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Social Media's Position in Web Within the Scope of Online Information Flow

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Abstract

World Wide Web (Web) is commercialized at the very end of 20th century and now, in the 21st century, almost half of the human society is using it. Web technologies have evolved and a relatively small set of them has a capacity of simulating complexity of sociality via interpersonal interactions; to define this small set many terms have been suggested, yet *social media* has been widely used by many scholars. Social media is a set of online communication networks that constitutes a crucial hub for producing, accessing and diffusing information. Inquiry on understanding the online flow of the information, it is essential to understand the topological position of social media within web's mesh structure. In this paper at first communication and information terms will be defined and social media will be discussed within the scope of complexity and information flow terms from network science and communication science perspective. At last, a graph analysis example on social media's topological position within web will be shared to emphasize social media's importance on online information flow.

Keywords: Social Media, Convergence Model of Communication, Information Flow, Communication Theory, Network Theory

Introduction

"There is nothing permanent except change."

Heraclitus

Change is the only constant in nature. Systematic changes create transformations and transformations affect sociality. One of the change agents is technology. A technology with an innovation status is affected by social changes and is affecting social's itself. World Wide Web is one of those technologies that affected human kind since Tim Berners-Lee invented it by the end of 20th century; and for several years, at the first quarter of 21th century, social media as another socio-technical change agent has been developed within the World Wide Web ecosystem.

Social media is a relatively small set of web technologies with a capacity of simulating complexity of sociality via interpersonal interactions. As an online communication network, social media is a hub within web for producing, accessing and diffusing information. Users of this technology are free to transmit messages between each other; users of this technology are experiencing mass communication and interpersonal communication at the very same time. However freedom of transmitting does not necesarilly means that every user have an equal potential of accessing millions. With the scale-free social network structure, there the power-law comes. A small set of users access to huge amount of users. The Pareto balance is always there for scale-free complex structures. Web is fragmented just like our sociality.

Through this paper first of all fundamental concepts of communication and information will be discussed; then the structure of web will be explained from the network science perspective. An experimental research study will be shared to identify social media's topological position in web according to users' web usage tendencies. The research will be combining social network analysis and ethnographic study. It must be emphasized that this research has a pilot study status for further researches, which will create a synthesis between network and communication sciences.

Background

Different perspectives have different definitions of communication yet it can be systematically defined as Rogers and Kincaid (1981, 63) did: a process in which the participants create and share information with one another in order to reach a mutual understanding. Information is one of the dominant and fundamental components of communication and just like communication; information has been defined innumerable ways. From cybernetics perspective, Information is mainly considered as a measure of uncertainty in a system of signals; it is a difference in matter-energy which affects uncertainty in a situation where a choice exists among a set of alternatives (Rogers & Kincaid, 1981, 48). Losee (1997, 265) states that "Information may be understood as the value attached or instantiated to a characteristic or variable returned by a function or produced by a process.". Information is what is capable of yielding knowledge, and since knowledge requires truth, information requires it also (Dretske, 1982, 46) then it can be seen as a commodity that given the right recipient

is capable of yielding knowledge. It must be emphasized that concept of information and concept of meaning have an important distinction.

Rogers and Kincaid (1981, 55) have showed this distinction within the scope of their convergence model of communication. Figure 1 and 2 shows the convergence model's perspective on the relationships of different levels of reality (psychological, social and physical) and relationships between concepts such as information, mutual understanding and communication. Convergence model is a dynamic model of communication that implies communication networks consists of interconnected individuals who are linked by patterned flows of information that may create mutual understanding (Rogers & Kincaid, 1981, 63). Information and meaning concepts have relationships in different reality levels and from a antrocentric point of view information might be seen as the core of the mutual understanding if perceived, interpreted and understood mutually. Rogers and Kincaid (1981, 66) stated "Convergence requires study of the direction and rate of change and study of networks of two or more persons who exchange information.". Nature's itself is a source of information; human beings have been perceiving, interpreting and understanding the physical reality and creating psychological reality and the information created by the psychological realities of individuals are the essence of social reality.

