

Understanding Sequencing in Social Network Communications

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Résumé

Comprendre le séquençage dans les communications dans un réseau social :

Le séquençage est un processus décisionnel indispensable dans la circulation de l'information. Cette note de recherche propose la conceptualisation de séquençage pour comprendre comment et pourquoi les expéditeurs d'information « priorisent » certains membres du réseau pendant qu'ils communiquent avec d'autres. Nous examinons l'utilité de cette conceptualisation avec les données recueillies à partir de GRAND, un réseau académique. Le concept de séquençage permet aux chercheurs d'explorer les processus décisionnels qui surviennent avant le flux d'information et de lier le comportement des individus au contexte social.

Abstract

Sequencing is an indispensable decision-making process during information flows. This paper proposes the conceptualization of sequencing to understand how and why information senders prioritize some network members when they communicate with others. We examine the usefulness of this conceptualization with data collected from GRAND, a scholarly network. The concept of sequencing enables researchers to explore the decision-making process that occurs prior to information flows and link individuals' behavior to the social context.

Mots clés

Séquençage, Réseaux sociaux, Flux d'informations, Méthodes qualitatives

Keywords

Sequencing, Social Networks, Information Flow, Qualitative Methods

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Introduction

While we live our lives in sequence – as the timeline flows on, one thing leads to another – so much of social scientific analysis is cross-sectional: analyzing the pseudo-simultaneous arrangement of phenomena. That is what correlations and cross-tabulations are all about.

By contrast, “sequencing” focuses on the temporal order of things or events, whether consciously done or less-consciously experienced. In the study of information flows, sequencing is also related to prioritization when people prioritize some of their contacts or some of the media they use (Heirich, 1964). Understanding how people sequence becomes especially important as we move to a society of networked individuals where work, friendship and even family are spatially and temporally distributed (Rainie and Wellman, 2012). Far-flung people need to communicate to accomplish tasks and to enjoy each other, and they need to have some understanding of what media to use and how to prioritize their messages.

In this paper, we analyze sequencing as the decision process during which individuals arrange the temporal order of their contacts in social networks by prioritizing or de-prioritizing some of the contacts when taking various factors into consideration. The factors consist of: (1) structural factors such as the social networks that the individuals are embedded in and their relationships with the contacts; (2) information factors such as importance, urgency, confidentiality and privacy; (3) physical factors such as geographic distance and media access.

We use data from a complex scholarly network as the source for our work.

As information flows, sequences and the sequencing process are linked to each other. Ryan’s concept of “information order” (2006: 299) discusses this relationship as: “the orderly patterns of information acquisition, storage, concealment, exchange, and dissemination and the distribution of collective, public, and private knowledge that they produce”. Ryan argues that the shape of the information order emerges from the interaction within social networks where actors continually make decisions about information dissemination and direct information flow through different channels. Although Ryan’s definition of sequence is vague and abstract, it points out that sequence, as a form of “orderly pattern,” is related to the decision-making process. It implies that actors are actively involved in a sequencing process. In other words, sequences and sequencing are linked in two ways: on one hand, individuals actively put the sequencing process into practice because they are required to follow socially constructed sequences; on the other, sequences emerge from the interaction within social networks during the sequencing process.

Because of the relationship between sequencing and sequences, the lack of conceptualization of the sequencing process may lead to confusion and ignore important findings in certain studies. For instance, Grossetti et al. (2011) aim to understand mobilization of social relations by looking at sequences of resource access. Using the relational chains method started in “small worlds” studies (Milgram, 1967), they elaborate the link between personal relationships and the sequences of communication in social networks. Although these authors are collecting qualitative data to understand the process of resources access, they focus more on the patterns of sequences rather than explaining how people decide on sequences.

Mançeron and Leclerc (2001), quoted in Locoppe and Smoreda (2005), conducted one of the few studies that shed light on the sequencing process during information flows. They found that when announcing the birth of their child, new parents call their parents by mobile telephone from the hospital immediately after the birth; they call close friends with landline telephones after they return home; and they send an email to other relatives and friends later on. In this case, the process of prioritizing and de-prioritizing the contacts on the list is the sequencing process, while the order itself is the sequence produced from the sequencing process.

