

# Review of Basic Research on Factors Media and Word Formation Typologies that Cause Bursts Between Online Social Networks

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**Abstract**—In this paper, we obtained a study on the interaction between Twitter and other media. As basic research on the interaction between large-scale media and discourse space in Japan, we will examine the characteristics of discourse space regarding the interaction of direct and indirect actions of information, based on the results of simulations of basic mentions and interactions centered on the characteristic keyword "human" from around 2011 to 2014. In this research, we explored the possibility of analyzing the characteristics of the discourse space regarding the direct and indirect actions of information.

**Keywords**-Social Media; Simulation; Sociophysical; Twitter.

## I. INTRODUCTION

As the number of academic approaches to social media increases, the number of social media outlets has also diversified, and the number of users and their contact time continues to grow. However, in recent years, there has been a tendency for Twitter to be linked to other social media such as images and videos, and the diffusion and perception of trends differs depending on the language. In this paper, we discuss the interaction between Twitter and other media. In this study, as basic research on the interaction between large-scale media and discourse space in Japan, we will examine the characteristics of discourse space regarding the interaction of direct and indirect actions of information, based on the results of simulations of basic mentions and interactions centered on the characteristic keyword "human" from around 2011 to 2014. In this research, we explored the possibility of analyzing the characteristics of the discourse space regarding the direct and indirect actions of information. According to [1], the equation of reputation dynamics in the mathematical model for hit phenomena has the following form:

$$\frac{dl(t)}{dt} = CA(t) - DI(t) + Pl^2(t) \tag{1}$$

Here, the first term corresponds to the effect of media as an external force; the second term corresponds to attenuation of attention and direct communication D; and the third term corresponds to indirect communication. In the analysis of reputation on social media, the third term, the indirect

communication term, is very important. However, for Web application access, the third term, the indirect communication term, has been discussed in previous studies as lacking [2][3][4], and we would like it to be re-examined in the process of basic research for this analysis, such as adjustment of random numbers.

In previous studies of mathematical models of hit phenomena [2][3], analyses were focused on topics that received special attention on social media in Japan.

In reality, however, it is necessary to conduct basic research on how one keyword or word is intertwined with or affected by other bursts of keywords, and to compare and discuss the relationship between the interaction of media information around these keywords and the actual results. In addition, it is necessary to compare and discuss the relationship between the interaction of media information around these keywords and the results of actual measurements. The task of this research is to find out what kind of universal keywords change their behavior on the Web due to the increase in their quantity on other media at what time, and to consider the difference between the phenomena in the real world and on the Web.

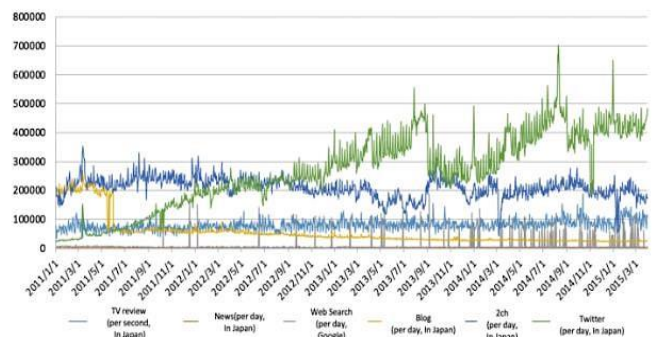


Figure 1. The amount of exposure in each media including "Keyword:Human" (the number of exposure in online social media and TV media in Japan), 2011/01-2015/03 (Tweet data sampling 1/10).

The reason for including the keyword "human" in the graph of data examples in Figure 1 is that "human" was the most frequently mentioned word in the Japanese language from 2011 to 2015, and it is also a frequently appearing word in Japanese idiomatic dictionaries. In addition, around 2011, Japan was hit by the Great East Japan Earthquake, an unprecedented disaster, and Japan received a great deal of support not only from within Japan, but also from countries

around the world. This is because, at that time, too, the keyword "human," which expresses "human life," was most frequently used in the center of communication keywords in the Social Network Sites (SNS) space within Japan. In other words, this keyword was first taken up because "human" was the keyword representing the core that was communicated a lot on SNS during the period when people were conscious of communication between people's hearts and minds.

## II. DISCUSSION

Nowadays, we are able to obtain information on social trends and excessive movements from social media.

In the early days of research on mathematical models of hit phenomena [2], the number of external forces in the media and the actual number of mentions on social media such as Twitter were to some extent determined by simulation results, and the transition could be inferred from the behavior of parameters in the calculation results. However, in recent years, due to complex factors such as advertising agencies, external forces have been arbitrarily applied to certain "keywords", and it has become somewhat difficult to analyze them using the mathematical models in previous studies [2][5].

In this study, we examine the number of Twitter, Blog, 2ch, and TV exposures of registered words in nouns, verbs, adverbs, coordinating verbs, conjunctions, and inspirations/interjections in Wiktionary: Japanese Basic Vocabulary 1000 [7] from the dawn of the social media space in Japan (2011/01-2015/03).

We wanted to extract the number of mentions in Twitter, Blog, 2ch, and TV exposure (in seconds) of the registered words in the basic Japanese vocabulary of 1000 [7] and return to the basic research to obtain a consideration of the behavior of these direct and indirect media information and media interaction. In order to understand the characteristic, arbitrary, and excessive behaviors on SNS as one of the natural phenomena, we think it is important to compare and analyze the behaviors and activities around the accounts (sources) that have a strong network structure on social media with the real-life events and phenomena on social media for the future development of the web science field. The number of mentions among online social networks (media) starting from keywords and topics is shown in Figure 2.

