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Continual Social Graph Analysis of Online Community for a Cultural Project in the Foreign Country

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Abstract: The globalization and internationalization are broadly deployed. At this moment, we can feel that the world is going to be flat in information communication and cultural exchanges. In 2011, JKT48; a music business project was started in Indonesia by using a business format of a popular music project in Japan. Continuously, an online fans' community in Japan was emerged and this community had possibility to be influenced from both an original project community in Japan and a popular music scene community in Indonesia. After 2 years, JKT48 became the best idol group and their song was ranked no.1 in Indonesian music chart. This is the limited experience of success in overseas and the researcher selected this project as a case of inter-cultural recognition. And this study focused on formation of public opinion in Japanese community and discussed how and what opinion is formed through international information exchanges by prolonged monitoring. To analyze communication data, the social graph and behavior graphics were used. As results, some bridge influencers were extracted in each period and their specific connections and relations are identified. Particularly, even they provided important information, they frequently connected in a peripheral position with rather low clustering coefficient. A node of an Indonesian bridge, influencer is more popular than Japanese bridge influencers in all kinds of centralities but Japanese bridge influencers showed more informative behavior graphics types.

Key words: Social graph, behavior graphics, online community, JKT48, pubic opinion

INTRODUCTION

The globalization and internationalization are broadly deployed. At this moment, we can feel that the world is going to be flat (Freidman, 2005) in economical transactions, information communication and cultural exchanges. In particular, the influence of Web 2.0 reaches a stage in post-industrial societies where ICT is sufficiently powerful and low cost to be used by people. The integration of pervasive technologies with changes processed the ways how we communicate and interact with information. Also, the ability of people to organize online communities was developed. And the social relationships have been altered by online communication in terms of scale and size.

The investigational study in this research is concerned with effects of an exportation of a music business project in Indonesia. And researchers focused on formation of public opinion not online community in Indonesia that were already appeared in some released studies but online community in Japan. And researchers discussed how the public opinion is formed through inter-cultural understanding by prolonged monitoring of online communication. This cryptic process and its characteristics can be the resource to imagine public opinion in the future internationalization of Japanese culture. Also, it needs to clarify how a new mode of communication forms collective intelligence.

So far, Japan has a limited case of success to deploy the socio-cultural system to foreign countries. Then, researchers selected a project of music business that could get great success in Indonesia.

Internationalization and an emerged community: The JKT48 (Fig. 1), an idol group that is active in Indonesian

Fig. 1: Idol group, JKT48

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music business, debuted in November 2011 by applying a music business format of an AKB48 project in Japan.

Immediately after the announcement of launching the JKT48 project on 11th September 2011, some Japanese began to search information of the project and started to exchange online messages via a Bulletin Board System (BBS); 2-Channel (hereinafter abbreviated as 2CH), the largest BBS in the world. This 2CH offers a large number of thread floating bulletin boards, about 230 million page views per day, about 2 million of message posts per day. Frequently, 2CH became the source to develop public opinions in Japan. In reality, more active message exchanges are seen in 2CH than message exchanges in Twitter or Facebook because it has a titled thread that is adaptable for deep discussion.

Communication: Rise of Japanese fans' online community of JKT48 was emerged in a thread of 2CH in September of 2011. On the other side, some online communities in Indonesia were appeared around the project. Therefore, this online community had possibility to be affected by online communities of social network in Indonesia.

At the dawn of the online community, it frequently encounters the cold-start problem. It is difficult to introduce deep discussion due to no one in the community has related information. Indeed, target community was a newly emerged online community but it was not cold-start at all because this community involved many users from AKB48 fans who have potential information of the project.

MATERIALS AND METHODS

Unfortunately, 2CH does not offer available API (Application Program Interface) that can be used directly in social graph analysis software. Then, the researchers collected message record from 2CH as the dat (data format file) data. The dat data were processed by a VBA (Visual Basic for Applications) script developed by the researchers to convert data into an xml (Extensible Markup Language) file. In addition, NodeXL, an extendible toolkit for community exploration implement, an add-in to the Microsoft Excel 2010 was used for visualizing social graphs and calculating graph metrics.