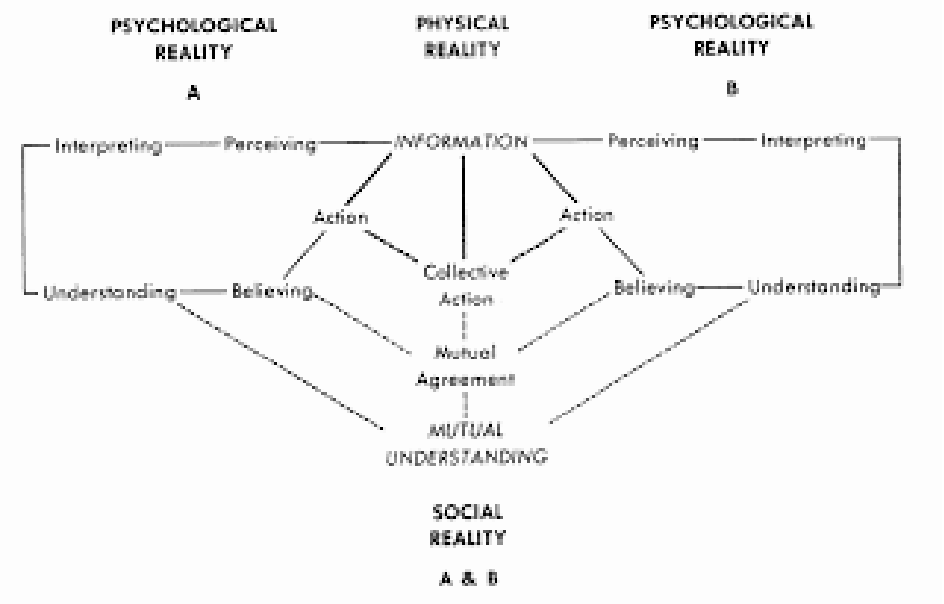


Figure 1: Basic Components of the Convergence Model of Communication (Rogers & Kincaid, 1981)

Communication as a process is a bridge between realities that may lead to mutual understanding between participants of the process and every fundamental element

of this process has an important role. The medium is one of the communication elements that affect the nature of communication. Mass communication for several decades have been transforming radically because of the medium element's transformations. These radical transformations are brought up the concept of new media that promises demassified and asynchronized media environment that is open to interaction between communication participants. One of the new media is World Wide Web (WWW or Web.)

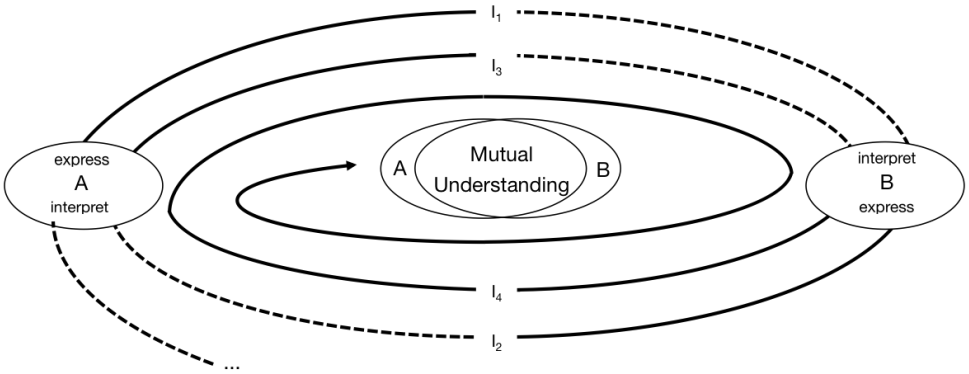


Figure 2: A Convergence Model of Communication (Rogers & Kincaid, 1982)

Web, as an information and communication technology, is affecting physical, psychological and social reality. Web affects physical reality by their very presence within nature; Web affects psychological reality by cognitive aspects; Web affects social reality by communicational and cooperational aspects… Information is a fragment of reality and Web is a technology of creating, storing and transmitting information between individuals then from Rogers and Kincaid's perspective Web is a technology of potential communicational convergences.

Web is a network that mechanisticly exists of interconnected websites that contains multimedia elements, and also web is a network of users; thus websites are the channels of information flow between individuals. According to Fuchs (2014, 43) web can be defined as a techno-social system that comprises the social processes of cognition, communication and co-operation. Figure 3 shows Fuchs' (2014) perspective of web's sociality which categorizes web pages into three according to Durkheim, Weber, Tönnies and Marx's social definition. By combining Rogers, Kincaid and Fuchs' perspectives, a syntheses can be generated: A website with any multimedia element will triger a cognitive process, a intracommunication which will ended up with constructing a psychological reality; if a website allows its users to reciprocally communicate then it will trigger the social reality construction; if users tends to converge then users collectively constructs a social reality and users will co-operate.

