

Proposal of Methods to Mitigate the Stagnation of Discussions to Promote Collaboration: Focusing on the Dynamics of Social Position of Community Members

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Abstract

Communication on Social Networking Services (SNS) provides limited information about the status of a colleague or a community. If SNS appears deserted, it is challenging to find appropriate members to talk to, especially for novice members. In this study, we propose a method to mitigate post retention, as a feature to facilitate participation in conversations, for people who have little information about their community and peers on SNS from a Group Awareness (GA) perspective. This will mitigate novice members' anxiety about posting to SNS. To verify the proposed method, we implemented an experimental system that artificially shifts the timing of the appearance of posted articles. The experimental system was applied to approximately a year's worth of past articles from a community, reducing intervals of more than five days between two posts, to three days. These results suggested that this system may reduce stagnation of postings in a community active on a one-week cycle. Regulating the timing of posting articles on SNS may mitigate the stagnation of discussions within a community, and encourage members post actively. However, the experiment on past articles was conducted in vitro, and it remains to be seen how actual community activities can be improved.

Keywords: stagnation of discussion, knowledge creation, group awareness, SNS

1 Introduction

We occasionally hesitate to talk face-to-face to avoid spoiling the mood, breaking an active conversation, or impolitely interrupting a conversation [1]. This observation applies when we post articles to Social Networking Services (SNS) [2]. However, compared to face-to-face contexts, we have minimal information about our colleagues and the state of each conversation on

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SNS [3]. It is difficult to know when to start conversations, which content is appropriate to address at a given time, how long we can talk, and so forth. Thus, we tend to hesitate more while posting to SNS than when talking face-to-face.

To address these difficulties, we propose a function to help people join conversations on SNS, especially those with limited information about a community and colleagues. We designed the function in a simplified manner, to make it applicable to a variety of existing online services.

2 Purpose

Sparsely posted articles on SNS may cause people, especially newcomers, to conclude that there are few people with whom they can converse. Therefore, this study proposes a method to mitigate the stagnation of posts on SNS. The development of the proposed function was based on the idea of delaying the date and time of posting, to level all the posting timings. We believe our function can help alleviate members' anxiety about posting to SNS from the Group Awareness (GA) perspective [3].

3 Research Background

3.1 Social Position in a Community

The hesitation for cutting into community discussion increases when one is a newcomer to a community [4], than an expert. In this context, the degree of commitment to communities decides the "social position" of its members. The degree of expertise typically reflects the differences in the social position of members: experts tend to be dealt with as members with a higher position in the community, while novices occupy lower positions.

In a face-to-face situation, we tend to initiate a conversation with a person who is not in a hurry, and seems friendly to novice members. However, these features are not easily discerned on SNS [3]. Furthermore, if the SNS appears deserted, it is challenging to find members with the appropriate degree of social position to talk to because we cannot know whether active people exist online.

3.2 Discussion Type in a Community

In knowledge-creation [5] or knowledge-building [6] communities, members are expected to proactively post articles or replies on SNS without being prompted by leaders [7]. The stagnation in posting articles occurs more often in cases of knowledge creation or knowledge building than in simple information sharing because members who want to share information take limited time before posting articles. By contrast, in situations where members are expected to contribute to solving complex problems in knowledge building, they take time to contemplate information before posting articles. Similarly, colleagues who read the articles in a knowledge-building community also take a long time to prepare replies because they must first read weighty posts and engage in significant reflection and interpretation before writing their opinions.

From the viewpoint suggested by Kahneman, time-consuming posting activity can be considered as System 2. Meanwhile, quick activities with paying a limited effort are categorized into System 1 [8]. This type has great potential to surpass the community of knowledge because the contents

of the posts are expected to enable members to think deeply. However, time-consuming posting activities tend to be avoided by members in place of fast and quick responses to maintain daily work, which can be executed by System 1. Therefore, it is necessary to consider how to encourage members to post time-consuming posts.

