

論文 / 著書情報

Article / Book Information

題目(和文)	言語的コミュニケーション中における情報伝達の度合いと身体運動の同期との関係の解明と応用
Title(English)	Relationship between Body Movement Synchrony and Degrees of Information Exchange in Verbal Communication
著者(和文)	土屋彩茜
Author(English)	Ayaka Tsuchiya
出典(和文)	学位:博士(理学), 学位授与機関:東京工業大学, 報告番号:甲第12347号, 授与年月日:2023年3月26日, 学位の種別:課程博士, 審査員:三宅 美博,山村 雅幸,石井 秀明,瀧ノ上 正浩,小野 功
Citation(English)	Degree:Doctor (Science), Conferring organization: Tokyo Institute of Technology, Report number:甲第12347号, Conferred date:2023/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

系・コース：情報工学系
Department of Graduate major in 知能情報コース
学生氏名：土屋 彩茜
Student's Name

申請学位(専攻分野)：博士 (理学)
Academic Degree Requested Doctor of
指導教員(主)：三宅 美博教授
Academic Supervisor(main)
指導教員(副)：
Academic Supervisor(sub)

要旨(英文800語程度)
Thesis Summary (approx.800 English Words)

Human beings live in groups and have shaped cognitive functions and behaviors influenced by interacting with other individuals in the groups through linguistic and nonverbal behaviors. In interaction, building cooperative relationships with other individuals is one important role in belonging to groups and survival. To maintain relationships, exchanging information about their experiences is essential to shape social behaviors. On the other hand, body movement has unconsciously coordinated with others in interaction. Body movement synchrony, a phenomenon of coordination, has been considered to predict the subjective outcome of communication. In addition, some studies have reported relationships between inter-brain synchrony and the degree of information exchange as well as body movement synchrony. However, it was unclear whether body movement synchrony is associated with information exchange. In this thesis, we revealed this relationship during a natural conversation. Moreover, we not only revealed this question from scientific motivations but also proposed a simple method for quantifying body movement synchrony to collect data in diverse communication in real-life. This attempt was also expected from practical motivations to develop systems that use body movement synchrony as an indicator of verbal communication. In addition, we preliminary investigated the time scale of the relationship from both scientific and practical motivations.

In Chapter 2, as a scientific approach, we tested whether body movement synchrony between talking pairs is associated with the degree of information exchange in a natural conversation. We designed the conversational experimental paradigm to quantify the degree of information exchange. Participants were instructed to talk about their experiences, especially to start their conversation with an experience of when they were a freshman in high school. Experimenters developed the four-choice questions based on sentences uttered by the participants. The degree of information exchange for each participant was quantified by the percentage of correct answers to these questions. During the conversation task, we measured body movements using an optical motion capture system and quantified body movement synchrony. We calculated the correlation coefficient between the degree of information exchange and body movement synchrony. We found that body movement synchrony occurred in talking pairs and this synchrony was significantly positively correlated with the degree of information exchange. This finding showed the relationship between body

movement synchrony and the degree of information exchange. It is expected that body movement synchrony could predict the degree of information exchange.

In Chapter 3, as a practical approach, we proposed a simple method to estimate the degree of information exchange by body movement synchrony. We proposed to use an omnidirectional camera and quantified body movement synchrony by Motion Energy Analysis method with an additional processing process to reduce noise. To test whether the body movement synchrony quantified by the proposed method could be used to predict the degree of information exchange, we analyzed the omnidirectional camera recordings from the experiments in Chapter 2 and calculated the correlation coefficient between this synchrony and the degree of information exchange. The results showed that the body movement synchrony quantified by the proposed method had a positive correlation with the degree of information exchange. This finding suggested the possibility that body movement synchrony quantified by the simple method predicts the degree of information exchange.

In Chapter 4, following the results of Chapter 2 and 3, we addressed the question of how long time does body movement synchrony need to estimate the degree of information exchange. To provide preliminary insights, we divided the data obtained in Chapters 2 and 3 into half or quarter times and quantified body movement synchrony and the degree of information exchange each time. The results showed that body movement synchrony between talking pairs was higher than that between not actually talking pairs in all conditions but a positive correlation with the degree of information exchange was only confirmed between body movement synchrony quantified by the method using an optical motion capture system in 5 minutes conversations. The results suggested that body movement synchrony requires several minutes of conversation to predict the degree of information exchange. It provided new insight into this relationship and the difficulty of real-time estimation.

This thesis presented the relationship between body movement synchrony and the degree of information exchange. Especially, our experimental paradigm could quantify the degree of information exchange in non-rehearsal conversations. Therefore, our findings provided important insights to explain the relationship between verbal and nonverbal communication. In addition, this thesis showed the possibility of applying this relationship to real-life systems. Our proposed method using an omnidirectional camera was expected to easily estimate the degree of information exchange. Our findings also suggested that synchrony obtained from small movements may explain the degree of information exchange for a shorter time. Finally, we discussed the mechanism of the relationship between body movement synchrony and information exchange and showed the hypothesis for future research.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note：Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

注意：論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。

Attention: Thesis Summary will be published on Tokyo Tech Research Repository Website (T2R2).