In their pioneering work, these – and other – scholars overlook the distinction between the active sequencing process and the sequences themselves. For example, several scholars have noticed that the asynchronous communication enabled by Information and Communication Technologies (ICTs) such as the Internet and cellphones largely changes the sequence of information flow (Haythornthwaite and Wellman, 2002; Boase and Wellman, 2006; Hogan, 2008). Because they do not point out that media are used during the sequencing process, their findings are more about how a certain medium changes the sequence rather than about how users choose different media for the purpose of prioritizing or de-prioritizing some contacts.

Methods

The process of sequencing may vary substantially in different social networks because each social network has distinctive structural and cultural characteristics. We examine the sequencing process in a scholarly network for three reasons. First, we try to decrease the importance of media access. In scholarly networks, most members have Internet access and landline telephones in their work place with their institutions, and their financial condition allows them to have cellphones. Second, it is relatively easy to trace information flows in scholarly networks. A high degree of communication through open channels (for instance, conferences and publications) and private channels (for instance, chatting and emailing) among members is maintained within scholarly networks which have clear boundaries (Wellman et al., 2006). Third, we were fortunate to receive major access to a new scholarly network in Canada: the Graphics, Animation and New Media Network of Centres of Excellence (GRAND).

GRAND is a networked organization. Thirty-two projects are conducted with the requirement that each of them should have collaborators from three disciplines from three different universities. GRAND is a large network within which each project is a sub-network or subgroup. Although all the projects are interdisciplinary, they are organized in five groups based on their general themes: (1) New media challenges and opportunities; (2) Games and interactive simulation; (3) Graphics, animation and imaging; (4) Social, legal, economic, and cultural perspectives; (5) Enabling technologies and methodologies.

For each theme, two Theme Leaders are appointed from Network Investigators (NIs) by the Board of Directors to help coordinate communications between projects and the board. In each project, there are Network Investigators and Collaborative Researchers (CRs). Both NIs (N=56) and CRs (N=88) are involved in the research. NIs are primarily responsible for building a network to initiate itself and

coordinate collaboration, and CRs focus on the collaborative research. Executive management of the organization is conducted by a Board of Directors and a Research Committee.

We examine the sequencing process of information dissemination by asking three broad questions: (1) Do scholars sequence when they make announcements; (2) If so, why do they sequence; (3) How do they use ICTs to aid this process.

To answer these questions, we conducted semi-structured interviews with 30 GRAND members to understand their decision-making processes. To understand the deeper meaning of sequencing and how the interviewees articulate the sequences, we approach the data qualitatively via narrative analysis (Berg, 2009). By using qualitative methods, we can understand how people perceive the scholarly network and how that perception influences the sequencing process. Three themes emerged from our analysis: formal position, media categorization, and norms of announcement.

Formal Position

The interviewees use hierarchical positions to explain how they communicate with other collaborators and how they sequence the information dissemination. They are aware of not only their own position as an NI or a CR, but also of their collaborators' position. Hierarchical position has been internalized when scholars use position to explain their collaborators' attribute, role, and status. When talking about network members in high positions, scholars are more likely to use the position such as an NI or a CR rather than names. By contrast, when talking about peers and graduate students, they use names more often.

The respondents report that *information always flows from a higher position to a lower position in their networks*. They share the idea that formal announcements should always be sent by NIs because they are "team leaders" or "captains". They assume that only scholars in a higher position have the responsibility to initiate information flows. Respondents in a lower position feel they are exempt from making announcements about the project.