3.3 Group Awareness

In a communication on SNS, there is limited information about the status of a colleague or a community. To solve this problem, various GA tools are being proposed [3]. GA refers to being informed about group-related information; that is, the knowledge and perception of a group and its members, including what they are doing, the topics they are focusing on, who is online on an SNS, and which relations between members are deep. GA tools provide GA-related information to members. A recent study categorized GA tools into three types: behavioral, cognitive, and social [9]. From the behavioral perspective, GA tools identify members who actively post articles on SNS, who are online at a time, and so on. The cognitive awareness of GA tools on SNS provide members with information, offering content for discussions; for example, what members think about each discussion theme that was categorized and visualized on SNS [10]. Social awareness GA tools provide members with information about what relationships among members were constructed or their depth. Ouyang and Chen provided members with the author's network of each article on SNS, using the Social Network Analysis (SNA) technique to compare the effectiveness of the SNA visualization with the network visualizations of topics and cognition of a community members [11]. The results showed the SNA visualization encourages the engagement of non-active members of the community. As each category of GA tools provide members with characteristic information, the tools can help them post on SNS.

However, when an SNS appears deserted, GA tools may provide misleading information to members. The tools mentioned above were designed for "active" SNS. If articles posted on SNS are rare or only a limited number of people actively engage, GA tools externalize the desertedness. This can curtail members' motivation to post articles because there are minimal possibilities of receiving replies. In a knowledge-building community, all posts have possibilities for improvement [6]. However, this possibility decreases or disappears when there are no responses. Thus, the stagnation of posts on SNS may result in members hesitating to post articles.

If the discontinuity of posting is indeed a reason for stagnation on SNS, it can be easily solved by artificially shifting the intervals of postings. Although some services have been suggested for solving stagnation on SNS [12] by focusing on the content of each article, posting articles can be enhanced without referring to the content. The suggestions regarding the content of discussions are indeed effective. However, referring to the contents using AI, such as a chatbot, may not be sufficient in a knowledge-building situation. Behavioral awareness in GA tools is a promising approach for involving members in discussions. However, chatbots do not provide behavioral recognition. Therefore, from a GA perspective, it would be difficult to expect the chatbot to effectively facilitate discussions and make it easier to post on SNS. With this understanding, we focused on a simple technique that controls the timing of an article's publication without editing its content on SNS.

4 Mitigating the Stagnation of Discussion

4.1 Regulating Group Awareness Through the Time-Shifting of Posts

To alleviate the stagnation of discussions, we propose a method to adjust the time between when an article is posted and when other members read it. In a normal SNS, articles are made available to other members as soon as they are posted. In the proposed method, the posted article is not immediately made available to other members; rather, it is put on hold in the system, which then monitors the pace of article postings in the community. When posting activities are about to stall, the system retrieves and displays pending articles so that they can be viewed. Consequently, when the number of sections in which articles have not been posted for long periods is reduced, stagnation of discussion is mitigated, and a GA that the other members are continuously active is created. The basic concept is presented in Figure 1.

