Complex coordination: How power dynamics and task demands shape interpersonal motor synchrony

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Introduction

- **Interpersonal coordination** captures the ways that interacting with other people influences emotion, behavior, and cognition over time.
  - Most studies analyze coordination by analyzing **how similar interacting individuals become over time**.
- Research is increasingly interested in understanding how coordination is shaped by **interpersonal pressures and contextual constraints**. For example, when studying partners in different kinds of interactions, previous work finds that
  - overall body movements become less similar during arguments [1],
  - overall body movements become more similar during friendly conversations and game-like competition [2],
  - ostracized individuals will mimic specific body movements of the person who ostracized them [3]
- One such contextual factor could be **power** (or social status).
  - Previous work on perspective-taking (proposed to be linked to synchrony [4]) shows that people accommodate the perspective of high-power individuals more than low-power individuals [5].
  - Previous work on social psychology documents a host of ways that power influences nonverbal behavior [6].
- Here, we examine **how power dynamics shape interpersonal movement synchrony** during interactions with higher-status versus same-status partners among native Korean speakers.
  - Korean has a well-studied system of grammatical honorific markers [7], but **nonverbal signatures of power, politeness, and deference** are highly understudied.
  - Because of the very salient cues to "doing deference" [6] in Korean, it provides a **well-scoped case to study coordination and power**.

Method

- **Participants**
  - N = 14 participants (M = 22.15 years; range: 19-27 years; female=7; male=7)
  - Recruited from students at University of Konkuk (Seoul, South Korea)
  - All speakers of standard Korean
- **Procedure**
  - Each participant attended 2 data collection sessions with a different partner (*order counterbalanced*):
    - A session with a **friend**
      - A friend who they had known for at least 1 year
      - Instructed to be a friend of the same gender, but 2 male participants did not follow this instruction
    - A session with a **professor** of English literature from the university
      - Same professor for all conversations
      - Not affiliated with the research (paid ~$177 USD)
  - Each session included 4 interaction tasks (*fixed order*):
    1. **Conversation**: Participant and partner discussed a recent movie
    2. **Tweety**: Participant described a "Tweety Bird" cartoon to partner [8]
    3. **Map**: Two rounds of the map task (participant-leading then partner-leading)
    4. **Role-play**: Participant role-played giving an apology to partner

Figure 1. Example interaction setup. Stills from friend (top) and professor (bottom) videos during the Conversation task for a single participant.

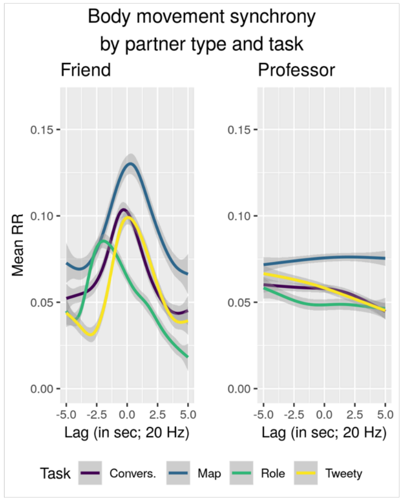

Figure 2. Diagonal recurrence profile (DRP) for interaction tasks performed with friend (left panel) and professor (right panel). Negative lags indicate participant-leading dynamics; positive lags indicate partner-leading dynamics.

Model results: Friend-only

	Estimate	Std. Error	*t*-value	*p*-value	
(Intercept)	0.06663	0.007154	9.313	0.0001	***
LL	-0.07444	0.0247	-3.014	0.003	**
QL	-0.2246	0.04312	-5.208	0.0001	***
Map	0.02594	0.01766	1.469	0.142	
Role-play	-0.01391	0.01125	-1.237	0.216	
Tweety	-0.008415	0.007923	-1.062	0.29	
LL x QL	0.3117	0.1345	2.317	0.02	*
LL x Map	0.1704	0.01809	9.42	0.0001	***
LL x Role-play	-0.1982	0.01682	-11.78	0.0001	***
LL x Tweety	0.2193	0.01682	13.04	0.0001	***
QL x Map	-0.01445	0.01281	-1.128	0.26	
QL x Role-play	0.02769	0.01178	2.35	0.019	*
QL x Tweety	-0.02538	0.01178	-2.153	0.031	*
LL x QL x Map	-1.172	0.2028	-5.779	0.0001	***
LL x QL x Role-play	1.332	0.1902	7.001	0.0001	***
LL x QL x Tweety	-1.695	0.1902	-8.91	0.0001	***

Model results: Professor-only

	Estimate	Std. Error	*t*-value	*p*-value	
(Intercept)	0.05582	0.009126	6.117	0.0001	***
LL	-0.0357	0.02607	-1.37	0.171	
QL	-0.02808	0.02254	-1.246	0.213	
Map	0.01906	0.0149	1.279	0.201	
Role-play	-0.005873	0.01615	-0.3638	0.72	
Tweety	0.001525	0.0103	0.148	0.88	
LL x QL	-0.295	0.07427	-3.972	0.0001	***
LL x Map	0.06567	0.009287	7.072	0.0001	***
LL x Role-play	0.01619	0.009287	1.744	0.081	.
LL x Tweety	-0.06963	0.009287	-7.498	0.0001	***
QL x Map	0.007867	0.006506	1.209	0.227	
QL x Role-play	0.04745	0.006506	7.292	0.0001	***
QL x Tweety	0.007844	0.006506	1.206	0.228	
LL x QL x Map	0.09376	0.105	0.8926	0.37	
LL x QL x Role-play	0.000673	0.105	0.006408	1	
LL x QL x Tweety	0.4932	0.105	4.696	0.0001	***

Table 1. Model results for follow-up models exploring higher-level interaction terms for friend conversations (left panel) and professor conversations (right panel). Factor for tasks are compared against the Conversation task as a reference category. LL captures leading/following. QL captures time-locked synchrony.

Analyses & Results

- **Analyses**
  - **Automatically extracted overall body movement** from videos using a frame-differencing method [BRM], implemented in Python
  - Quantified interpersonal synchrony of overall movement with diagonal recurrence profiles from **cross-recurrence quantification analysis (CRQA)** within 5-sec window and **growth curve models**
    - **Linear lag** (**LL**; first-order orthogonal lag) captures leading/following
    - **Quadratic lag** (**QL**; second-order orthogonal lag) captures time-locked synchrony
  - Created a linear mixed-effects model in R with participant identity and partner order condition as random intercepts with maximal random slopes
- Due to higher-order interactions with partner type, **complete results of the follow-up models** broken down by partner type are presented in **Table 1**.
- Code and results from our models (including the full model with both partner types) are available on our project's GitHub repository:

http://github.com/a-paxton/politeness-and-coordination

Discussion

- Broadly, we find **marked differences in dynamics depending on partner**.
  - Intriguingly, we find no evidence of time-locked synchrony with the professor, although we see similar levels of coordination overall.
  - However, there was no difference in overall levels of coordination within the 5-second window.
- However, we do see some **signatures of task constraints across partners**.
  - Follow-up work will compare difference among conversation types between partner types.
- Our work demonstrates…
  - that—like other contextual social constraints [1,2,3]—**power dynamics can shape the emergence of interpersonal coordination.**
  - that power and deference have **verbal *and* nonverbal signatures in Korean**, suggesting that the constraints of politeness shape the entire dyadic system in powerful, multileveled ways.

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