The awareness of the necessity of sequencing varies across positions. Theme Leaders and NIs are sensitive to the hierarchical positions because their position determines whether or not they have a broader view of the structure of their networks. Their networks contain not only their collaborators within the projects but also high-status partners outside the projects. NIs are more apt than CRs to take the sequence of communication into consideration. Thus, it is common for Theme Leaders or NIs to prioritize their partners. Some NIs view prioritization as directly related to the receivers' hierarchical position. Lisa, an NI, gave a good example of how she sequences the contacts:

The department was immediately updated... We called the manager of the city of Vancouver, the vice president of research; he already knew of course he heard from the major funder before we did. The Dean and our sponsors that would be BC Hydro, we have a long list of sponsors [all names are pseudonyms].

The GRAND scholars in this project immediately understood that this announcement to non-scholarly partners was directly related to financial resources and future application of the research. As Lisa explains,

It really has the tendency for most things, there's a hierarchy of announcements too. It's not just how you send out the information it's who do you send out the announcement to.

The NIs' choices of communication media are related to the sequencing process. The NIs tend to contact the high-status partners by sending a personal notification via telephone or email. For example, when Lisa explains why she chose telephone to contact the prioritized receivers, she says it is because using the telephone enables the conversation to have a "personal touch". However, she switched to email after making only three or four telephone calls. For most of the NIs, the emphasis on a "personal touch" disappears when they contact scholars in lower positions such as CRs. Yet, when most NIs give news to their graduate students, they do so face-to-face with a personal touch. Because the students are frequently working in the NIs' labs, face-to-face talk is the most personal, convenient and least time-influenced way of communication. NIs use media differently to aid the process of prioritization.

When emergencies occur, NIs often use multiple media to reach their primary contacts. They prefer email to telephoning because email is considered as a "default" media by their collaborators. When email is not answered in a timely manner, they use alternative media to send the information until they receive a response. For example, Ron, an NI, sent an email to the committee director first. After he waited a few days for the response, he made a telephone call to the same contact. When he found that the telephone could not help him reach the contact, Ron went to the office to talk with the director face-to-face. Ben, another NI, also reported that the best way to contact the committee director is "to catch him when he is in the office" so that they can have a face-to-face conversation. Face-to-face communication is usually saved as the last option.

Differently than NIs, CRs pay less attention to sequencing. Some of them tend to use only one kind of medium, such as email, to contact primary and secondary receivers. Some of them do not even sequence. Instead, they use an email list or project Web page to circulate the information to all network members. They only try to use different media to reach the primary contacts when emergencies occur.

CRs tend to use the same medium to contact different groups of receivers. The two most frequently used media are email and face-to-face talk. When telling the news to their colleagues face-to-face, the CRs talk randomly to their network members whom they encounter in close proximity rather than approaching the receivers with a pre-designed list of names. They use mass email to send the notifications to multiple receivers at the same time. The interviewees gave three reasons for choosing mass email: (1) they know the receivers are too busy to talk; (2) the contacts are not collocated – often not even in the same university; (3) they are used to sending email. If they sequence, CRs tend to sequence only their contacts without regard to which media they use. Although we assume that people arrange the order of their contacts and the media they use, the data show that some interviewees choose not

Table 1. Typology of sequencing

		Ordering Media	
		Yes	No
Ordering Receivers	Yes	Full-Sequencing	Contacts-oriented Sequencing
	No	Media-oriented Sequencing	No-Sequencing

to sequence either of them or any of them. We will discuss the complexity of sequencing process later (Table 1).

The CRs’ disregard of sequencing indicates their disregard of hierarchical structure in their networks. For some CRs, proximity, rather than hierarchical position, is more convenient for disseminating information. For example, Jason and Scott spread the news to their peers because they were collocated in the same building or on the same campus. Furthermore, proximity enables scholars to enjoy face-to-face communication and its personal touch. Jason even held the news until he could chat with all the colleagues’ doors to tell them the news in person “because you can see the nuance in their reaction”. Hierarchy is ignored because the hierarchical structure around CRs is flatter with only NIs, CRs, and graduate students, while the networks around NIs include external actors and GRAND leaders.

