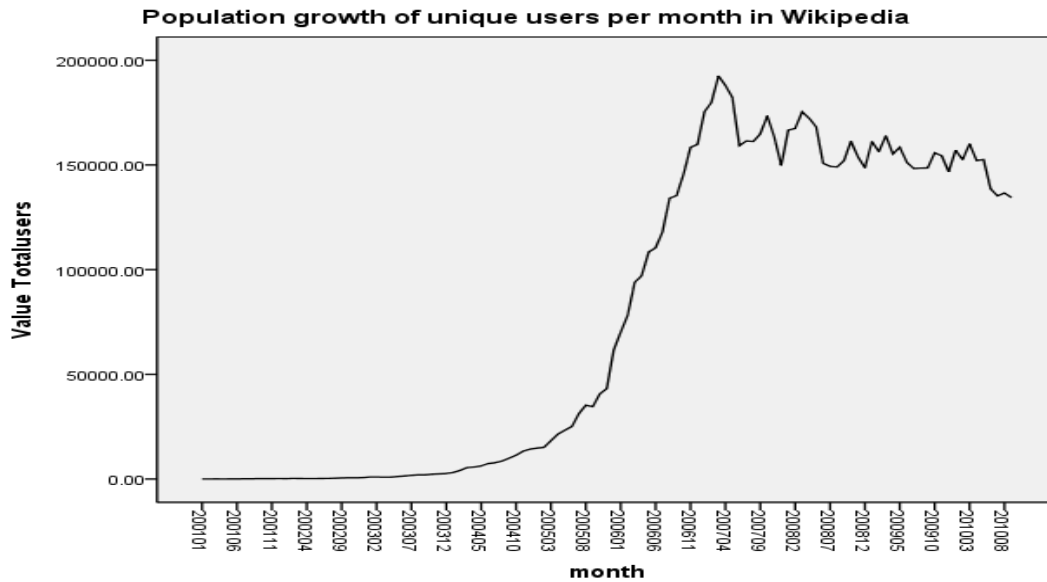


Figure 2 Growth of unique participants per month in Wikipedia

Influence of participants

Although Wikipedia has attracted an impressive number of participants to contribute, the fact that a massive number of people can contribute easily does not guarantee that everyone makes an equal contribution to Wikipedia. Similarly, the fact that anyone can modify or change the articles does not mean that all authors have similar power to affect Wikipedia as they would in a democratic system. To address such question, we will examine the argument of Kittur et al. (2007a) mentioned in the related research part to explore what pattern of mass collaborative Wikipedia follows and whether it has changed throughout the development of Wikipedia.

Our judgement of the dominating participants in Wikipedia is based on the examination and comparison of the amount of edits and the proportion of total edits to which they had contributed. There are two main reasons why we chose to investigate the amount of edits. First, based on the unit of edits previous researchers have employed such ways to simplify the collaborative model of Wikipedia to a type of production activity. This facilitates the process of analysis and calculation when there is a large database. In fact, mass collaboration is the process of people working together under a certain organizational system. In the traditional organization system, we take the working hour of individuals as the basic evaluation method to calculate their contribution. Here in Wikipedia, the basic unit of contribution is the “edits”

participants make. Therefore, although edits may not be the only way to evaluate participants' contribution in Wikipedia, we use it as the basic unit for evaluating contribution.

In order to find out the dominating participants, we need to divide the millions of participants as groups. We have used the number of edits to categorise participants. We termed participants with the highest number of edits as “elites” and participants with lower number of edits as “crowds”. It is important to separate the “elites” and “crowds” in our analysis in order to examine mass collaboration in Wikipedia. Therefore, we divided participants in Wikipedia into five groups in a decreasing order of editing activity:

- *Group 1: Participants who made between 1 and 4 edits;*
- *Group 2: Participants who made between 5 and 99 edits;*
- *Group 3: Participants who made between 100 and 999 (<1K) edits;*
- *Group 4: Participants who made between 1000 (1K) and 14999 (<15K) edits;*
- *Group 5: Participants who made more than 15,000 (15K+) edits;*

The numerical criteria defining the groups are based on our basic calculation on the number of edits made by the most active participants. ‘15K’ is the average number of edits made by the top 100 participants in 2007 and ‘1K’ is that from the top 100 participants in 2004. ‘100’ is the average number of edits among the top 100 participants in 2002. ‘5’ is the standard to define a ‘Wikipedian’, i.e. an active participant.

