



Significance of the Correlation in Turn-taking Dialogues

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Abstract

This piece of work investigates the relation between characters in a play based on turn-taking dialogues. As the dialogues are related to each other in the play, numbers of turn-taking are significant of the characters' relationship and the utterances give indication about the information content of the interaction. In this Manipuri radio play, the sequence of turns taken by the characters convey different amount of information with different functions. Numbers of dialogues oscillate significantly with a period of 2 scenes during the play. The degree of oscillation present in turn-taking dialogues carries significant information functions. The nature of the relationship between the characters involved and the theme of the play may be characterised by calculations on turn-taking dialogues.

1. Introduction

Conversational Analysis (CA) is a systematic study of the talk produced in everyday situations of human interaction which naturally occur in talk-in-interaction (Hutchby and Wooffitt, 1998). Under its scope falls also talk-in-interaction whose objective is to discover how participants of the conversation understand and respond to one another in their interaction, the focus being on how sequence of actions are generated. CA is in fact a methodology used by sociologists, anthropologists, and linguists who study group culture, people's conversational norms or people's style of life. In this regard, Moerman (1988) proposes conversation is a central part of communication that makes people understand the social order. However, according to founder philosophers like Sacks and Jefferson (1974); Schegloff (1992), an ideal model of conversation is focused on the exchange of turns, turn management and turn order along with the patterns of sequence of turns such as minimal gap, conversational

pairs, overlaps, etc. The principle of CA can be applied specifically to spoken dialogues within dramatic conversations as general interaction. In the study of general interaction, the order of conversational sequences, pairs of utterances (also known as adjacency pairs (Sacks, 1992)) and preference of pairs are organized according to the pattern of turns or turn-taking management. The speaker manages turns when he/she speaks, he/she takes a turn at dialogic speech, and as speech alternates, turns alternate as well. That's how various numbers of turns are distributed in order to fulfill the participant's rights to speak and take turns. For this, characters who are the speaker in the play managed the turns to mitigate the threats of speech chaos when numerous interactions take place in the play.

It is a phenomenon that the order of dialogic speech in dramatic text is generally organized to reflect the order of turns to be taken by the characters in the play. Then turns are ordered into sequences to reflect the necessary dialogues. A dialogue in a play is always well constructed, and also has finite properties of meaning. The information conveyed by dialogic speech in a conversation is a goal-oriented communication. We may assume a framework where each utterance in a turn has one specific goal in the communication. This communicative goal intends to share some persuasive information among the characters and represent it to the audience with a specific value of information. In the dialogic communication, when an audience listens to a dialogue, he/she only tries to grab the shared information either implicitly or explicitly, then he/she understood either some part of the intended meaning or the whole information in the conversation. In this case, the information transferred from a turn or dialogue which is produced by a specific character is numerically accounted as one unit of information and can be calculated with some statistic assumptions. This specific unit of information can be derived either from a general or a long turn, even though the turns had different propositions. The quantitative value of one turn should be mapped onto one numeric value, and then alternate for other turns, so that all the numbers of turns taken by the characters can be marked with a specific quantitative value (i.e. as one value) in order to count whole numerical values in the play. Once this mapping is established for every turn, the numbers of turns which have different information functions produced by distinct characters in the play can be separately evaluated for each of the characters. Based on this different numeric value for different characters, we can distinguish the level of importance that a character has in the story of the play. The result will be beneficial when we show that the play have protagonists who took a maximum number of turns, supporting characters who took a smaller number of turns as well.

We organize our work as follows. In Section 2, the theory and methods which we used to analyze turn-taking, turn management and talk-in-interaction in the proposed play, are discussed. The detailed results and discussion are presented in Section 3. Some conclusions are drawn based on the results that we analyzed.

2. Theory and Methods

Dialogue is generally made by the tidied up speech and it is organized according to the plot of the play. The study of such dialogues of a voice play as general interaction of a conversation is a complex matter which involves various backgrounds of analysis. For extracting some information from such dramatic dialogues is also involved a complete study of discourse. However, focus on the study of the sequence of utterances and the organization of such sequences, the target of conversational interaction is turned into the concept of turn-taking in the play. Study of turns and turn-taking in the play is somewhat adequate with the study of interaction in a communication. This background will support in rating the degree of dramatic information. However, calculating an accurate information which is contained in a turn or dialogue is also a bit complex in the context of human interaction.