Media Categorization

Most of the time, GRAND members assess whether or not a medium is appropriate to be used for sending announcements based on the nature of the medium, the content of the information, and the actor’s position in GRAND. They divide media into two dichotomies. The first dichotomy is personal vs. non-personal media. Personal media are channels that facilitate only one-to-one communication such as telephone, email, and face-to-face talk. Non-personal media refer to channels that enable actors to communicate with multiple contacts simultaneously, such as an email list and a Web page.

When NIs sequence their receivers, they prioritize personal media to use them to contact partners in high positions. As they report preferring a personal touch with the higher-ups. When sequencing is not a concern for the interviewees, they tend to move to non-personal media. This phenomenon is not only seen in the use of email lists to contact less important network members, but also seen in many CRs’ choice of email lists when they care less about sequence.

However, personal media are not always the appropriate choice. Scholars use personal media, but they refrain from media that are too personal. When emergencies happen, the mobile telephone is widely regarded as the best medium because of its portability, connectivity and enabling of synchronous communication (Rainie and Wellman, 2012). Nevertheless, the interviewees in a lower-status positions are reluctant to use mobile telephones to contact the scholars in higher positions even for an urgent announcement. Face-to-face contact is more personal. It is not rare to see scholars, especially NIs, deliberately avoid face-to-face communication unless

necessary. Many NIs use emails first to set up a meeting with actors in high positions. They only make telephone calls or go to the office directly when the emails are not responded to in time.

The second media dichotomy is: on-the-record vs. off-the-record. Scholars sequence the order of on-the-record and off-the-record media in three ways: one or the other, simultaneously, or one after the other. Some actors prefer on-the-record media such as emails or the project Web page to off-the-record media such as the telephone because on-the-record media can be used to document the information or trace the source of the information. The emphasis is on the function of the medium rather than the content of communication itself.

Some scholars choose to use off-the-record media and on-the-record media at the same time. Off-the-record media, such as telephone, are convenient because information senders are not required to input much time and energy composing the information. However, this convenience means that the message cannot be traced after the transmission. To complement this weakness, scholars combine off-the-record media and on-the-record media. Lisa and Joan, both NIs, use cross-posting strategy to make sure that the announcement is made appropriately. As Lisa notes, after she called collaborators in a high position, she “backed it up with an email right away.” Joan cross-posted the same message with different media because she wants to avoid missing information or inaccurate information. Another NI, Diana began to use Skype because it enables document transmission when she has voice-to-voice communication with her collaborators online. Although off-the-record media might be used as the primary choice, on-the-record media and cross-posting are used to guarantee that the personally sent message is accurately documented and tracked.

The interviewees also use off-the-record media and on-the-record media one after the other. This pattern is frequently used in media-oriented sequencing when emergencies occurs. The interviewees often use on-the-record media first to explain the situation and set up the discussion over off-the-record media. When contacting higher-position receivers, scholars prefer to use emails and then telephone. But for lower-position receivers, they use mobile telephones, text, face-to-face talk, or Skype chats. They use this sequence because off-the-record media facilitates synchronous communication that is suitable for discussion and opinion exchange when scholars expect to reach a quick resolution to an emergency.

The choice of media is closely related to the senders' and the receivers' hierarchical positions. Although the interviewees understand the function of each medium, they *only* choose the appropriate media by considering the receivers' position and the content of the information. In other words, scholars sequence their contacts first and they aid this process by sequencing media.

Norms of Announcement

As elaborated above, the scholars' sequencing process is largely shaped by their hierarchical position in GRAND – which is correlated with their general scholarly status. Meanwhile, the socially regulated sequence also functions as a social norm in the

networks. The interviewees apply sequences because sequences help them to avoid communication constraints, follow communal preferences, and reward their supporters. Consequently, sequencing is used to maintain and reinforce the hierarchical structure of GRAND.

The interviewees sequence their contacts and media because they are exposed to communication constraints. They particularly report constraints from the unavailability of NIs. With the understanding that scholars in high position are mostly busy, information senders use various media to reach the receivers when emergency occurs. The awareness of the (un)availability of scholars in high positions is also reported when scholars set up routine meetings. David and Neil both mention how their project members prioritize “the most constrained person”. As Neil told us:

John’s schedule is the most constrained, generally mine is the second constrained, and the students are the least constrained.” Jonathan sets a time and then I put a modifier on it, and then the students have to go along with that.