Web is a complex system for interconnecting both websites and individuals. Web technologies have evolved from websites that allows one-way technology-mediated communication to multi-way technology-mediated communication; a relatively small set of the Web has a capacity of simulating complexity of sociality via technology-mediated interpersonal interactions; to define this small set many terms have been suggested, yet *social media* has been widely used by scholars. Social media is a set of online communication networks that constitutes a crucial hub for producing, accessing and diffusing information; thus social media constitutes communicational convergence potential for individuals. From an euphoric perspective social media can be seen as the ultimate convergence medium however what make web social is human agent then it should be considered as a tool of both convergence and divergence. Users have the responsibility of constructing and destructing the social in social media; and the medium itself by design has a role to lead users. Then is it possible to say social media is providing equality or information flow that may lead a convergence?

	Approach	Sociological theory	Meaning of sociality on the WWW
1	Structural Theories	*Émile Durkheim*: Social facts as fixed and objectified social structures that constantly condition social behaviour.	All computers, the Internet and all WWW platforms are social because they are structures that objectify human interests, understandings, goals and intentions, have certain functions in society and effect social behaviour.
2	Social Action Theories	*Max Weber*: Social behaviour as reciprocal symbolic interaction.	Only WWW platforms that enable communication over spatio-temporal distances are social.
3	Theories of Social Co-operation	*Ferdinand Tönnies*: Community as social systems that are based on feelings of togetherness, mutual dependence, and values.	Web platforms that enable the social networking of people, bring people together and mediate feelings of virtual togetherness are social.
		Karl Marx: The social as the co-operation of many humans that results in collective goods that should be owned co-operatively.	Web platforms that enable the collaborative production of digital knowledge are social.
4	Dialectic of Structure and Agency *Émile Durkheim*: cognition as social due to conditioning external social facts *Max Weber*: communicative action *Ferdinand Tönnies, Karl Marx*: community-building and collaborative production as forms of co-operation	Web 1.0 as a system of human cognition. Web 2.0 as a system of human communication. Web 3.0 as a system of human co-operation.	The Web as a dynamic threefold system of human cognition, communication and co-operation.

Figure 3: Web's Social Dimensions (Fuchs, 2014)

Many euphoric individuals see web and social media as a medium of equality however both have a scale-free topology that the vast majority of documents are hardly visible (Barabasi, 2002, 174). Users are free to create, visit or participate a website however scale-free attribute causes a power-law for information flow. The web is fragmented and not all pages can be connected to each other so Barabasi (2002) argues that a directed network like web will never be a single, homogeneous, complex network. Barabasi shares a model (Figure 4) that web can be represented by four main continents; central core, in and out continents, tendrils and disconnected (isolated) islands (Neumann & Baumgrass, 2013):

Central Core: A scale free network that every node can reach every other node in the central core. (Major sites in the most connected areas of Web.

In Continent: Every node can reach nodes within the Central Core but no path can return to the In Continent. (Sites not likely to be referenced by others)

Out Continent: Every node holds many links from nodes of the central core, but these nodes to not link back to the central core. (Heavily referenced documents or corporate websites which contain specialized information but few links out)

Tubes: The feeders linking into content with nothing linking back them.

Tendrils: Nodes reach from In Continent to the Out Continent without touching the central core

Island: Seperated nodes from the rest of the network (E.g. Corporate intranets)

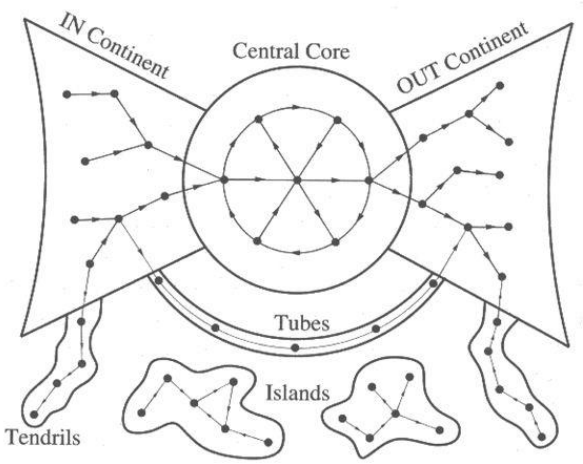


Figure 4: Continent Model of Social Networks (Barabasi, 2002)

Topology of the medium is crucial for information flow, as Barabasi's model suggests Web has a complex and scale-free network thus some mediums within Web have advantages and some mediums have disadvantages due to their position in the ecosystem. Some mediums are connected to the large amount of other mediums via

user tendencies; the Pareto balance in Web makes several websites such as social media very crucial.