A speaker has right to speak by taking an opportunity to speak in the speech event or situation (Herman, 1998b,a). When a speaker speaks, he or she takes turn at speech and as speech alternates turn alternates as well. In these numbers of turn alternates, the turn allocational component regulates the changeover of turns such as one participant talks stops, the next participant talks, stops, and so on. Thus, speakers always arranged the sequences for the 'next' turns to maintain the required understanding of what the 'prior' was or will about. This structure of the arrangement of turns is known as next-turn proof procedure in CA. The conflict that problematized by CA at the changeover point of the turn is termed as transition-relevance place (Sacks, 1992; Levinson, 1983). In such theory of CA, to understand these whole conversational patterns of turn-taking, the conversational sequences are introduced as adjacency pair particularly in turn-taking and proof-procedure analysis. An adjacency is the adjacent part of one pair (half of one) of conversation that ordered the pairs of utterances in the sense that the first and the second pairs that produced by different speakers. The first pair required the second but not all the parts of sequences. In such situation the first part of the turn counts only the second which is responded in the pair. Thus, the concept of conversational pairs was used and developed in dialogues (Linell, 1998; Schiffrin, 1994) into two categories i.e. initiative and response. He classified most of the utterances under initiative and response. This phenomenon of classification is to be considered as true because the principle of double contextuality is caused into the utterances of a conversation.

The dialogues of this play have some textual contexts in talk-in-interaction such as requests and acceptance, greetings and proposals, questions and answers, accusations and complaint, statements and reports, etc. In such distinct textual propositions of conversation, the initiator and responder interchanged their required information according to the situation that's the plot demanded in the play. They also initiate the turns as per the turns that specifically allotted to them. In this distinct rate of initiation and response of turns taken by the characters in a play have various information functions. According to this different rate of the changeover of turns and turn-takings,

the value and the role of a character is marked in the play. It illustrates that as per the rate of turn allocation the role of a character is considered to be as protagonist or supportive in the play. Generally, protagonist has more numbers of turns other than supportive characters has, so the amount of information produced by protagonist is larger than that of supportive characters. For calculating the whole data in this study these variable amount of information can be counted quantitatively or qualitatively from the numbers of the changeover of turns. For instance, the dialogues of female protagonist which is produced in the mode of solo turn such as the dialogue of individual secret love which involve expressions, propose, decline, acceptance, etc. may reflect coordinating behaviour between the characters. This total numbers of the changeover of turns can be measured as one value specifically as per one turn. Based on this phenomenon, while we investigate the play, the data of R.K. and Phajabi shows oscillation roughly in a period of two scenes. These particular data of two scenes which is started from scene one to two have variable in values and then the other data from scene four to scene eight shows the behaviour of correlation in the play. Then the plot starts diverting from scene nine onwards until end of the play. It means the maximum scenes of the play are correlated. The exhibition of these true functions is shown in Figure 1.

2.1. Correlation function technique

If x and y are the variables indicating the number of turn-taking dialogues of R.K. and Phajabi respectively such that $\{x, y : R\}$. The two characters are paired via the pairs of turn-taking dialogues which take place between them, and both the characters understand to each other in the interaction and act according to it. Therefore the rate of correlation behaviour can be calculated numerically from the following cross correlation function $c_{xy}(\tau)$ (Quiroga et al., 2002),

$$c_{xy}(\tau) = \frac{1}{N} \sum_{i=1}^N \left[\frac{x_i - \langle x \rangle}{\sigma_x} \right] \left[\frac{y_{i+\tau} - \langle y \rangle}{\sigma_y} \right]. \quad (1)$$

From here, one deduce the following autocorrelation function of the two variables x and y respectively,

$$c_{xx} = \frac{1}{N} \sum_{i=1}^N \left[\frac{x_i - \langle x \rangle}{\sigma_x} \right]^2, \quad c_{yy} = \frac{1}{N} \sum_{i=1}^N \left[\frac{y_i - \langle y \rangle}{\sigma_y} \right]^2 \quad (2)$$

where $\langle x \rangle = \frac{1}{N} \sum_{j=1}^N x_j$ and $\langle y \rangle = \frac{1}{N} \sum_{j=1}^N y_j$ are the means of the data of x and y variables respectively. $\sigma_x^2 = \frac{1}{N} \sum_{k=1}^N [x_k - \langle x \rangle]^2$ and $\sigma_y^2 = \frac{1}{N} \sum_{k=1}^N [y_k - \langle y \rangle]^2$ are variances of the variables x and y respectively. N is the total number of data points in

