# When I Move, You Move: Coordination in Conversation

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## Introduction

- *A conversation is a complex, yet effortless joint action which requires coordination at some level for effective communication to occur (Clark & Brennan, 1991; Clark & Krych, 2000).*
  - *Coordination requires timing.*
- *To explicate coordination requires an understanding of the foundation of conversational exchange; turn-taking (TT) (Benus, 2009; Bosch, Oostdidijk & Boves, 2005; Sacks, Schegloff & Jefferson, 1974).*
- *TT here refers to the back-and-forth exchange of spoken information (Clark & Brennan, 1991).*
- *Researchers have found evidence that supports the notion that interlocutors are making use of a precise timing process required to contribute successfully to the conversation (Schegloff, 2006; Stivers et al., 2009).*
  - *Specifically, it has been proposed that an oscillator model of conversational coordination explains this timing process (e.g., Benus, 2009; Wilson & Wilson, 2005).*
  - *Since TT is theoretically the timing of a dialog, understanding it is crucial for explaining the coordination or synchrony of conversational participants.*
- *Thus, the purpose of this study was to test this model explicitly using rate of turn-taking as the impetus for movement coordination.*

## Hypotheses

- *Interlocutors will synchronize paralinguistic cues as a function of their rate of turn-taking.*
  - *The more coordinated their rate of speech, the more they will coordinate movement.*

## Methods

### *Participants*

- *Videotaped interactions of 11 dyads engaging in conversation.*
- *Five minute speech segments were randomly selected from each dyad for analysis.*

### *Procedure*

- *An estimated rate of TT was computed as a function of speech rate disparity between members of a dyad.*
- *Larger speech rates indicate more speech, longer turns and thus fewer turn changes throughout (see Figure 1.).*
- *Image sequences were created from the videos at a rate of 8 fps.*
- *Body movement was then measured using an image-differencing algorithm in MATLAB.*
  - *Frame-by-frame movement was calculated by averaging pixel values across images.*
- *TT rate was then used to inform window size selection for the windowed cross-correlation analysis (Boker, Xu, Rotondo, & King, 2002) (see Table 1.).*
  - *This method produces mean correlations between the short time windows from signal A & signal B.*

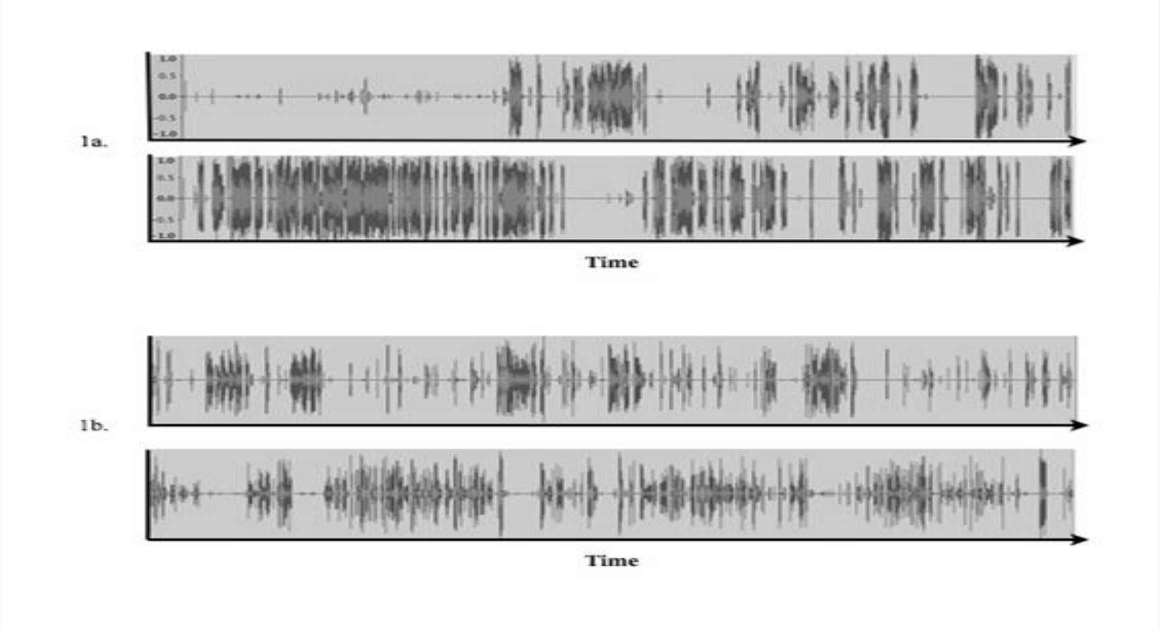


Figure 1. A comparison of two speech signals from two dyads.