Figure 3 shows the growth in number of participants in the different groups. The figure illustrates that Group 1 and 2 represented by the green and blue lines, share a similar growth curve, which remained the same from 2001 to 2004, and increased sharply until mid-2006, after which the number of participants fluctuated and decreased gradually. It is noted that the period of growth in these two groups takes place from 2004 to 2006, which is the same period where an increase in the number of total participants is seen. The number of participants in Group 3, represented in brown, rose gradually from 2004 to 2006 when compared to Group 1 and 2. The number of participants in Group 3 has also fluctuated, and decreased slightly from 2006. The number of participants in Group 4 (purple line) has a growth curve generally similar to that of Group 3 but the gradient is much gentler. Finally, the number of participants in Group 5 (yellow line) has increased only fractionally, which suggests that the group that have made the most edits has always been small. Conversely, the number of

participants with fewer than 100 edits (Group 1 and 2) rose sharply and comprises the majority of participants.

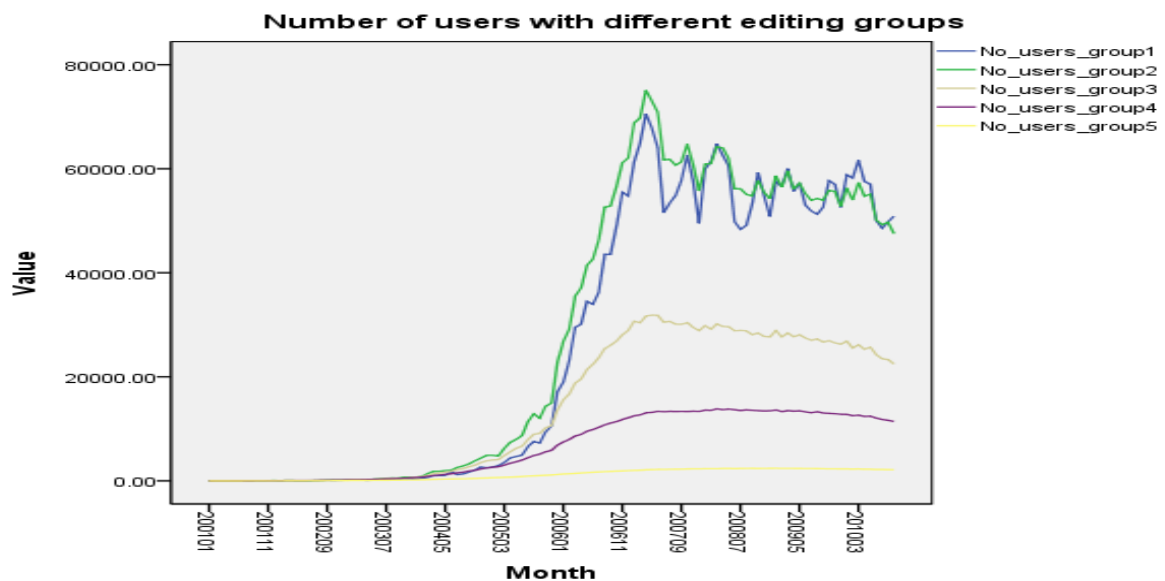


Figure 3 Number of participant grouped by the number of edits monthly

This led us to investigate the number of edits made by participants in different editing levels and the result is shown in Figure 4. It is interesting to note that the order of edit number from high to low in different groups is the reverse of that of the number of participants in these groups. Specifically, Group 5 which has more than 15,000 edits in total has provided the highest number of edits, although it has the smallest number of participants. Taking the two figures together, it becomes clear to us that the majority of participants are in Group 1 (<5 edits), and collectively they have the smallest contributions in terms of number of edits; whereas the smallest group of participants, namely those in Group 5 with over 15,000 edits provided the most contribution to the content in Wikipedia. It is also noted that Group 4 and 5 share an almost identical growth curve until the end of 2006. After that, Group 4 shrank gradually whereas the number in Group 5 increased with some fluctuations.