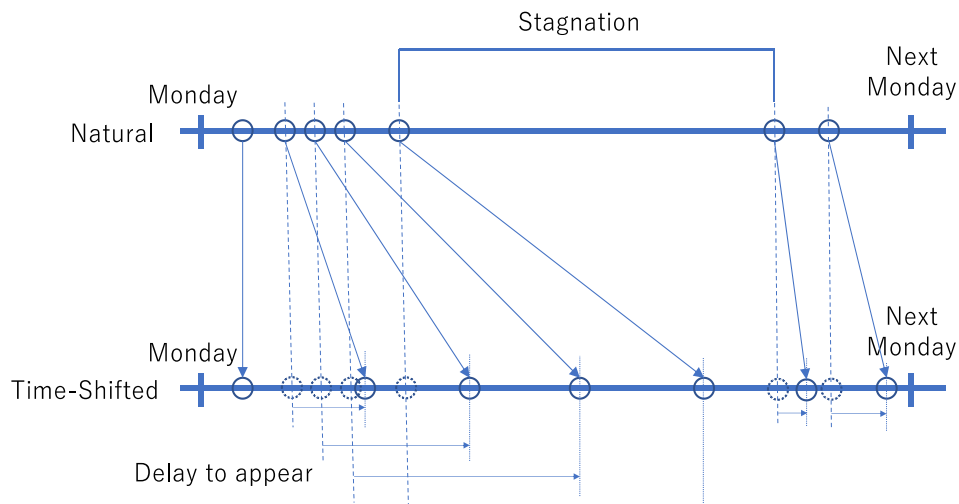


Figure 1: Basic Concept of Mitigating the Stagnation of Discussion

The horizontal axis represents the time from left to right. The figure illustrates the period from a particular Monday to the ensuing one; the axis labeled “Natural” represents the normal SNS time passage. A circle on the time axis reflects when the article was posted. Seven circles indicate that seven articles were posted during the week. As can be observed, five articles were continuously posted in the first half of the week, and two articles were posted toward the end of the week. There are no posts between the five and the two, and this period can be called “Stagnation” of discussion on SNS.

The “Time-shifted” axis shows the application of the proposed method. As mentioned earlier, the posted articles will not suddenly appear on SNS because they are withheld until the appropriate time. Therefore, the posted date and time of an article, and the appearing time of the article on SNS are different. Dotted circles indicate when the articles are posted, and solid circles indicate when the article appeared on SNS. As a result of changing the timing of each article’s appearance shown in the Time-shifted axis, the “Stagnation” on the Natural axis is eliminated. Thus, the posting activity in a community was changed into a continuous one without stagnation throughout the week.

4.2 Priority by Topic

In practice, it is difficult to delay all articles on SNS. For instance, time-sensitive communications cannot be delayed; similarly, articles about issues that need to be unexpectedly addressed, or about time-sensitive decision-making, are considered to have higher priority than other articles. These will need to be excluded from time-shifting and posted to the SNS without delay, as soon as they are posted. In this method, we term such articles “URGENT” communication.

Conversely, messages, such as daily reports, are less time-sensitive. For example, a delay until the next business day is not a pressing problem. Articles in which members discuss problem-solving asynchronously may be less likely to cause problems, even with further delays.

4.3 Priority by Members’ Social Position

Depending on the community context, prioritizing articles according to the members’ social position may be necessary. In communities that have been active for many years, the timing and frequency of members’ participation are not constant. A typical example is members of an open-source software development community. Newcomers in such a community hope to discuss issues in the same way as old members; however, they may hesitate to post on SNS if old members’ posts are prominent. In such situations, a more favorable time-shift may be achieved by prioritizing articles of new members over those of old members.

Although the explicit social position of the time of participation in a community is used as an example here, dynamic and implicit positions, such as the status of the statements made in the community, may be equally relevant for prioritization.

5 Evaluation Method

5.1 Target Communities and SNS

The SNS of staff members—approximately a faculty member and 10 part-time students—who operate university facilities were targeted. The number of members varies over time. The staff members are expected to act as a collaborative knowledge-building community. The members’ activities are heavily influenced by the university’s operational cycle. Key members are involved on a part-time basis, making it difficult for them to immediately respond to posts on the SNS. Therefore, the staff members are expected to make an effort to access and respond to the SNS approximately once every 24 h. The community is obliged to submit daily reports, among other things, and stagnation of discussion is not a serious problem. However, the community is affected by long vacations and classes, thus there are periods when no articles are submitted.

The SNS used in this community is a hierarchical reply system. It is possible to post an article, reply to it, and respond to more replies. The posted article cannot be erased. In this SNS, a forum is prepared for each topic, and it is widely known that specific topics are to be written under this forum. There are 53 forums, including some that are no longer in use. Some forums have clearly defined roles; for instance, one for emergency communication, another for sharing daily reports, and so on. Therefore, whether an article falls under URGENT communication can be formally determined by the forum in which it was posted. Other forums are created on a project-by-project basis, and discussions are held as relevant. All forums are open to the all staff members.

5.2 Experiment Period

The proposed method used an experimental system from December 1, 2019, to January 31, 2021. The staff members are also university students and work in cycles of one year, hence a one-year period was considered. This period was extended by one month before and after the one-year period, to include long vacations when discussions seem stagnant. We analyzed this period from the perspective of the entire experimental period to determine the extent to which stagnation can be mitigated.