There are "keywords" and "topics," especially "natural phenomena". For this reason, as mentioned in the introduction, we believe it is necessary to consider the interaction of information and keywords that spontaneously generate interaction outside of the media in the future.

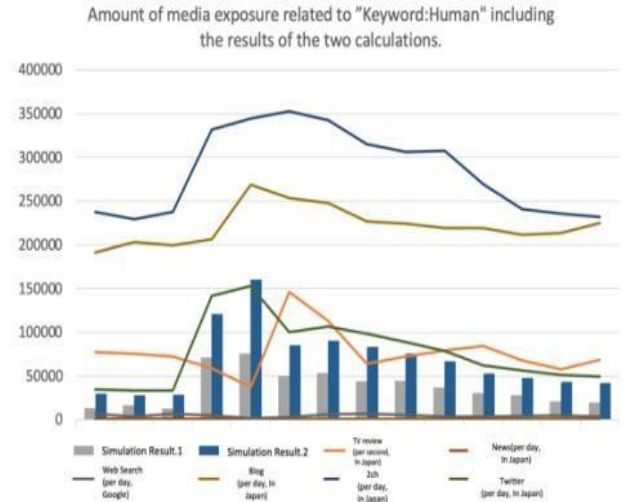


Figure 2. Amount of media exposure related to " Keyword: human" including the results of the two calculations during disasters in Japan, when social incident (Tweet data sampling 1/10), Simulation Result1: Effect TV, Simulation Result2: TV and News.

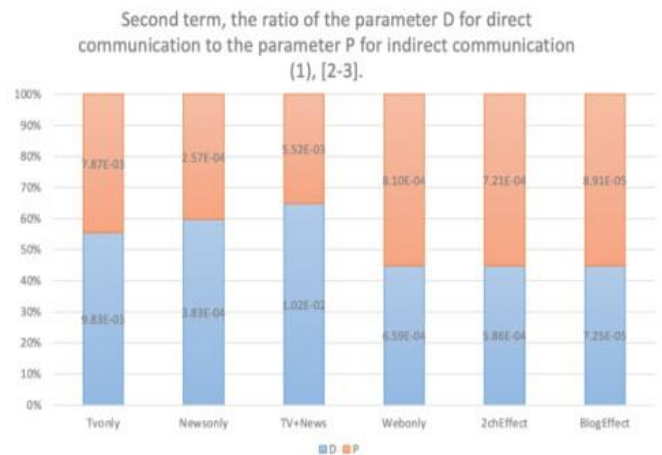


Figure 3. Result of simulation 1,2, the second term, the parameter D of direct communication and the third term, the parameter P of indirect communication, are accounted from the proportion of optimal solutions from the proportion and random number calculation (1), 10000 times [2][3].

### III. CONCLUSION

As shown in Figure 2 and Figure 3, when looking at the number of mentions among online social networks (media) starting from naturally occurring cases such as when a disaster occurs, or keywords that appear frequently in daily life, the number of mentions in the above Figure 2 and Figure 3 are the number of mentions when a disaster occurs.

In the case of a major incident, the number of press mentions of a common word can have a rapid impact one or two days after the incident occurs. Therefore, it is difficult to predict the number of mentions on Twitter and 2ch, where the volume of information exchange is large.

As for the calculation results, D and P show the optimal solutions by assigning parameters using the Monte Carlo method to generate random numbers, but in the case of sudden incidents, the number of reports increases rapidly by a day or two. On the other hand, when the keywords are generalized, the calculation results show that the influence of the parameter D (especially, TV+News) as the influence of extremely direct information is a little strong. Therefore, in the case of using a sociophysical approach for this kind of analysis, it is important to examine the qualitative characteristics of the real numbers and conduct the analysis, and to compare the parameters of the simulation results separately at the time of the incident and before and after the incident. We believe that it is important to further accumulate basic research. By accumulating these studies, we may be able to propose ideas to compensate for the missing parameters in (1) according to [2].

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### REFERENCES

- [1] N. Yoshida, A. Ishii, and H. Aragaki, "The equation for big hits: Mathematizing the word-of-mouth effect of social media" Discover 21, Inc., 2010.
- [2] A. Ishii, H. Arakaki, N. Matsuda, S. Umemura, T. Urushidani, N. Yamagata and N. Yoshida, The 'hit' phenomenon: a mathematical model of human dynamic Interactions as stochastic process. New Journal of Physics 14, 2012.
- [3] S. Suzuki and S. Morimoto, Present status and issues of internet television in Japan: Information Processing Society of Japan 74th Nationwide Meeting (4-733).
- [4] J. B. Pendry, "Reliability Factors for LEE D Calculations." J. Phys. C3: 937, 1980.
- [5] N. Yamagata, "Discussion of parameters of mathematical model of hit phenomenon using random numbers," Graduate thesis, Department of Applied Mathematics and Physics, Faculty of Engineering, Tottori University, 2010.
- [6] A. Ishii, T. Koyabu, K. Uchiyama, and T. Usui, "Mathematical theory for social phenomena to analyze popularity of social incidents quantitatively using social networks", Proceeding in Adaptation, Learning and Optimization, vol. 2, pp 389-402, ISI Proceedings by Springer-Verlag, 2015.
- [7] Wiktionary, 1000 Basic Japanese Vocabulary (Ref:2015/08/26), <https://ja.wiktionary.org/wiki/Wiktionary>