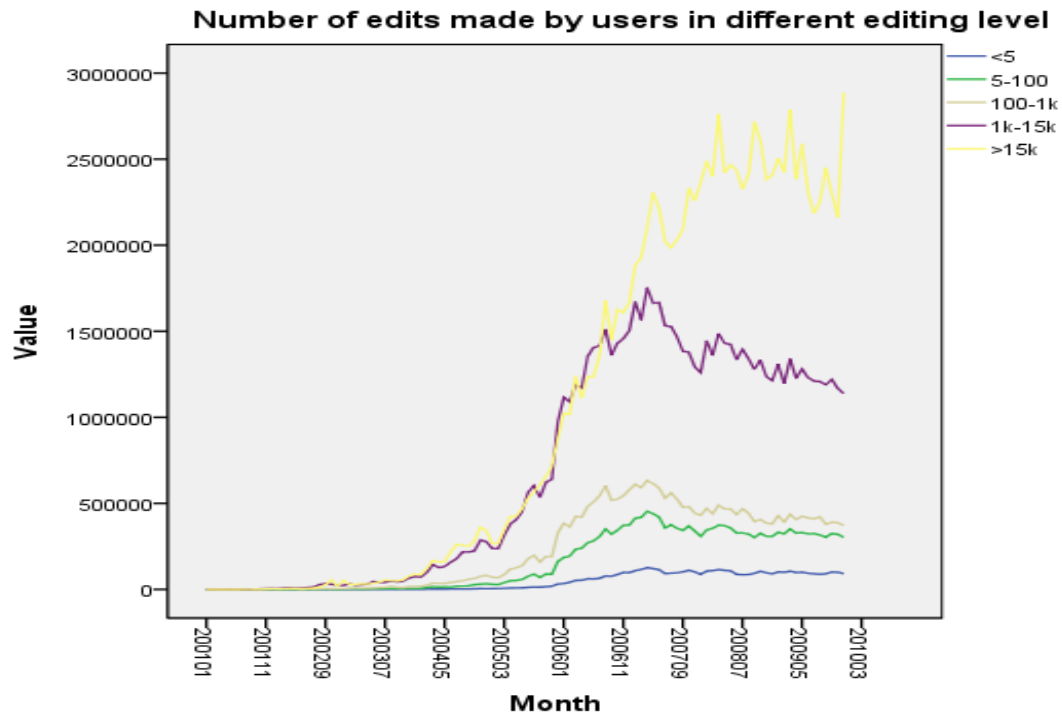


Figure 4 Number of total edits made by participants in different editing groups

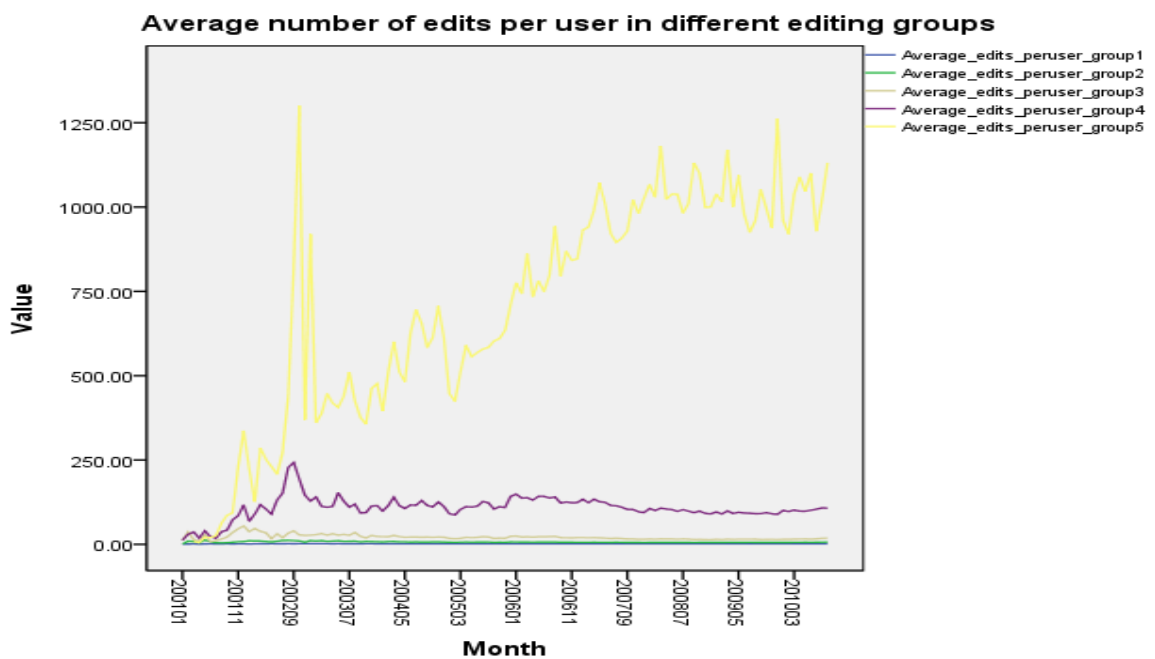


Figure 5 Average number of edits per participants in different editing groups

To further analyse the number of edits from different groups we calculated the number of edits per participant in different groups. Figure 5 shows that the average

number of edits in Group 5 (elite participants with more than 15000 edits) has the highest average number of edits. More importantly, the peak of approximately 1250 edits per participant was reached twice, once in 2002 and the second time in 2009. It suggests that high-contribution elites may have had two active periods during which their contribution rate increased. Another important finding is that the average number of edits per participant in Group 1, 2, and 3 is very similar and there were no marked changes over the last decade.