Local potency was also analyzed to verify if the experimental system mitigated argumentation stagnation. Specifically, the “three-week period,” which consists of the week that includes the date and time of the relaxation of discussion stagnation, and the weeks preceding and following it, was analyzed. This determined how the stagnation was relaxed, as well as the values for the entire period of the experiment. For example, if the relaxation of stagnation occurred on December 4, 2019, the analysis would cover the period from November 25, 2019, the Monday of the previous week, to December 15, 2019, the Sunday of the following week. In this case, even if more than one relaxation of stagnation occurred within a three-week period, the interval would be considered as one. Even if another relaxation of stagnation occurred on December 5, 2019, only one three-week period would be considered: November 25, 2019 to December 5, 2019.

5.3 Experimental System for Time-Shifting

To verify the proposed method, we implemented an experimental system that time-shifted articles posted by the staff members in the past. It repeatedly applied the proposed method to articles in the database, while advancing the internal time in 15-min increments. The results of the time-shifted articles in the database were observed to examine if the proposed method could mitigate the stagnation of the discussion. The experimental system compared the case of time-shifted article submissions to instances when they were not time-shifted. We evaluated the area around the time-shift and the entire section for this study. The time-shift was evaluated around the date and time when the time-shift occurred and during the entire experimental period.

The experimental system was conducted as follows.

a) Post Importing Phase

Articles posted on SNS we developed (not the articles that appeared), in the 30 min preceding time t in the experimental system were retrieved from the database. For the retrieved articles, those posted in a specific forum were considered URGENT communication, and were displayed in the SNS with no time-shifting. Articles were posted in other forums but were first stored in the stock area before being posted on the SNS. This phase was executed every 30 min on the internal clock of the experimental system.

b) Stagnation Mitigation Phase

The number of articles that appeared on the SNS (not the articles posted) during the three days preceding time t in the experimental system was retrieved from the database. If the number of retrieved articles was less than the value of “THRESHOLD” (in this study, the THRESHOLD was set to 3), it was judged to be in a “stagnation of discussion” state. The oldest articles in the stock area were retrieved and posted on the SNS. Figure 2 shows the method used to determine whether the posting activities had stalled. Figure 2 indicates that two articles were posted in the past three days. Since this is less than the THRESHOLD, it was judged to be in a state of discussion stagnation. Articles were retrieved from the stock area and posted. If there were no articles in the stock area, the mitigation of stagnation failed. This phase was executed once every 15 min on the internal clock of the experimental system.

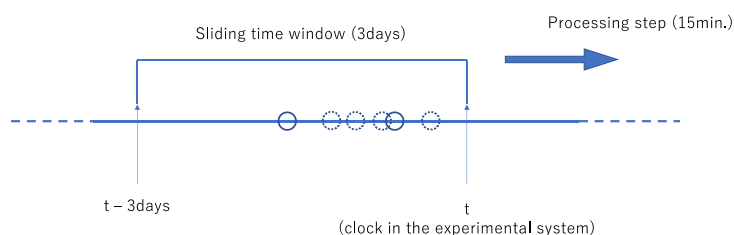


Figure 2: Determining the Stagnation of Discussion

c) Stock Clearance Phase

Next, the number of articles in the stock area was checked. If the number of articles was greater than the THRESHOLD \times 2, the system determined the presence of an overstock. Accordingly, the oldest articles were removed from the stock area and made visible in the SNS. This phase was executed every 15 min on the internal clock of the experimental system. The function of removing the oldest articles is termed as “Stock Clearance.”

At the end of the stock clearance phase, the time in the experimental system was advanced by 15 min, and the system returned to the post importing phase. If the clock in the experimental system exceeded the period covered by the experiment, the process was terminated immediately. At this time, even if articles remain in the stock area, they would not be processed.

Since the purpose of this experiment was to validate the idea of time-shifting, the current experimental system did not implement priorities based on the social positioning of the members.