Research

By its design and users' tendencies, web is ruled by power-law. There is a Pareto balance in web ecosystem that some sites are chosen more to use. In Figure 5 Alexa's (2016) ratings of websites are shown for Global and for Turkey; these are the sites constitute the central core. According to these rankings 29 sites out 100 for Global and 27 sites out of 100 for Turkey are considered as social media. Social Media's importance for information flow may be understood with Alexa's popularity ranking however for a better understanding of the social media's position users' tendencies should be considered. As mentioned in the background section, web is a scale-free network; to identify the central core of web's network topology Alexa ratings is not sufficient.

Global			
Rank	Website	Rank	Website
1	Google.com	51	Stackoverflow.com
2	Youtube.com	52	Naver.com
3	Facebook.com	53	Apple.com
4	Baidu.com	54	Aliexpress.com
5	Yahoo.com	55	Xvideos
6	Amazon.com	56	Google.com.mx
7	Wikipedia.org	57	Whatsapp.com
8	Twitter.com	58	Imdb.com
9	qq.com	59	Google.com.hk
10	Google.co.in	60	Google.co.kr
11	Live.com	61	Pornhub.com
12	Taobao.com	62	Fc2.com
13	Google.co.jp	63	Google.ca
14	Linkedin.com	64	Youth.cn
15	Sina.com.cn	65	163.com
16	Instagram.com	66	Ok.ru
17	Weibo.com	67	Amazon.in
18	Bing.com	68	Jd.com
19	Yahoo.co.jp	69	Blogger.com
20	Msn.com	70	Xhamster.com
21	Google.de	71	Google.com.tr
22	Vk.com	72	Office.com
23	Hao123.com	73	Google.co.id
24	Yandex.ru	74	Soso.com
25	Google.co.uk	75	Craigslist.org
26	Reddit.com	76	Amazon.de
27	T.co	77	Rakuten.co.jp
28	Ebay.com	78	Google.pl
29	Google.fr	79	Booking.com
30	Google.ru	80	Dropbox.com

Turkey			
Rank	Website	Rank	Website
1	Google.com.tr	51	Aliexpress.com
2	Youtube.com	52	Memurlar.net
3	Facebook.com	53	Wordpress.com
4	Google.com	54	Stackoverflow.com
5	Onedio.com	55	Blogger.com
6	Eksisozluk.com	56	Popads.net
7	Sabah.com.tr	57	Denizhaber.com.tr
8	Haber7.com	58	Amazon.com
9	Hurriyet.com.tr	59	Microsoft.com
10	Sahibinden.com	60	Vk.com
11	Twitter.com	61	Imdb.com
12	Milliyet.com.tr	62	Hepsibahis162.com
13	Live.com	63	Kariyer.net
14	Ensonhaber.com	64	Fullhdfilmizlesene.org
15	Yandex.com.tr	65	Isbank.com.tr
16	Instagram.com	66	Github.com
17	Yenisafak.com	67	Cnnturk.com
18	Wikipedia.org	68	Odatv.com
19	Yeniakit.com.tr	69	Haber3.com
20	Hepsiburada.com	70	Vidyomani.tv
21	Sozcu.com.tr	71	Booking.com
22	n11.com	72	Oyunskor.com
23	Mynet.com	73	Tureng.com
24	Internethaber.com	74	Ulke.com.tr
25	Haberturk.com	75	Dailymotion.com
26	Kizlarsoruyor.com	76	Yemeksepeti.com
27	Gittigidiyor.com	77	Apple.com
28	Sporx.com	78	Twitch.tv
29	Blogspot.com.tr	79	Milliyetemlak.com
30	Onclickads.net	80	Vatanbilgisayar.com