In this section, we have discussed the changes in the number of edits, participants and the average number of edits per participant in different groups. We found that a small group of people have edited more of Wikipedia's content than the groups with larger numbers of participants. However, the absolute value of edits in different groups does not define who have contributed the majority of the content in Wikipedia. In the next section, we calculate the percentage of edits made monthly by different groups, which will allow us to specifically explore that which group have made the most contributions in Wikipedia and also to examine whether there was any change in editing practices during the development of Wikipedia.

The Shifts of proportion in total edits by different groups

This section will examine the proportion of edits produced by the different participation groups. Following the study of Kittur et al. (2007a), we can test whether the proportion of edits has changed from 2001 to 2010. Another important point is their claim that this "shift" occurred in 2004 (Kittur et al., 2007a).

In Figure 6, it is clear that Group 5 made approximately 40% of the total edits in the latter part of 2002. More interestingly, Group 4 also contributed quite a high percentage of edits from March, 2001 to the latter part of 2002; prior to that, Group 3 contributed the majority of edits. Another important point to notice is that Group 4 has edited almost 40% of the total edits from 2003 to 2006, which was roughly equal to the contribution made by Group 5. However, this balance of equal contribution was broken at the end of 2006, when contribution from Group 5 surged in comparison to the rest of the groups and the percentage contribution made by other groups have remained constant until 2010.

Figure 6 shows that Group 4 and 5 have been responsible for the majority of edits – which made around half of all edits during Wikipedia's development. This observation illustrates that the development of Wikipedia has always been led by a

small group of participants. The only exception is that Group 3 and Group 4 took a majority of edits at the beginning few months in 2001. In other words, a small group of top-level editors has always been responsible for the majority of content on Wikipedia. However, along with the development of Wikipedia, the criteria for top-level editors have changed from hundreds to millions. Following this assumption, we can deduce that if the participants with the top-level edits have maintained their contribution both qualitatively and quantitatively, the quality and quantity of Wikipedia should not diminish.

During the specific period under our review, although there seem to be two groups (Group 4 and Group 5) with major contributions, we still can claim that Wikipedia has been produced by a small group of active participants because the total number of participants in those groups comprises fewer than 20% of the total number of participants. However, there is no evidence of any marked shift in the percentage of total edits from these two groups from the middle of 2002 to the end of 2010, as opposed to what Kittur et. al' claimed that there is a shift in 2004.