**Table 1.** Window and lag for each dyad.

| Dyad | TT rate | Window(sec) | Lag (sec) |
|---|---|---|---|
| 1 | 0.18 | 2 | 2 |
| 2 | 0.37 | 3 | 1 |
| 3 | 1.08 | 5 | 2 |
| 4 | 0.15 | 2 | 3 |
| 5 | 0.49 | 4 | 3 |
| 6 | 0.20 | 3 | 2 |
| 7 | 0.35 | 3 | 3 |
| 8 | 0.87 | 4 | 3 |
| 9 | 1.03 | 5 | 3 |
| 10 | 1.15 | 6 | 4 |
| 11 | 0.90 | 5 | 3 |

TT rate is represented as the difference in speech rate between the members of a dyad.

## Results

- *Below are density plots from three of the dyads demonstrating the pattern of results found by using TT rate to determine two important parameters of the analyses.*
- *Vertical patterns across the density plots indicate patterns of movement. Patterns appearing along the horizontal plane indicate when the movements become stationary.*

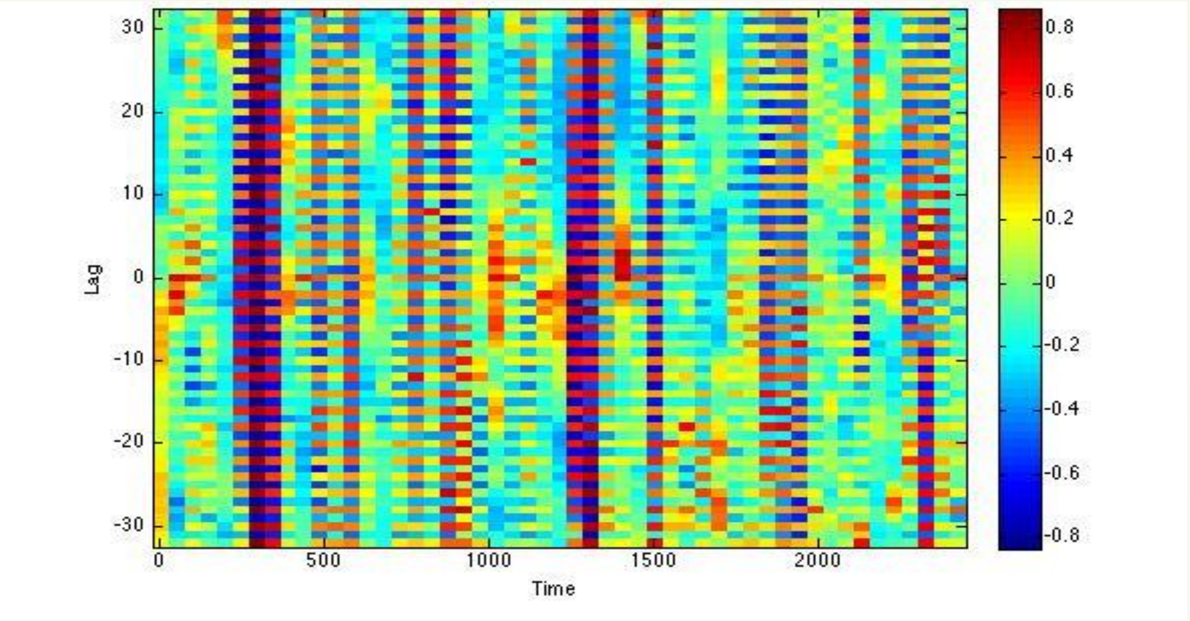


*Figure* 2. Density plot from session 10 with the largest difference in speech rate $W_{max}$ of 6 seconds and $T_{max}$ of 4 seconds.