Study target: The researchers selected three separated periods and collected record of each period for a month:

- September 2011: at the dawn of the online community, just before selection of JKT48 members by an audition. Communication in BBS was processed under limited information of Indonesia

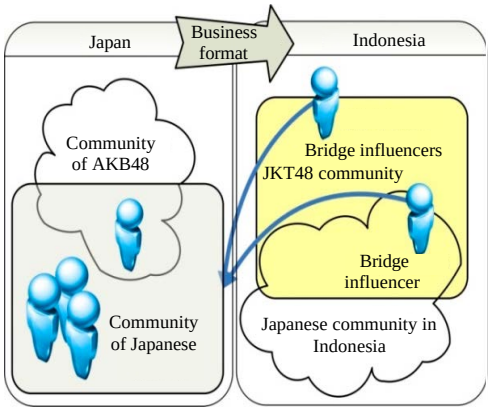

Fig. 2: Situation of an emerged online fans' community

- February 2012: JKT48 had appeared frequently on TV, news and internet
- January 2013: they had a theater in a shopping mall that dedicated to JKT48 and offered daily show by two teams (Researchers did not post any message on the target threads of 2CH)

Social graph and bridge influencers: The researcher adapted a method of social network analysis as a way to investigate the online community by tracing messages. As usual cases of social graph study, message ties among users are used for analysis. Besides in this study, we processed the analysis by searching bridge influencers that posted information of another online community. In this case, potentially following two types of bridge influencers are able to effect on the community (Fig. 2):

- A user from Indonesian online community: a bridge connecting information between Japan and Indonesia and has chances to tie two communities
- Well-informed Japanese fans who live in Indonesia: a user who knows music scene and society of Indonesia and can value information that is indispensable to Japanese by overt criteria

Many of users were fans of AKB48 as well, however many of others mentioned that they were fans only JKT48. Then, related information of AKB48 to JKT48 were possible to introduce, even fans only JKT48 could join the discussion by searching WEB where enormous information AKB48 existed and there was no boundary between both fans.

There is no available survey report of the whole sum of Japanese fans but researchers can estimate this from some cases such as the total visitors of fans' blogs targeting on JKT48 or the number of leaked e-mail address from a AKB shop that made reservationsfor DVD of JKT48 that would be around 1,000-2,000 in early 2013.

Also, there is no available survey data about estimating generation of Japanese fans. However, it is possible to estimate the generation from posted messages because messages often included users favorite songs or other cultural information that were deeply related to their generation. It would be forties. To the surprise, there were many aged users who post messages that included their favorable music scene formore than sixties. This was because Japan had long history of pop culture and idol >40 years. On the other side, Indonesian fans were mainly teenage and twenties.

Behavior graphics: In this study, the researchers tried to know the style of communication and used social technographs developed by Solis (2010). To identify a style of communication, the researchers classified messages by extracting 14 message types from 17 message types in behavior graphics:

- B1 (problem solvers): commenters respond with resolution or direction
- B2 (commenters): providing thoughts, opinions, observations, experiences and sometimes, unfiltered reactions to the information shared online. They are less likely to produce original content but are compelled to share their views based on the introduction of content by others in and around their social graph
- B3 (researchers): researchers rely on their social graphs for information and direction to make qualified decisions. They are also active in comparing data and surveys to truly learn about the thoughts and opinions of those connected to them
- B4 (conversationalists): participation in conversations through proactive updates seeking responses or direct responses to other content, conversationalists enhance communication in a thread
- B5 (curators): in the context of behavior graphics, curators are recognized as a different role. This group works diligently to find and only share what captivates them as filtered by what they believe will interest their followers
- B6 (producers): they generate original content accepted by followers
- B7 (broadcasters): broadcasters are mostly one-way communicators who either intentionally or unintentionally push information to followers without injecting conversational aspects
- B8 (marketers): they dedicated to offering marketing ideas, products or services. They may exclude content outside of their interests unless the opinion is focused on beneficial and value-added solutions to specific audiences
- B9 (socialites): individuals who are famous in online community. Their effects are increasingly spilling over in real world
- B10 (self-promoters): unlike broadcasters and marketers, self-promoters are open in their own intentions through constant updating of activities, events and accomplishments
- B11 (egocasters): contribute to the "ego" in the egosystem and represent the developed self-promoters. They make constant promotion and the activities and responses. They think what they say and believe to become reality. Then, they lose natural communication
- B12 (social climbers): the sole mission of social climber is to rise to the top. These individuals intentionally climb ladders on the avatars, profiles and social capital of others. They often misrepresent their purpose and stature to get an audience
- B13 (TMI) "Too much information" is dictated by those on the receiving end of the update not those who publish it
- B14 (complainers): complainers post opinions that something bothers them. Complainers are often sharing their discontent as a primary communication in a thread