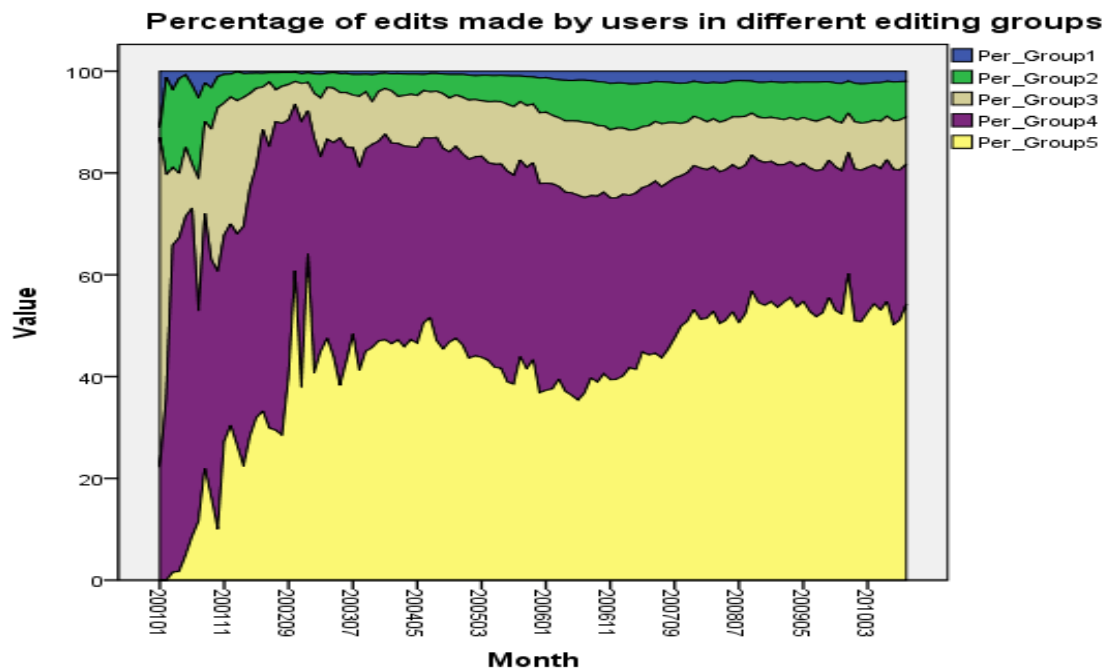


Figure 6 Percentage of edits made by participants in different editing groups

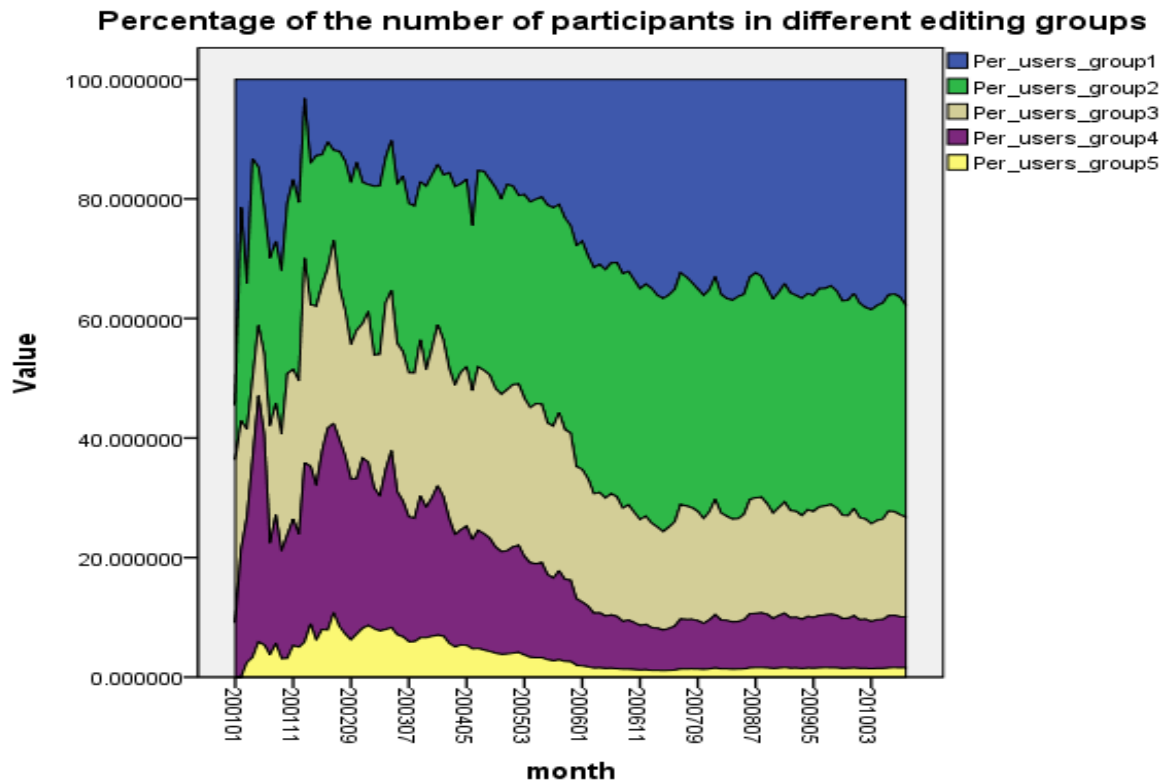


Figure 7 Percentage of the number of participants in different editing groups

Figure 7 shows the change in the percentage of participants in different editing groups. It clearly indicates that the percentage of participants with different editing levels has fluctuated since Wikipedia was founded, up until 2006. After that the percentage of Group 1 and 2 increased to almost 40% each, while Group 5 maintained at less than 3% of the total number of participants. This illustrates not only that the participants with higher edits make up a few percentage of total participants, but also shows that participation in Wikipedia may have stabilised in 2006 and all groups have remained unchanged since then.