When the experimental system decides to display an article, its timestamp is time-shifted to the date and time indicated by the clock in the system where the decision was made, and not that of the submission.

5.4 Novice Boost

To implement functions based on the social position of members, we categorized members into two classes: experts and novices. We sought to mitigate stagnated discussions while enhancing the presence and contribution of novices by prioritizing them over experts.

Members’ social position can be affected by the contents of activities in a community. For ex-

ample, members who are good at programming will be active when the members work on learning to program collaboratively. However, another member who is good at writing papers will be active when the members work to write papers collaboratively. Thus, the social positions of members in a community can be changed according to the time series, depending on the domain of the activity types. For this reason, it is desirable to use an indicator that can be dynamically calculated from members' activities rather than using an assigned value for members' years of experience. In this study, the value of betweenness centrality was adopted as an indicator of members' activities, and the function "Novice Boost" was implemented to intervene in time-shift behavior. This function modifies the behavior of time-shifting as follows.

a) Classifying Members by their BC Values

To categorize whether a member is an expert or a novice, we used the reply relationship of articles [13]. This method constructs a network among authors of articles, based on the reply relationships between articles posted during a certain period. It uses the value of the author's mediational centrality (value of betweenness centrality: BC value) in the network as an indicator. BC value is one of the indicators of the importance of the nodes that compose the network. The higher the BC value of a member, the more the member refers to, or is referred to by other members' articles. It is sometimes used as an indicator of leadership [7].

In this study, we calculated the BC value for each member for the week prior to a certain time t , based on the reply relations among the articles posted during that week. The BC value determines the social position of members for a week, including time t . Less than 1.0 BC value means that the members are still connected even if they are not present; experts are expected to engage with more members in their activities. For this reason, we defined a member whose BC value is less than 1.0 or cannot be calculated as a novice, and all other members are considered experts.

b) Change Mechanism of a Stagnation Detection

If a novice's posts are held in the stock area, the THRESHOLD, which determines whether a discussion is stagnated, is doubled. In this study, the THRESHOLD is set to 3, so doubling the threshold results in the THRESHOLD value of 6. In this experiment, the THRESHOLD is used to classify whether the discussion is stagnant. Thus, a discussion is classified as stagnant when the number of posts within a window of time (three days in this study) falls below the THRESHOLD. Therefore, if the THRESHOLD is doubled, the discussion will likely be classified as stagnant. Consequently, the function of mitigating stagnated discussions becomes stronger. If there are no novices' submissions, and only those from experts in the stock area, the THRESHOLD is set back to the normal level (3 in this case).

c) Prioritized Selection of Articles

During the Stagnation Mitigation and Stock Clearance phases, the experimental system selects and retrieves articles from the stock area. Thus, the Novice Boost function also intervenes in this operation, preferentially removing articles from the stock area. Furthermore, when the Novice Boost function intervenes in this operation, it preferentially retrieves novice articles from the stock area and displays them on the bulletin board, even if old articles written by experts are still in the stock area. Consequently, it is thought that posts by members with limited participation (typically novices) will become more prominent, and more likely to receive replies. This is expected to mitigate stagnated discussions and encourage novice members to participate more actively in discussions.

6 Expected Results

6.1 Reducing Intervals

In this study, the time between the publication of two consecutive articles on an SNS is called an “interval.” If the maximum value of the interval is lower when time-shifted than when not time-shifted, the stagnation of the discussion can be judged to have been mitigated. The staff members maintained the university’s classrooms and supported each class’s operation. Classes are held weekly (five weekdays). Discussion exchanges (in other words, turnarounds) occur during this time. The lack of discussion exchanges is a major obstacle for the community. It would be appropriate to mitigate large intervals, such as those spanning weekdays, to approximately three days.

6.2 Reasonable Amount of Delay

The interlude between the submission and publication of an article when time-shifting is employed is called “delay.” The length of the delay is checked to determine if it is within a reasonable range compared to the non-time-shifted case. Staff members are expected to access SNS once every 24 h. The time of the delay should not greatly exceed 24 h period. It was considered that the time should be limited to a maximum of approximately two cycles (48 h), to avoid significantly interfering with community activities.