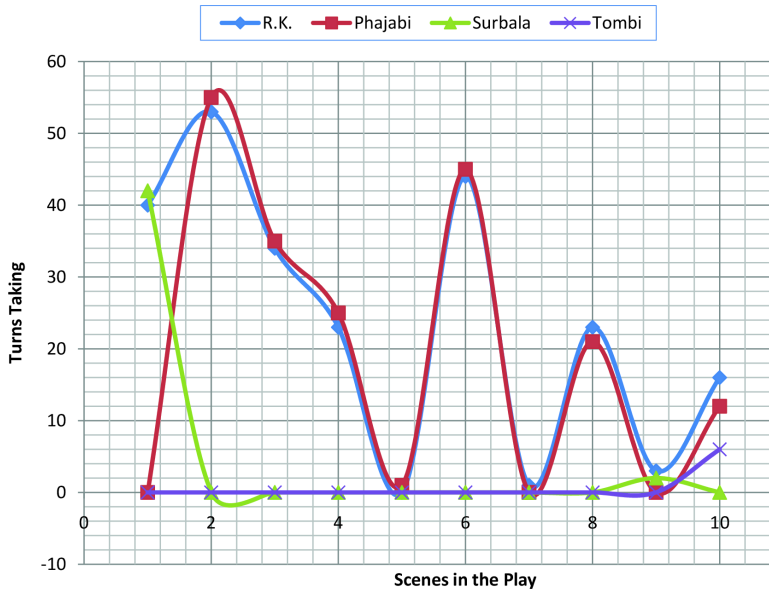


Figure 1. The play, ‘Nongaallbasu Thaballei Manam’ (Lingering Fragrance), a script of Moirangthem Inao, is represented in the form of a graph. The number of dialogues of the individual characters, namely R.K., Phajabi, Surbala and Tombi, are represented by the four lines in the graph. Scenes four to eight (specifically a period of two scenes) show the oscillation behaviours among the protagonists.

x and y . τ is the time lag. The value of $c_{x,y}$ are in between 0 and 1. If the value of $c_{x,y}$ is zero then the two variables are uncorrelated, i.e. the information carried by the two variables are in fact not related at all, however, if the value is 1, then the two variables are exactly correlated.

2.2. Complexity measurement technique

The study of the process of human interaction is a complex phenomena but the information embedded in such interaction can be measured through the process of permutation entropy technique (Bandt and Pompe, 2002). Permutation entropy, derived from entropy known as a measure of randomness in general, can be used as a technique to measure complexity or information contained in a symbolic sequence of data. The calculation is done as follows considering the data that is given by a symbolic sequence, $x(t) = \{x_1, x_2, \dots, x_N\}$, where N is the size of data. This sequence is then partitioned into M number of short sequences, $x(t) = \{q_1, q_2, \dots, q_M\}$

of size L , $q_i = \{x_1, x_2, \dots, x_L\}$ by sliding a window of size L with maximum overlapping (any two consecutive short sequences overlap $(L - 1)$ symbols in our calculation). The information contained in the case of any such short sequences, q_i can be measured by defining sequence of embedded dimension s , mapping onto q_i sequence and calculating Shannon entropy, H of it (Bandt and Pompe, 2002; Cao et al., 2004). This can be done by generating all possible inequalities of sequence of length s and calculating the probabilities of occurring each inequalities $p_j : j = 1, 2, \dots, u$ in q_i sequence so that one is allowed to calculate permutation entropy, $H_i(s) = -\frac{1}{\ln(s!)} \sum_{j=1}^u p_j \ln(p_j)$, where u is the number of distinct possibilities out of $s!$ permutations and $0 \leq H_i(s) \leq 1$. It is also to be noted that as $H(s)$ increases complexity is also increased according to it. Then one can map the sequence onto permutation entropy spectrum: $\chi(t) = \{H_1, H_2, \dots, H_M\}$.

The data used in the study are usually small in size and partition of sequences to be made even in smaller, we take all possible inequalities of neighbouring, next to nearest neighbouring in ascending order to obtain each H_i of $\chi(t) = \{H_1, H_2, \dots, H_M\}$. This permutation entropy spectrum may not highlight different emotions of individuals during interaction but for a certain specified emotion such as romantic, annoying, aggressive, etc. that feel between the characters, one can estimate qualitatively the amount of information of such emotion contained in the interaction by this technique.