Figure 6 and Figure 7 demonstrate that Wikipedia follows the Power distribution, in which a majority of content is only produced by a small group of participants. Therefore, Wikipedia is built by a small group of “elites” participants. Now the following question will be whether the “elite” come from the well-known administrators’ group. If so, Wikipedia then provide the traditional organizational system where the privilege members share high power as well as dominate contribution and development.

Influence of administrators

In order to clarify the relationship between “elites” and administrators, or to answer the relationship between “privilege” and “contribution”, this section will examine the percentage of edits and the number of people in administrator groups versus normal participant group. With this understanding, we will then be able to distinguish whether Wikipedia is an authority-oriented system or a non-authority-oriented system. Although in the last section we clarified that Wikipedia was produced by a small group of elites, we could not exclude the possibility that administrators were among this group.. Therefore, we divide the participants into administrators and non-administrators to test whether administrators contributed more to Wikipedia.

First of all, we need to clarify who the administrators of Wikipedia are. Administrators are selected by an agreed process, which involves: self-nomination or nomination by others, a self-statement followed by a poll, and lastly the declaration of an administrative title. Administrators are elected by a consensus of more than 80% approval in the community. Wikipedia claims that it is a non-hierarchical system and the status of administration is granted only for technical reasons since the server cannot possibly entitle everyone with similar technical rights. However, administrators do indeed have some privileges that general participants do not have, such as blocking or unblocking articles, and blocking or unblocking editing rights for particular participants². Because of this, administrators could be considered as special participants with specific rights.

Unlike the “elites” with higher number of edits, administrators may not have a higher quantity of contributions, because the number of edits is not the primary factor for their election³. In other words, administrators are not required to hold a large number of edits to stand for election. For instance, we will first explore the number of edits made by administrators. It is clear that the contribution of administrators has increased sharply since the end of 2006 and fluctuated afterward as shown in Figure 8.

Administrators may affect participation in Wikipedia in different ways due to their ability to modify others’ edits. As we can see in Figure 8, the average number of edits per administrator is higher than that of normal participants. Generally, the average number of edits made by normal participants has remained steady between 50 to 100,

² The details from the administration policy of Wikipedia at <http://en.wikipedia.org/wiki/Wikipedia:Administration>

³ In the explanation of guiding to requests for administrators nominees, the number of edits is important but not identified as a necessary factor of success, from http://en.wikipedia.org/wiki/Wikipedia:Guide_to_requests_for_adminship

whereas that made by administrators rose and remained between 500 to 600. In other words, the number of edits per person among administrators is ten times of that among the general crowd. This trend again fits with the Power distribution of Wikipedia, where the administrator group represents a small group of elites that contributed the most.