31	Gmw.cn	81	Nicovideo.jp
32	Pinterest	82	Pixnet.net
33	Google.com.br	83	Google.com.au
34	360.cn	84	CNN.com
35	Tmall.com	85	Alibaba.com
36	Mail.ru	86	Xinhuanet.com
37	Netflix.com	87	Diply.com
38	Sohu.com	88	Googleusercontent.com
39	Amazon.co.jp	89	Google.com.tw
40	Google.it	90	Popads.net
41	Google.es	91	Quara.com
42	Microsoft.com	92	Amazon.co.uk
43	Onclickads.net	93	Youku.com
44	Paypal.com	94	Microsoftonline.com
45	Chinadaily.com.cn	95	Cntv.cn
46	Wordpress.com	96	Outbrain.com
47	Tumblr.com	97	Bongacams.com
48	Blogspot.com	98	Bilibili.com
49	Imgur.com	99	Coccoc.com
50	Github.com	100	Alipay.com

31	T.co	81	Karar.com
32	Haberler.com	82	engageya.com
33	Donanımhaber.com	83	Trendyol.com
34	Garanti.com.tr	84	Mackolik.com
35	Linkedin.com	85	Ligtv.com.tr
36	Uludagsozluk.com	86	Hdfilmcehennemi.com
37	Whatsapp.com	87	Ahaber.com.tr
38	Turkiye.gov.tr	88	Fotomac.com.tr
39	Osym.gov.tr	89	Superbahis238.com
40	Fanatik.com.tr	90	Gemius.pl
41	Yahoo.com	91	Aksam.com.tr
42	Msn.com	92	Turktelekom.com.tr
43	Incisozluk.com.tr	93	Yapikredi.com.tr
44	Junbi-tracker.com	94	Sondakika.com
45	Ntv.com.tr	95	Ofpof.com
46	Cumhuriyet.com.tr	96	İzlesene.com
47	Meb.gov.tr	97	Dizibox.com
48	Tumblr.com	98	Bing.com
49	Shiftdelete.net	99	İlacrehberi.com
50	Gazetevatan.com	100	Filmifullizle.org

Figure 5: Alexa Global and Turkey Rankings

The main purpose of this research is to construct an experimental survey to identify relationships between websites not only from mechanistic data but also from web user tendencies; so it must be emphasized that this research can be considered as a pilot study for further researches. A mixed research approach, both qualitative and quantitative, is structured to create a synthesis of social network analysis and ethnographic research. By this means a survey is designed to find out the websites participants are using and the referrals done by the participants between these websites. Data is collected between 18.08.2016 to 25.08.2016 from 10 Turkish participants by face-to-face interview and web browser data of the participants. Fundamental research questions for participants are:

A: Which web sites do you use and how often?

B: Which web sites do you go via these websites and how often?

C: How do you do referrals? By clicking a hyperlink or else?

D: For what purpose do you do these referrals?

To measure frequencies participants was asked to rate with a Likert scale (0-5). From participants' responses a matrix is obtained for each participant to create a relationship graph. Graph is obtained via Gephi software and graph representations are:

Nodes: Websites

Color of the Node: Website Type

Size of the Node: Frequency of User Visitation

Edges: Referals

Color of the Edge: Referral Source Color

Size of the Edge: Frequency of Referrals

In total, 10 participants have given responses for 131 websites. Figure 6 shows the graph obtained from 10 participants' responses (The frequencies are taken as arithmetic mean values) and Figure 7 shows the statistics of the graph.