RESULTS AND DISCUSSION

We could confirm increasing posted messages from three periods of threads data; September 2011, February 2012, January 2013 (Table 1). Major messages were undirected utterances. However, some utterances involved inducements to lead replying messages of others. And appeared directed communication of significant messages between users was introduced to social graph analysis.

Expanding community size: From calculation results of NodeXL, researchers could confirm the growing size of graphs (community) especially in terms of number of vertices; users to communicate and edges; messages to connect two users. The following data are graph metrics and value (Table 1). Here, total edges had increased 22 times during 17 months where posted messages had increased 8 times.

Table 1: Network data statistics (Sep. 2011, Feb. 2012, Jan. 2013)

Graph metric	Sep. 2011	Feb. 2012	Jan. 2013
Messages	513	687	3929
Vertices	102	277	1306
Unique edges	101	302	2154
Total edges	120	419	2611
Graph density	0.011	0.0045	0.0014
Diameter	9	26	46
Average geodesic distance	3.87	8.48	15.94

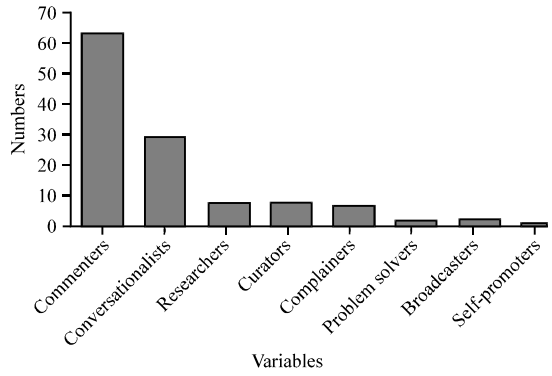

Fig. 3: Emerged types of behavior graphics

2CH allows anonymous posting and use a system of tripcodes instead of ID. This tripcode is the hashed result of a password that allows one's identity to be recognized without storing any data about users. When a user uses another terminal to post messages, the system is capable of generating a message of a different tripcode. Therefore, real the number of users would be less than scores of vertices above. However, researchers identified messages in which users mentioned a message of another trip code to be a same user and put them into a same vertex manually.

Behavior characteristics at the dawn of the community: After analysis at the dawn of the online community, September 2011, totally 8 types of behavior graphics were extracted (Fig. 3). Scores of types look to fall into the scale-free networks and power-law degree distributions. In addition, it could find characteristics that integrated types occupied major edges and integrated types located in a long tail.

Social graphs: Many of the clusters are visually grouped together by the Harel-Koren fast multiplex layout (Harel and Koren, 2001, 2002). Onelarge cluster and one smaller cluster were confirmed. There were many red vertices that meant low cluster coefficient. Also, there were some green vertices that had clique relation with neighboring vertices. One hub was observed (Fig. 4).

This Fruchterman-Reingold Layout is a Force-Directed Layout algorithm which treats edges like springs that move vertices closer or further from each other in an attempt to find an equilibrium that minimizes the "energy" of the system (Hansen *et al*., 2010; Harel and Koren, 2002, 2001). The researchers confirmed a vertex of an Indonesian bridge influencer with a label was pulled out to the peripheral area but vertices of Japanese fans in Indonesia are located in the peripheral from the initial view (Fig. 5).