The schedule of scholars in high positions is more likely to be taken into consideration by project members. Theme Leaders are especially likely to receive an early notification; thus their schedules are set as the baseline of the network. After this, NIs and CRs can state their availability, “then the student sort [of] has to go along with that” [interview with Neil].

At the same time, the (un)availability of receivers in the low position, such as graduate students, is not as much a concern for information senders. Part of the reason is that scholars in lower positions are less involved in information flows and are less required to be involved when emergencies occur. Their availability has less influence on information flow. Another reason is that scholars in lower positions, such as graduate students, are assumed to work in the office more often. Therefore, it is easier to catch the scholars in lower positions in their offices.

When the interviewees prioritize the time-constrained actors in high positions, the sequence produced during this process is accepted and adopted as a social norm by all network members. More importantly, the sequence is produced by the interviewees in high positions. Scholars in lower positions, who are de-prioritized, have to follow the rule because they rarely initiate information flow. In this way, sequencing is used to maintain and reinforce the hierarchical structure by prioritizing the actors in higher positions.

Many interviewees note that they use a particular sequence because it is a communal preference. For instance, NI Keith refers to the use of email as a “communal preference,” thus explaining why he uses email: Most of his collaborators “interact with one another or do a lot of their work by email”. Sometimes, personal preference may become a communal preference when most of the network members accommodate the preference, such as when Diana contacts Susan with Susan’s preferred media – the telephone.

Communal preferences can function as collective norms. The interviewees explained why their professional practice follows the collective norms rather than personal experience. Some have worked together before, and if they are important in

the team, their past collaborative practices have become current norms. Scott and Ben use their experience in a previous collaborative project to figure out how they should communicate with the members in the current project. Lisa even wants to introduce to her GRAND team an Internet application she used for her last project that aided routine announcements. Social norms are also produced during GRAND interactions. For example, David explained how his way of sequencing is accepted in his project:

I'm senior enough that I tend to get to pick the communication style and so that is what I pick . . . Group norms come about in my group because we just do it my way.

David learned the sequence from a previous collaborative project. His reasoning illustrates the effects of hierarchical positions on the development of project norms. As DiMaggio and Powell (1983) have pointed out, collective norms can be coercive when they are related to professionalism. That is to say, scholars who want to show their professionalism have to engage in the sequencing process.

Thus, the sequence becomes the embodiment of social norms in scholarly networks. The interviewees use a socially accepted sequence (Ryan, 2006) to maintain existing social norms while they also produce sequences as social norms. Both the maintenance and production process are aided by the strategic use of various media including both ICTs and face-to-face communication.

The interviewees prioritize those who (will) provide support when making announcements. Lisa notes that her primary contacts are “a long list of people who were very supportive”. The support is offered in the forms of funding, executive management, and collaboration. The scholars who received financial support from their partners are more likely to contact their partners first; those who received a favorable policy from the university which enables them to go through an expeditious executive procedure sent the announcement to the president or the management staff first. For those who want to initiate the project right away, graduate students are the first group of receivers because they are going to provide major technical support to the project.

Some interviewed NIs report that they are obligated to update their partners and to apply for funding to the university. When making a formal announcement such as “the proposal to GRAND has been approved,” they need to use prioritization to show their gratitude. And to make their gratitude more perceptible, they choose the medium that has a personal touch when contacting the prioritized receivers.

Prioritizing supporters, who are usually occupying higher positions, is considered to be appropriate. This rule was either naturally developed during the interaction among collaborators or introduced by network members who learned it from previous collaboration experience.

Discussion

The findings can be summarized as follows: A. Hierarchy in networks shapes the sequencing process; B. Senders use media strategically to aid their sequencing process;

C. People sequence to maintain and produce norms which reinforce the hierarchical structure within networks.

Apart from these three findings, we found four types of sequencing processes in GRAND. People sequence in two dimensions – receivers and media. That is to say, people may produce a temporal order by prioritizing some of their receivers or prioritizing some of the media. Meanwhile, they may choose not to sequence when they are able to communicate with multiple receivers simultaneously. We developed the following typology of sequencing to identify different decision-making processes.