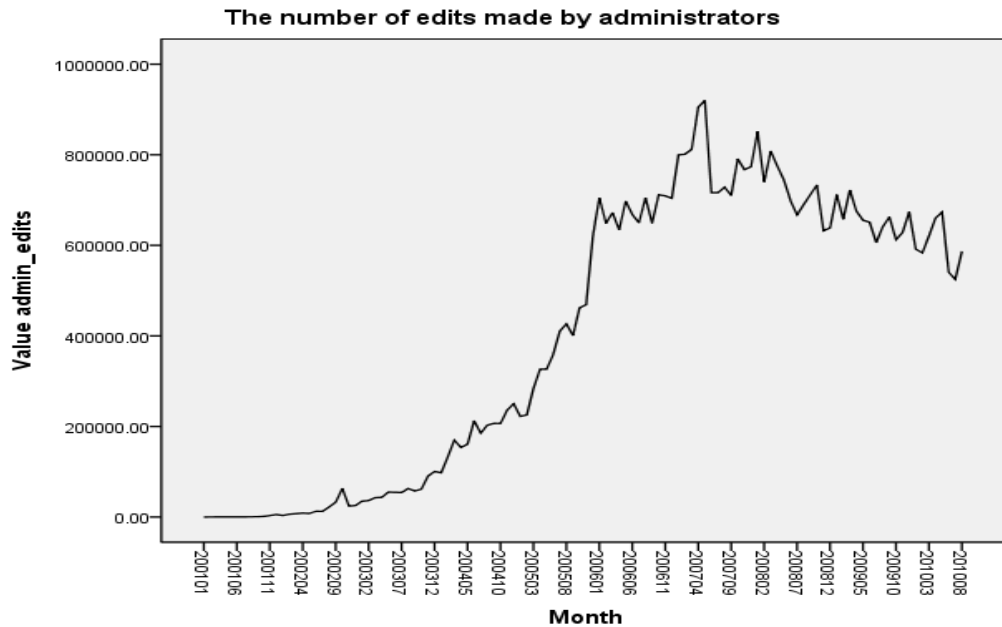


Figure 8 Number of edits made by administrators per month

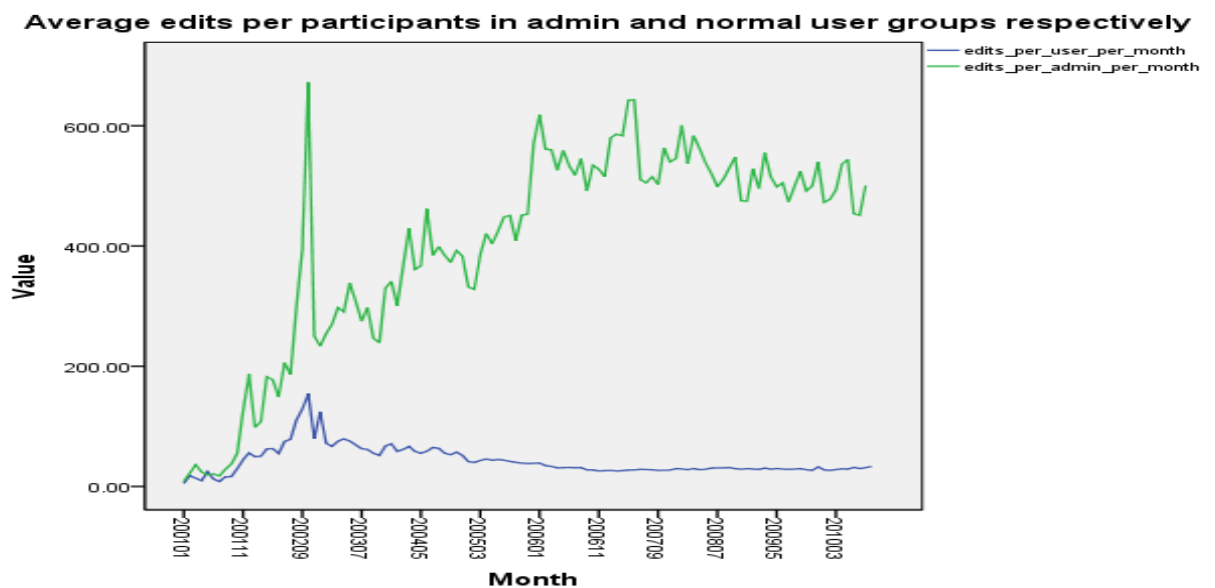


Figure 9 Average number of edits per participant in admin and normal participant groups respectively