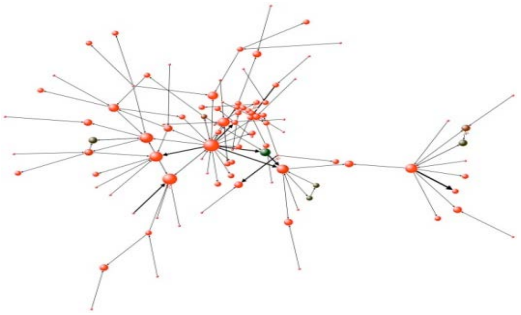

Fig. 4: A social graph of Sep. 2011 with node size proportional to node in-degree statistics and node color mapped to the value of the clustering coefficient: low values are indicated in red, high value indicated by shades of green (Harel and Koren Fast Multiplex algorithm)

Fig. 5: A social graph of Sep. 2011 where bridge influencers are pulled out to the peripheral area manually (Fruchterman-Reingold algorithm: Fruchterman and Reingold, 1991)

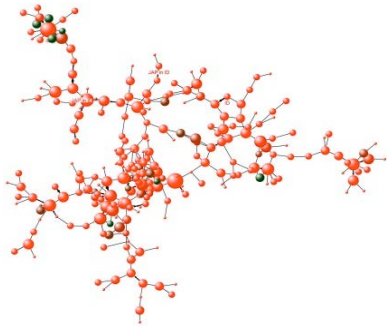

Fig. 6: A social graph of Feb. 2012 (Harel-Koren Fast Multiplex algorithm)

Several clusters were confirmed. And the number of green vertices had increased and it meant that points of discussion had increased (Fig. 6).

It was confirmed that a vertex of Indonesian fan had rather large in-degree and this fan exchanged frequent messages with a specific user (Fig. 7).

Although, vertices were increased, edges did not increase so much. All green vertices were small in-degree scores. However, many clusters and various points of discussion were appeared (Fig. 8). Bridge influencers located as smallerin-degree scores even in this graphs and there was no large hub (Fig. 9).

Indeed, the sparse links were observed at the dawn of the online community. Concerning activity in social network, Li (2007) analyzed online adults and reported that 52% of adults were inactive, 33% were spectators, 19% were joiner, 15% were collectors, 19% were critics and 13% were creators. Then, it could be calculated that users who post messages were 19+13 = 32% in all other online users of 67% (33+19+15) and estimation as roughly double number of users were viewers of never posting a message. From the statistic data of 2CH, 100 times of page views occuragainst one posting messages (calculated from the data of Wikipedia, 2013). Then, even an active user, chances to post messages would be limited.

The same characteristics are seen in following graphs as well. As a whole, the number of vertices of high clustering coefficient with green circles in social graphs were shown is few in Fig. 9. There was a hub in each social graph but these clustering coefficients were rather low score.

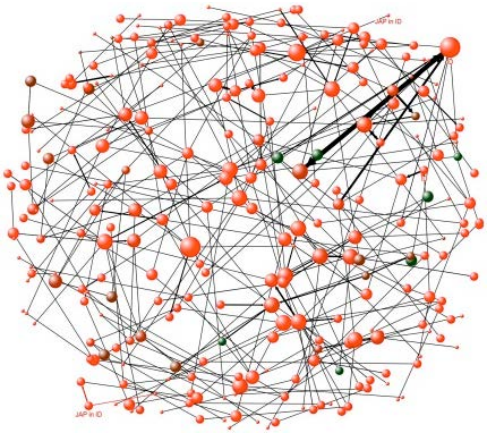

Fig. 7: A social graph of February 2012 (Fruchterman-Reingold algorithm)

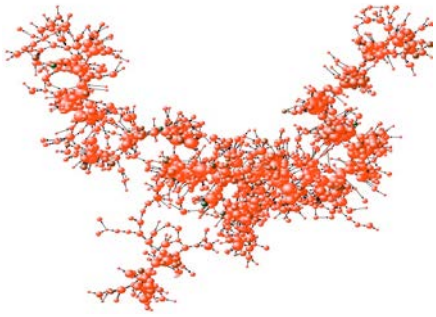

Fig. 8: A social graph of January 2013 (Harel-Koren Fast Multiplex algorithm)