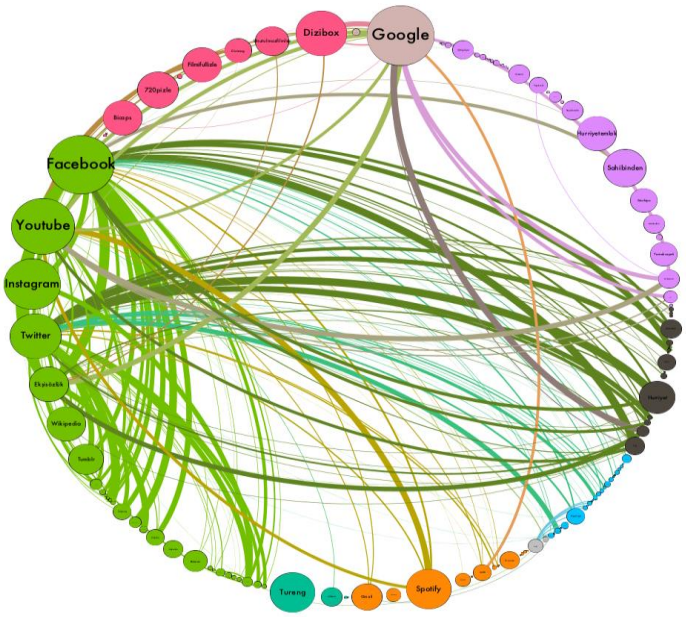
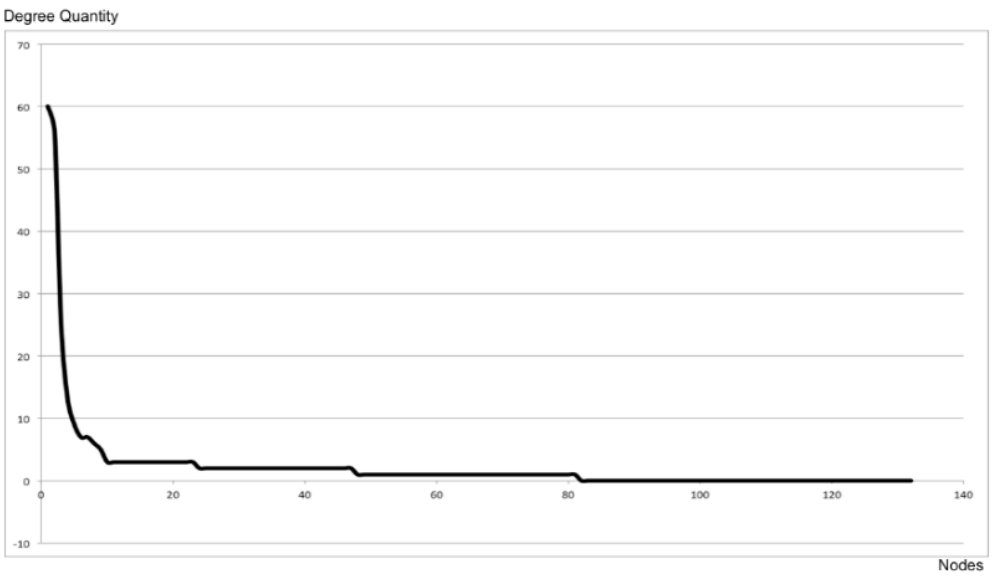


Figure 6: Websites Relationship Graph Obtained From 10 Participants' Responses



Average Degree	2.364
Average Weighted Degree	0.626
Network Diameter	3
Graph Density	0.009
Modularity	0.335
Connected Components	52
Average Path Length	1.887
Average Clustering Coefficient	0.262

Figure 7: Graph Degree Distribution and Network Statistics

There are two main findings. First one is 17.42% of websites have 73.72% of the degrees and social media with 66.67% of the overall degrees is 19.85% of the overall websites participants use. As Barabasi (2012) stated, web have a scale-free topology and there is a power-law in this ecosystem and also according to continent model social media can be considered as the central core which makes social media very important for information flow. Second one is all participants states that they go to sites by clicking and hyperlinks within a website and also by entering the address to the web browser. Two fundamental reasons are obtained for opening a new page and entering the address: Search and Share.

Conclusion

"We can see now that information is what our world runs on: the blood and the fuel, the vital principle."

Gleick (2011)

Information is one of the fundamental elements of communication process. For both offline and online communications the information flow structures have crucial role. Web as a complex structure have a power law that information actually flows within a small set of websites relative the overall ecosystem. With this experimental research study, social media is observed as it is in the very core of the online information flow. As mentioned in the research section, this study has a pilot study value for further researches.

The experimental methodology used with this research has to be restructured to find a trend for representing larger universe with a high confidence interval. The new research design is planned to be covering longer period of time and using automated data gathering software; thus web's dynamic structure will be represented significantly. Also instead of mapping the relationship of web's mechanic structure, mapping the user's tendencies is believed to lead us a better understanding for semantic value of the online information pathways. Network science as a positive

science and communication science as a social science, together, can lead us to achieve the physical reality of our sociality. This research was only a small step for bigger steps for synthesis of network and communication science disciplines.

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