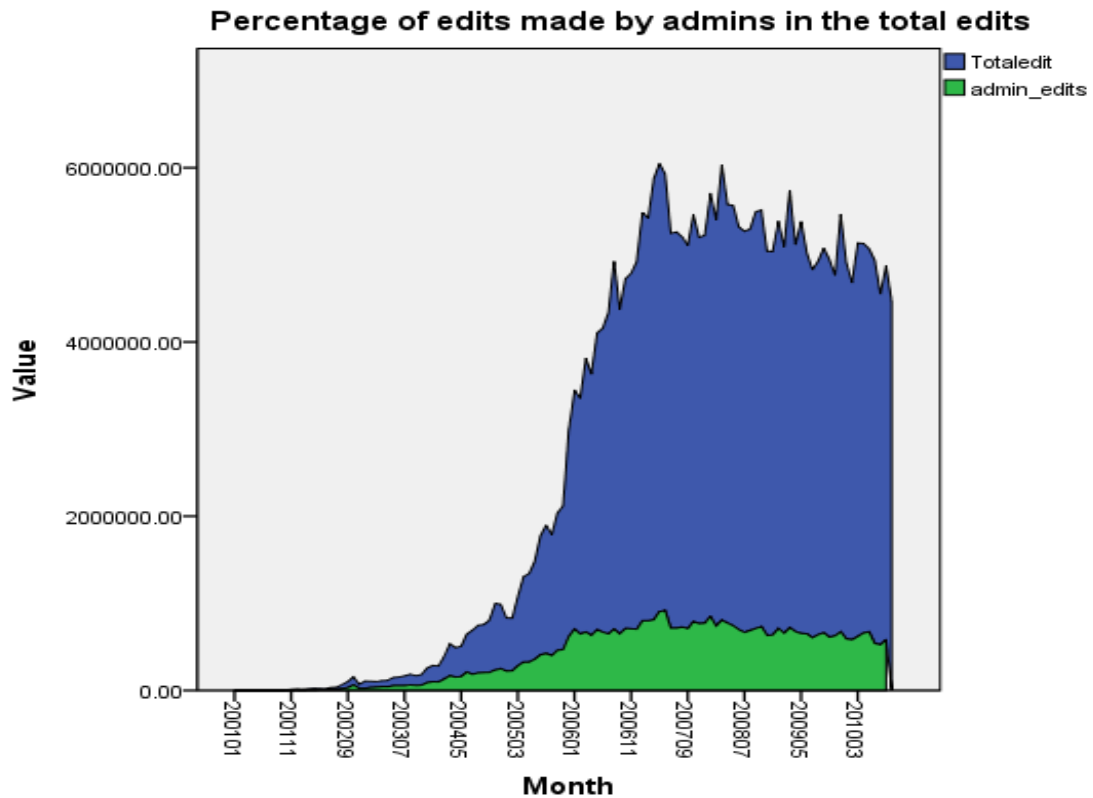


Figure 10 Percentage of edits made by administrators against total edits

Although the average number of edits per administrator is higher than that of normal participant, administrators' edits did not account for a significant portion in the total number of edits as shown in Figure 11. It shows that administrators' contributions do not dominate Wikipedia in terms of edits, unlike those “elites” with high-edits which we highlighted in the previous section.

This section explored the influence of the administrators on Wikipedia based on calculating their number of edits and the percentage of total edits. There are two findings: first, the quantity of edits produced by administrators is much higher than the average amount of edits made by normal participants, which suggests that administrators are part of the “small group of elites” who contribute to the greater part of content in Wikipedia. Second, the number of edits produced by administrators actually provided only a small portion of total edits to Wikipedia, because there are only over 1790 administrators (as of data) compared to millions of participants. The fact that administrators have made only a small proportion of edits also demonstrates that they have not dominated the edits as our hypothesis postulated.

Conclusion

We have demonstrated that the overall change of edits was not due to the growth of participants with low edit number, but instead was driven by an increase in the activity of the elite participants according to our comparison of the of average edits per person among different groups. In other words, the elites with a high number of edits were responsible for approximately half of the total edits from 2006 because of their increasing contribution compared to the constant level of edits by other groups. It was also illustrated that the participation pattern in Wikipedia did not shift from a small group of elites to a massive crowd, as suggested by Kittur et al (2007a). On the contrary, after a slight shift in the percentage of contribution between Groups 4 and 5, the elite group still continued to produce around 50% of the total edits from the middle of 2007. These results suggest that the participants with the highest number of edits were not only the pioneers who selected and refined Wikipedia's direction, but also the main force for maintaining its development.

Although Wikipedia has a team of administrators to maintain the organization, those administrators do not affect and produce most of the content. It can be assumed that Wikipedia is directed by the group who make the majority of contributions. Our analysis demonstrates that the edits from administrators generally are over average level but their edits do not make up a considerable percentage of the total edits. Therefore, it was found that administrators are unable to affect Wikipedia's content in terms of the knowledge within. This is not however to neglect the contribution from administrators on peacekeeping in Wikipedia, especially in cases such as preventing vandalism. Our argument is that administrators do not make up the major contribution group that actually produces the content.

This paper suggests that Wikipedia is produced by a small group of participants regardless of their administrative status. Unlike the traditional technological products where a certain number of authorized members are empowered to manage the entire system, Wikipedia is a collaborative product where everyone shares equal rights. Wikipedia has been dominated by a small group of participants "elites" with high edit-number, but such a group is rather dynamic and echoes changes in volunteers' activities.

We also argued that such a collaborative system is much looser than the traditional multi-author system in which knowledgeable persons have been selected to be

responsible for edits based to their knowledge and related experience. Wikipedia offers a self-nominating system where participants could work at editing more to become one of the dominating groups. Based on our studies, we clarified that the administrator group does not dominate the process of mass collaboration on Wikipedia, which suggests that being an administrator with seemingly more powers and privileges does not guarantee more influence over the system. Therefore, we conclude this paper in the speculation that in the organization of Wikipedia, the ability to manage and the ability to contribute have no direct or indirect connections. In our further research, we would like to discuss whether such a separation of power is better fitted for applications on the Internet, which is an open and collaborative platform.

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