Bridge influencers as ties to another online community:

- Degree centrality: the sum of vertices attached to a vertex divided by the number of the grap's other vertices
- Closeness centrality: the inverse of the sum of the shortest distances to the graph's other vertices
- Between centrality: the count how many paths a vertex involved into the shortest paths of the graph's other vertices
- Eigenvector centrality: it assigns relative scores to all vertices in the network based on the principle that connections to high-scoring vertices contribute more to the score of the vertex in question than equal connections to low-scoring vertices

Bridge influencers of Indonesian fans showed higher values of all centrality and it was clear that bridge influencers of Indonesian fans were more popular than bridge influencers of Japanese in Indonesia (Table 2).

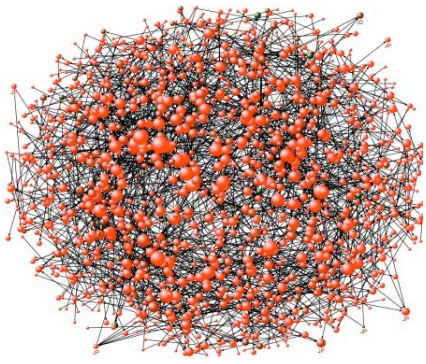

Fig. 9: Social graph of January 2013 (Fruchterman-Reingold algorithm)

Table 2: Centrality of bridge influencers

	Degree centrality		Closeness centrality		Betweenness centrality		Eigenvector centrality	
Parameters	Sep. 2011	Feb. 2012	Sep. 2011	Feb. 2012	Sep. 2011	Feb. 2012	Sep. 2011	Feb. 2012
ID fan	0.079	0.0200	0.0052	0.0016	870.0	571	0.04000	0.090000
JP in ID	0.023	0.0050	0.4000	0.0026	47.3	59	0.00022	0.000069

ID fan: Bridge influencers of Indonesian fans; JP in ID: Bridge influencers of Japanese fans in Indonesia

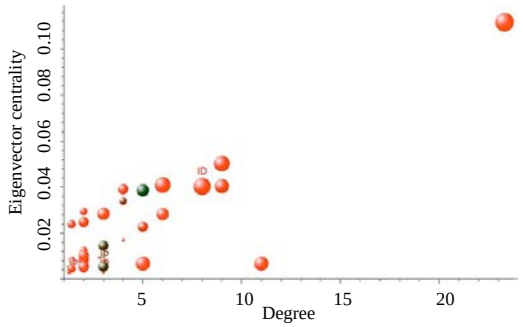

Fig. 10: A graph of Sep. 2011 mapping degree to the x-axis and eigenvector centrality to the y-axis. Edges are hidden. The size of each vertex is based on its in-degree whereas its position on the x and y axis is determined by its degree and eigenvector centrality score, respectively

Table 3: Observed type of behavior graphics (percentage, number in parentheses)

Type of behavior graphics	Sep. 2011	Feb. 2012
B1) Problem solvers	1.7 (2)	0.72 (3)
B2) Commenters	52.5 (63)	29.6 (124)
B3) Researchers	6.7 (8)	7.2 (30)
B4) Conversationalist	24.2 (29)	48.2 (202)
B5) Curators	6.7 (8)	4.5 (19)
B6) Producers	-	2.1 (9)
B7) Broadcasters	1.7 (2)	1.4 (6)
B10) Self-promoters	0.83 (1)	-
B11) Egocasters	-	1.7 (7)
B14) Complainers	5.8 (7)	4.5 (19)

Characteristics of bridge influences were possible to compare by visualizing a graph based on eigenvector centrality (Fig. 10). The graph made an outliner at the right top that was a hub. Indonesian fan could be seen in the middle and Japanese fans in Indonesia were located left bottom. Then, bridge influencers of Indonesian fanswere popular and showed clearly higer score than bridge influencers of Japanese fans in Indonesia.