Full-sequencing occurs when senders order both receivers and media. As found during data analysis, NIs mostly use different media to contact different contacts. This type of sequencing requires multiple types of media and contacts who are at different positions in the social networks.

Contact-oriented sequencing is produced when senders only use the same medium to order contacts. Respondents in a lower position are more familiar with this type of sequencing because of two reasons. First, they are less concerned about the sequencing issue. Second, the social norms of using email as the default medium keeps them from using other media.

Media-oriented sequencing is comparatively rare because multiple media are usually used when there are multiple receivers. However, when emergencies occur, both NIs and CRs try to use different media to contact the same group of contacts if their first notification was not answered. For this situation, people in different positions may develop a different order of media use. For instance, NIs tend to use the media in the order of email, landline telephone, face-to-face talk; while CRs may use a distinctive order of text on cellphone, face-to-face, and email.

No-sequencing: When there is no ordering of receivers and medium, no-sequencing happens. This may happen when the information is not disseminated. But for most of the cases, the information is sent to multiple receivers simultaneously. When the interviewees consider the information to be less novel and should be open to all the project members, they chose to circulate it by email list or post it on blogs, Twitter, Facebook, project Web sites. Thus, no-sequencing occurs.

In this paper, we proposed the conceptualization of sequencing and examined the usefulness of the conceptualization with the data collected from GRAND, a scholarly network. Our findings have verified some of the factors – hierarchical position and media use – that influence the sequencing process. These findings illustrate how people arrange the order of their contacts and how they use media to aid this process. We have also presented a typology of the sequencing process. The four types of sequencing process can be used to explain why people utilize various sequences under different circumstances. As Marshall McLuhan (1964) preached, “the medium is the message.” But as our data show, the medium is not the only message. Hierarchy also powerfully affects which medium is used in what circumstances.

In conclusion, compared to sequences, the concept of sequencing excels in two aspects:

A. Sequencing is heuristic. The concept of sequence emphasizes the patterns of sequences. This is a non-exhaustive list because people tend to use different sequences when the context of information flows or the content of information varies. The concept of sequencing enables researchers to explore the decision-making process that occurs

prior to the appearance of sequences. It is easier to find the patterns of the sequencing process by understanding the factors of this mechanism rather than by looking at the patterns of the outcomes.

B. Sequencing links individuals' behavior to the social context at a higher level. Both the concepts of sequence and sequencing focus on the individuals at the micro level. However, when the concept of sequencing inquires why and how individuals interact in a certain way with other network members, the factors such as the hierarchical structure and the norms in social networks serve to explain individual behaviour from a higher level. The relationship between the social settings and the individuals is incorporated in the sequencing process. Therefore, the concept can be used to explain the perception of social structure, the (perception of) structure's effects on individual behaviour, and the development of social norms (sequences) in social networks.

Although we believe that our study has implications for both knowledge transfer and the structure of networked organization, it has certain limitations. Compared to other social networks, GRAND might be a particular network with a higher density of ties and a higher degree of similarity among members because they are all from faculties collaborating on projects with similar themes. This means that some factors that may influence the sequencing process are excluded. For instance, media access is a crucial physical access factor. When people have only one medium for transmitting information, they obviously cannot use full-sequencing or media-oriented sequencing. Furthermore, when the network members are less similar to each other, the norms of sequencing may be less visible in the networks. Thus there will be less awareness of media categorization and media preference. Lastly, many social networks may have a less hierarchical structure. Therefore, the structural factors may vary in other settings. To further explore the usefulness of the concept of sequencing, we call for more research in various social networks.

Although we used qualitative analysis here, we are moving ahead to combine it with social network analysis. Using mixed methods will allow us to compare the network structure with network members' sequencing process and find sequencing models, if there are any.

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