7 Results and Discussion

7.1 Entire Experimental Period

This section discusses the results of applying the time-shift function to a dataset from an existing community.

a) Results for the Entire Experimental Period

For the period of December 1, 2019, to January 31, 2021, there were a total of 3,640 articles posted to the SNS. The community was active throughout the experimental period.

Of these, 120 articles were determined to be URGENT communications, and they appeared on the SNS at the same time as they were posted. Meanwhile, 83 cases were determined by the experimental system to be stalled discussions, and attempts were made to mitigate them by using articles in the stock area. Articles other than URGENT communication were delayed by the stock release phase. When the experimental system finished processing the period under study, six articles remained in the stock and were not posted to the SNS.

b) Amount and Relevance of Article Delay by Time-Shifting

Table 1 shows the number of articles by time-shifted delay range for 3,634 out of 3,640 total articles, excluding the six articles that remained in the stock without being processed until the end. URGENT communications were included in the less-than-24 h category. Approximately 97% of the articles fell within a time-shift range of less than 48

Table 1: Time-Shifted Amount

Amount of delay	# of posts	Ratio
Less than 24 h	3,463	95.30%
More than 24 h but less than 48 h	71	1.95%
More than 48 h but less than 72 h	26	0.71%
72 h or more	74	2.04%

h. In the experimental community, members are expected to access and respond at least once every 24 h, hence causing a delay of less than 48 h. Therefore, time-shifting by the proposed method is considered reasonable in many cases.

By contrast, approximately 3% of the articles caused delays longer than 48 h. Members are expected to access the site approximately once every 24 h. Thus, a 24-h delay in an article may not affect the member's activity. However, if an article is delayed for 48 h, it will certainly affect the member's activity. Therefore, we set 48 h as the threshold. It will be necessary to monitor the articles in the stock area, to ensure they do not become too dated.

Table 2: Maximum Change in Intervals Per Three-Week Period

	Three-week period	Natural interval (max.)	Time-shifted interval (max.)	Diff of interval (max.) (Natural - Time_shifted).
(1)	2019-11-18:2019-12-09	147164	95400	51764
(2)	2019-11-25:2019-12-16	147164	95400	51764
(3)	2019-12-16:2020-01-06	347335	254700	92635
(4)	2019-12-23:2020-01-13	347335	254700	92635
(5)	2020-01-27:2020-02-17	170100	169200	900
(6)	2020-02-10:2020-03-02	178363	178200	163
(7)	2020-02-17:2020-03-09	178363	178200	163
(8)	2020-03-02:2020-03-23	164215	164700	-485
(9)	2020-03-09:2020-03-30	202043	201600	443
(10)	2020-04-27:2020-05-18	210260	177300	32960
(11)	2020-05-25:2020-06-15	273172	227700	45472
(12)	2020-06-01:2020-06-22	441707	188100	253607
(13)	2020-06-08:2020-06-29	441707	188100	253607
(14)	2020-08-31:2020-09-21	162600	161222	1378
(15)	2020-11-16:2020-12-07	183497	174600	8897
(16)	2020-12-07:2020-12-28	195805	196200	-395
(17)	2020-12-21:2021-01-11	195430	171900	23530
(18)	2021-01-04:2021-01-25	176550	176400	150
(19)	2021-01-11:2021-02-01	176550	176400	150

c) The Amount of Mitigation of Stagnation in the Discussion

Table 2 shows that the longest no-postings term had been made before the time-shift was 441,707 s (approximately 5.1 days). After this period was time-shifted, the longest time that no postings occurred was 254,700 s (approximately 3.0 days). Compared to the case without time-shifting, the stagnated discussion period was shortened by 186,907 s (approximately 2.2 days) during the experimental period. This mitigation effect seems promising because community activities take place in one-week cycles.

7.2 Results for Each Mitigating Period

Time-shift results for each three-week period were analyzed. The 83 mitigations occurred in 19 three-week periods. The maximum interval for each period in the natural state, in the time-shifting state, and the difference between them are shown in Table 2. Natural is the maximum interval without time-shifting, Time-Shifted is the maximum interval with time-shifting, and Diff is the difference between the maximum interval, without and after time-shifting. An interval with a negative Diff means that the time-shift had the opposite impact (stagnated time increased).