Behavior of bridge influencers: Table 3 shows percentage of each type of behavior graphics of all edges. The power-law degree distribution is still seen in Feb. 2012 but maximum score is the "conversationalist" and more ingratiating manner of communication prevailed.

On the other hand, type of behaviorgraphics of bridge influencers had distinct differences. Indonesian local fans behaved as Table 4.

Out-degree of Indonesian fans was increasing and it had more than the number of in-degree in Feb. 2012. In both months, Indonesian fans were not a hub but had edges to a hub. Then, their initial utterances could lead responses as in-degree. Besides, Indonesian fans posted frequent ingratiating messages to communicate.

Table 4: Type of behavior graphics of Indonesian fans (number)

	In-degree		Out-degree	
Type of behavior graphics	Sep. 2011	Feb. 2012	Sep. 2011	Feb. 2012
B1) Problem solvers	-	-	-	1
B2) Commenters	1	8	1	1
B3) Researchers	-	2	-	5
B4) Conversationalist	4	8	1	8
B5) Curators	-	1	-	1
B6) Producers	-	-	-	5
B14) Complainers	2	-	-	-
Total	7	19	2	21

Table 5: Type of behavior graphics of Japanese fans in Indonesia (number)

	In-degree		Out-degree	
Type of behavior graphics	Sep. 2011	Feb. 2012	Sep. 2011	Feb. 2012
B2) Commenters	-	-	3	-
B3) Researchers	1	-	-	-
B4) Conversationalist	1	1	-	1
B5) Curators	-	-	2	2
B10) Self-promoters	-	-	1	-
Total	2	1	6	3

Nevertheless, a fan of Sep. 2011 was disrespected two times. This shows that there was certain mental resistance of Japanese at the dawn of inter-cultural communication. Also, an Indonesian local fan provided important information and recognized as to make ties to online communities in Indonesia.

Japanese fans in Indonesia: There were some Japanese who live in Indonesia and knew how to access local information. Their activities were mainly to post information that Japanese should know, however, continuous communication were limited on in-degree and out-degree shown in Table 5. They looked taciturn and seemed to avoid strategically attendingdiscussion around a hub. Nevertheless, posted information was indispensable for most users and recognized to compose ties to other communities.

It was clear that posted messages were decreased where total vertices and edges were increased because many of users had reached source of online information.

CONCLUSION

As described above, researchers investigated how the cultural project in a foreign country was recognized by Japanese online community. Particularly, effects of bridge influencers were discussed. From the analysis of social graphs and behavior graphics, it revealed some interesting findings.

There were many users waiting important information that they never know becausethey were strategic onlookers. And information was frequently appeared as utterances of bridge influencers. But, users did not pump

bridge influencers up to post continuous information. When they encountered unknown information or unexpected information, they tried to seek something meaningful information by themselvesrather than to post a soft-soap message. Under limited information environment, this trait reduced replying messages, particularly at the dawn of the online community. After users knew various informationsources sites, communication was developed by exchange more natural messages as the rate of overall behavior graphics score in the case to Indonesian fans. On the other side, Japanese fans in Indonesia showed continuous strategic taciturn but their utterances were still valuable for other users. Surprisingly, Japanese fans in Indonesia preferred to stay in peripheral where Indonesian fans posted messages related to a hub discussion. This exact opposite characteristics would imply difficulties of Japanese to discuss inter-cultural issues.

On the other side, it looked easy to happen cyber cascade under shortage of information (Sunstein, 2001) but users were frequently asked and confirmed original resource of information when they saw an unreasonable message and exchangetheir opinions by using type of "commenters" and "conversationalist".

At this moment (September 2013), JKT48 online community has variegated and appearednine independent active thread boards. JKT48 became No.1 idol group in Indonesia and their song was ranked number one in the Indonesian song chart on 2nd September 2013 (RCTI, 2013).

Also, information sources have increased and users of online communities in Japan are expected to have more cooperating manner with various Indonesian online communities.

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