3. Results and Discussion

The one-act radio play named *Nongallabasu Thaballei Manam* (The Lingering Fragrance) of Moirangthem Inao (Inao, 1995), which was broadcasted at All India Radio, Imphal on 2nd April, 1995, is a heart rendering and classic romantic play. We investigate this play within the framework of CA in terms of turn-taking, talk-in-interaction and adjacency pairs. In total over the whole play, R.K. takes 237 turns, Surbala takes 44 turns, Phajabi takes 193 turns and Tombi takes 6 turns. The total number of turns taken in this play is 480 turns in about one hour. The average number of words per turn suggests that there are unequal numbers of dialogues; there are very significant differences in turn-taking between the male protagonist and the female protagonist and also numerous differences in the number of turns between the two supporting characters. The notions of turn-taking and overlapping underlie the concept of sequences in the dialogues. However, the romantic dialogues that were uttered in the interaction between the male protagonist and the female protagonist are nearly equal in number and correlate to each other. These pairs of dialogues make the play complete up to the end and serve as the backbone for the plot of the play. To give an example of various pairs of turns, some dialogues are emotional, argumentative, interactional, narratives, and use figures of speech such as when one is to show his neglectance and the other one is showing her intensions with full expression of love and hatred.

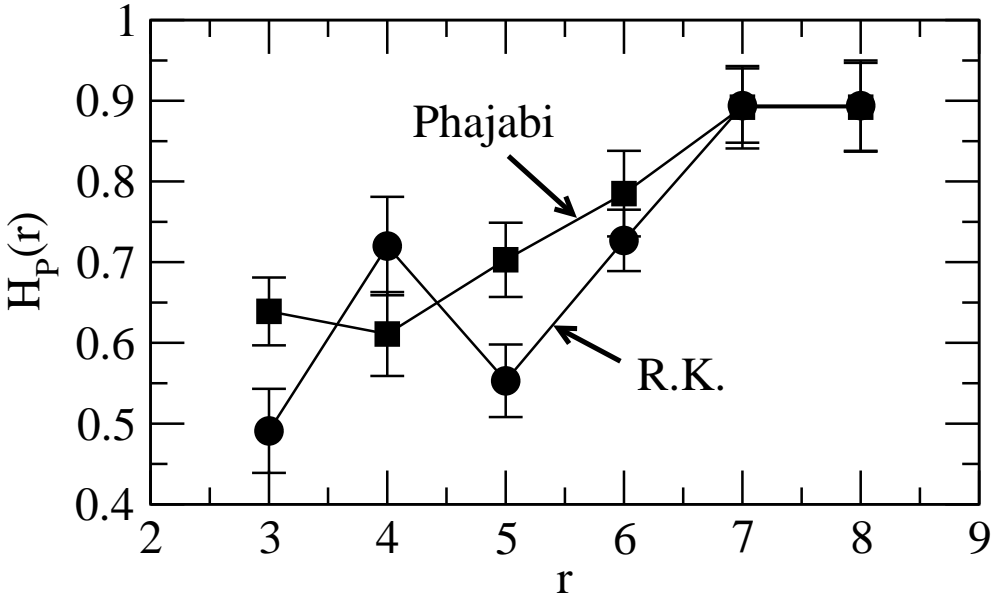


Figure 2. Measurement of information: the plots of permutation entropy $H_P(r)$ as a function of scene number r of two main protagonists, R.K. and Phajabi.

The data we collected for the study describe numbers of turns taken by protagonists in the play, namely R.K. (male protagonist) and Phajabi (female protagonist), and the supporting characters of the play, namely Surbala (wife of R.K.) and Tombi (husband of Phajabi), as shown in Table 1. This data is used as our primary data for analysing information embedded in each character's utterances. It is mainly used for inferring the number of pairs of turns which capture interaction among the characters. The data for each character is used in the plot as a function of scenes in the play, as shown in Figure 1. In the different stages of the plot, the data of R.K. and Phajabi particularly showed oscillation behaviour indicating association of information in the utterances. For this, the phenomenon of persuasive communication that is being in the interactions among the characters can be fully analyzed through correlation, given in Equation (1). Through this analysis, the content of correlated information may be inferred directly from the data or indirectly from the play.

We consider the data of R.K. and Phajabi individually and represent them by variables x and y respectively. Using the above equations, the values of the means and variances of the two variables are obtained as $\langle x \rangle = 23.7$, $\langle y \rangle = 19.3$, $\sigma_x = 17.91$ and $\sigma_y = 19.29$ respectively. Then using Equation (1), we calculated c_{xy} and found to be

Scene: Timing	Flash Back (FB) and Live Scenes	Number of turns taken by			
		Tombi	R.K.	Surbala	Phajabi
1: 0:00:01–0:11:03	Live Scene	0	40	42	0
2: 0:11:08–0:22:11	1st FB start	0	53	0	55
3: 0:22:18–0:27:10	1st FB cont.	0	34	0	35
4: 0:27:17–0:31:52	1st FB cont.	0	23	0	25
5: 0:32:39–0:33:58	1st FB cont.	0	0	0	1 long
6: 0:34:20–0:46:35	1st FB end	0	44	0	45
7: 0:46:40–0:47:11	Live Scene cont.	0	1 long	0	0
8: 0:47:19–0:54:17	2nd FB	0	23	0	21
9: 0:54:22–0:55:01	3rd FB	0	3	2	0
10: 0:55:09–1:00:03	Live Scene	6	5+11	0	12
Total number of turns	480 100%	6 1.25%	237 49.37%	44 9.17%	193 40.28%

Table 1. Turns taken by characters in the play in different scenes represent patterns of the play in the form of a graph, given in Figure 1. This table shows number of turns taken by each character, including main protagonists, in the play scene by scene.