Two of the 19 periods — (1) and (2), were not targeted for the analysis because both periods extend beyond 2019-12-01, the start date and time of the period targeted for analysis. The experimental system is not in action for the outside periods. For this reason, these two periods were excluded from those targeted for analysis.

In the two periods (8) and (16), the Diff values became negative due to the time-shift. This means that the delays became longer than without the time-shift. The delays should be alleviated by the suggested method. However, this will not cause a big problem to the community's activities because both delays are less than 10 min. It is highly likely that they already appeared without problems, when members are expected to access SNS.

In the 15 periods, except for (8) and (16), the intervals are shortened by the proposed method. However, for 10 periods— (5), (6), (7), (9), (10), (14), (15), (17), (18), and (19), the shortened intervals are only a few hours or less, and the improvement may not have much impact in a real-world situation. The intervals from the five periods — (3), (4), (11), (12), and (13), were successfully shortened by one day or more, because the frequency of access for the staff members is at least once every 24 h on average.

The impact was most pronounced in the two periods (12) and (13). In these periods, the stagnated time interval was shortened from 441,707 s (5.11 days) to 188,100 s (2.18 days). This reduction seems to indicate the promise of the proposed methods. As noted in the expected results of this study, the work is under the influence of college classes and proceeds on a weekly basis.

7.3 Amount of Time-Shift for Each Article

For this community, which mostly operates on a weekly cycle, a delay of more than one week is too long. Checking the system behavior logs for the latency of individual articles, we found that

45 of the 3,634 time-shifted articles had a longer latency than one week. The longest delay was 133.3 days. All of these articles were considered expert articles with high BC, a side effect of the Novice Boost that prioritizes novice articles and keeps expert articles in the stock area.

8 Conclusion and Future Work

We proposed a time-shifting method that actively adjusts GA to mitigate the stagnation of discussion. We conducted experiments using past articles posted on SNS to confirm that time-shifting may alleviate the stagnation of discussion.

These experimental results are promising, but there are some limitations. The time-shift in the experimental system is only an alteration of the past record. However, when time-shifting occurs on an actual SNS, it may change the pattern of activities of the actual community. The articles, and the timing of their posting will also significantly change. This effect cannot be predicted from this experiment. Thus, it is necessary for future research to implement a functioning time-shift function on an SNS, and analyze the changes in members' activities.

While the Novice Boost feature suggested the promise of the idea of considering a member's social position, it is far from fully functional. Continued research is needed in this field to make time-shifting more practical, as shown below.

a) Considering Articles Intended to Regulate Among Members

In this study, all articles are treated as homogeneous, regardless of the content of all the posted articles on electronic bulletin boards. However, the actual bulletin board articles are not homogeneous, as each article is posted with a unique purpose. Some articles may be for community decision-making, and, naturally, articles providing information for reference purposes are posted, but others may be intended to regulate relationships among members. Members in leadership roles may actively write articles that encourage other members to contribute. It is not unlikely that the expert is actively asking newcomers questions, and encouraging their participation through posts. However, the proposed method does not consider such articles as regulating the relationship among members. In the future, it will be necessary to control the time-shifting to become more flexible, depending on the nature of posted articles.

b) Improving Novice Boost for Community Activities

The Novice Boost function examined in this study is an ad-hoc one, that prioritizes articles written by novices over those written by experts, based only on the criteria of the authorship of the posted articles. It focuses only on the posting of novices' articles and does not consider the relationship between the articles. However, the activity in the community is not only about novices independently posting articles. Rather, in a community that aims at knowledge building, it may be desirable for the expert and the novice to take turns, to collaboratively proceed with their interactions. In such an exchange, the idea of a Novice Boost, which formally prioritizes only the novice, may not be sufficient. In the future, it will be necessary to improve the Novice Boost function, to consider not only individual members, but also the activities of a community, and to handle experts.

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