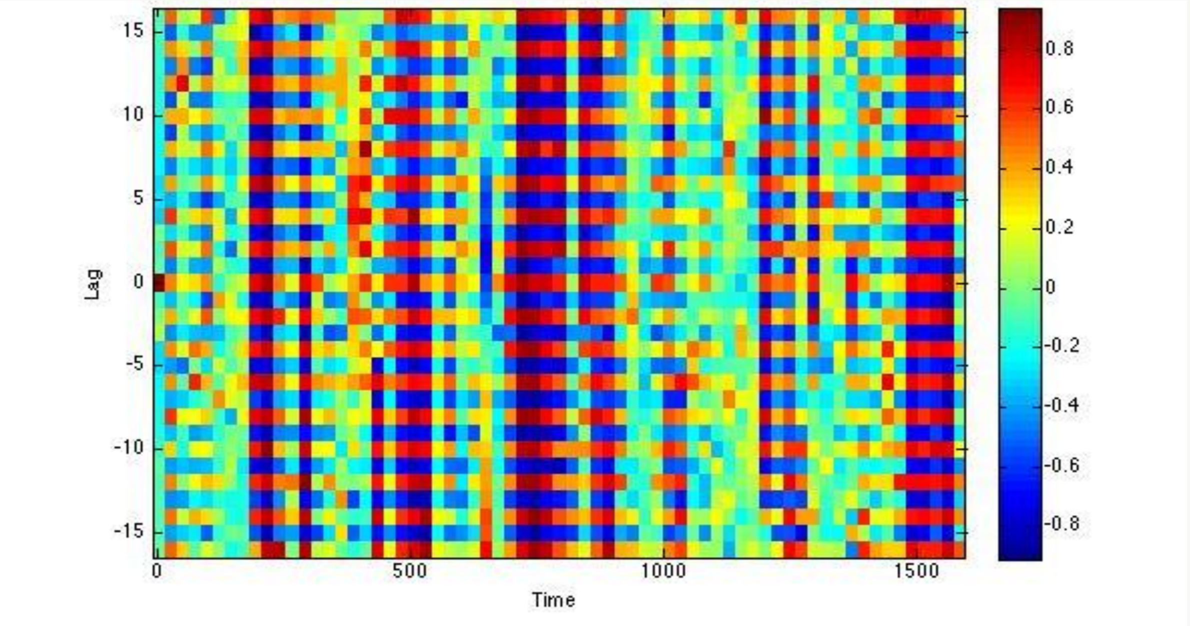


*Figure* 3. Density plot from session 6, which had one of the smallest differences in speech rate of the 11 dyads; $W_{max}$ is 3 seconds with $T_{max}$ of 2

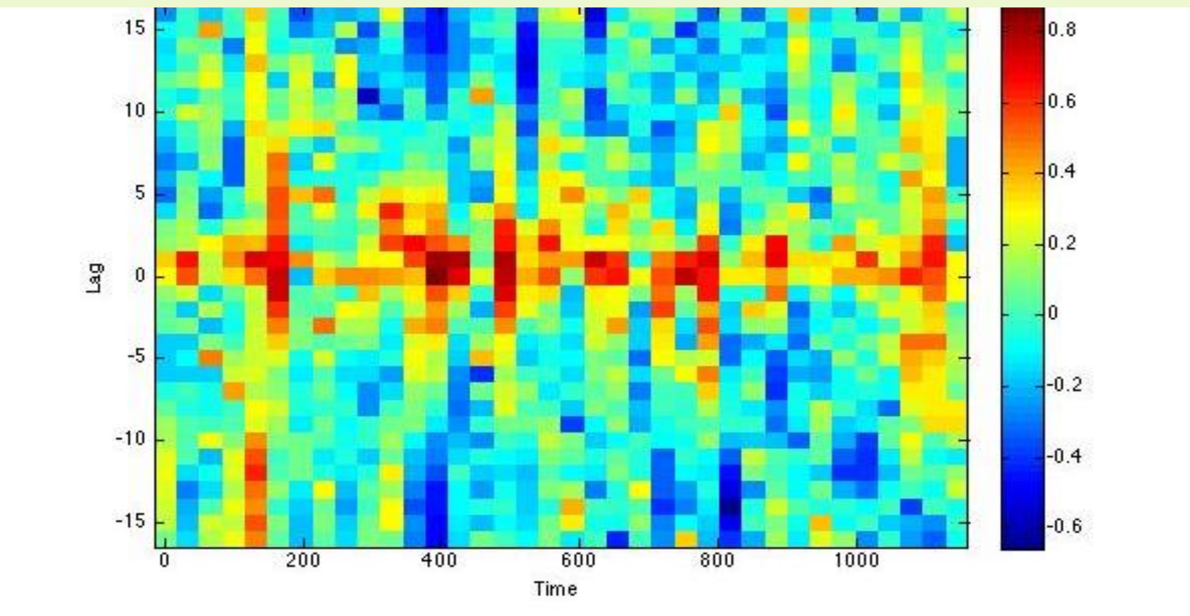


*Figure* 6. Density plot from session 1, which had the smallest difference in speech rate. $W_{max}$ of 2 seconds and a $T_{max}$ of 2 seconds.

- *Mean correlation vectors were submitted to a one-way ANOVA with window size as IVs and mean correlations as DVs.*
- *Results show a significant difference between windows $F = 14.02$ (df = 5, 5207), $p < .001$.*

## Discussion

- *These results lend support to an oscillator model of turn-taking as it does appear that a precise timing mechanism inherent in turn-taking is generating rhythmically entrained nonverbal behavior.*
- *While preliminary, these data reveal an interesting area of exploration which focuses on social coordination without an examination of linguistic data.*
- *Future planned research includes an analysis of the current data using mixed dyads as well as a cross-modal measure of coordination.*

## References

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