$c_{xy} = 0.97438$ which is very close to 1. This is meant that the information carried by R.K. and Phajabi are very closely related to each other and understand each other's interactions. Since the underlying theme of the play is about love and romance, R.K. and Phajabi clearly understood the manners of propose, rejection, acceptance, greeting, wishing, questions and answers associated with the theme in the play.

We again calculated autocorrelation function using Equation (2), and found the values to be $c_{xx} = 0.31623$ and $c_{yy} = 0.99998$ respectively. It indicates that whatever turn-takings made by R.K. are not respond necessarily positive towards the main theme in the play regarding the emotion expressed by Phajabi. However, the emotion content in Phajabi in the main theme of the play is much more than R.K. and shows very serious interaction as the play actually does in the story and the plot.

Generally, protagonist has more dialogues so as they take more turns than other characters in most of the plays. In this play, two protagonists take more numbers of turns other than that of two supporting characters. So there are inadequate in the numerical values of turns in the whole play. Hence, the functions of each turn correlates according to the size and texture of the turns which have taken by the dramatis personae in the play. So, every qualitative and quantitative values made by the characters is reflected from their numbers of turns, therefore, the functions of information can be marked as per their number of turns.

Since the data of R.K. and Phajabi synchronize in their behaviours in between scenes 4 to 8, the functions of data shows that the information function contained

in the interaction and the understanding lies between them is highly correlated; no matter the dialogues express rejection, support, agreement, mocking, satirical etc. However, during the initial scenes (1-4) and the last scenes (8-10), the data approximately uncorrelated which means that they are not able to persuade the communication properly towards the main theme or they diverted from the theme in order to maintain the time and situation. The nature of the data of Surbala shows uncorrelated behaviour towards that of the R.K. or Phajabi. Similarly, the data of Tombi also shows a nature of independent character in the play.

The information contents in data of R.K. and Phajabi which we have taken from Table 1 are calculated using permutation entropy technique. Since the length of each data is not large, we have chosen the length of short sequences partitioned ($q_i : i = 1, 2, \dots, M$) to be $L = 5$ and embedded dimension s is taken to 2, 3 and 4. The permutation entropy spectrum of $s = 2, 3, 4$ are calculated using the procedure described in the previous section and the behaviors of all three values of s are approximately the same. Then we take the average of the corresponding values of all s and average permutation entropy spectra of R.K. and Phajabi are shown in Figure 2.

The plot of Phajabi shows that at the beginning of play in scene 3 the value of H is at lower in values (scene 3-4), however the value starts increasing as the number of turns increase in upcoming scene. This behaviour may be marked according to the amount of their emotions which are sharing among them. The content of shared emotion is also increased (due to anxiety, frustration, instability etc.) as the number of interactions increase between them and it may be a result of that the number of scenes are increased. Then after scene 7-8 the information contained is remained in constant. It may be the cause of stabilizing emotion between them. The same behaviour can be obtained in the case of R.K. too. However, in the whole case of R.K. there is a cause of fluctuation in his behaviour where we compared to that of Phajabi.

In this work, the relation that is having between any two characters such as the type of relationship in which how much the relationship is strong between them can be captured through the study of correlation function and permutation entropy techniques based on the analysing of the turn-taking dialogues. This analysis could be qualitatively true because human relationships are generally delicate in nature and sometimes it is not much expressive. The techniques may not be pin pointed on what exactly is going on between the characters but could say how characters processes information between them. Moreover, permutation entropy technique can tell how complex human brain functions which is reflected in their respective turn-taking dialogues.

4. Conclusion

In conclusion, what the characters may do in turn-taking reveals their emotion as well as showing the functions of information conveyed in each dialogue of the individual character. The numeric values computed from numbers of turn-taking are used

as the data for each character. From this data we estimate the variation of information contents in the play by computing correlation. Since the data is not large enough, the result may be too approximate, but the analysis gives us important understanding of relations between characters in the play in a qualitative sense.

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