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Toward Automated Analysis of Communication Mirroring

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■ Background :: Nonverbal Communication

Gestures are forms of nonverbal communication that use body movements instead of words. These movements include the hand, head, or other parts of the body.

"***Gestures enable to produce more intuitive communication and flexible interactions.***"

Nonverbal mirroring communication is an action that reflects the behavior of the talking partner which can help to create a strong connection with both side during the conversation.

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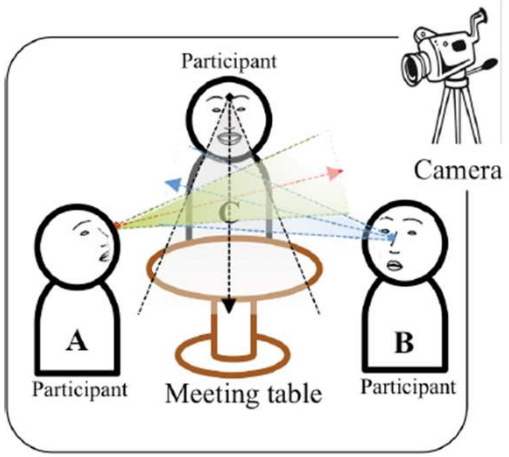
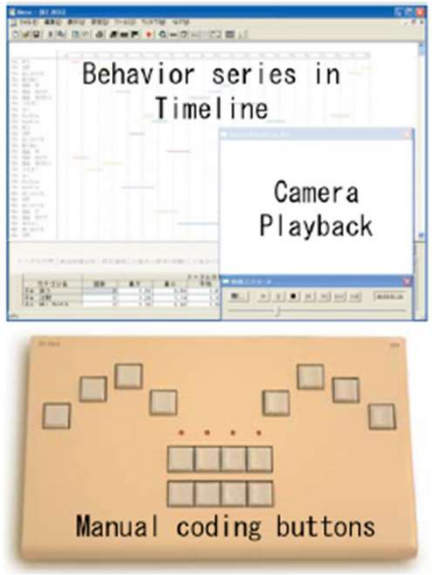
■ Background :: Behavior Analysis During Conversation

Traditionally, the measurement of behavior includes recording the number of times of behavior, measuring duration, measuring response wait time and inter-response time, and time sampling of predefined behaviors between intervals.





BECO2

In Japan, BECO2 [1], a behavioral coding system, is widely used in applied behavior analysis classes at many universities.

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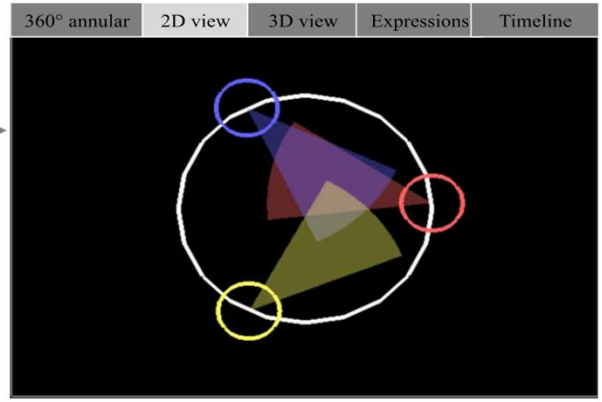
■ Background :: Automated Behavior Analysis During Conversation

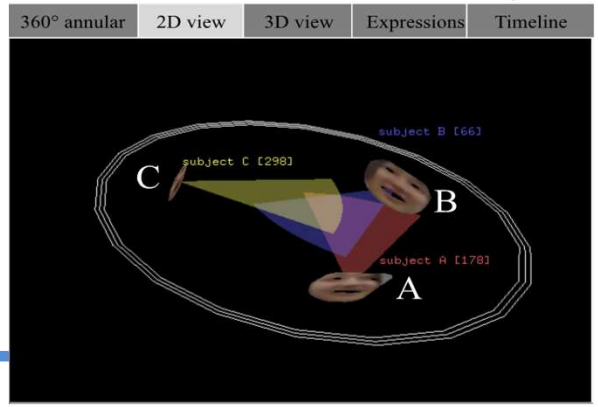
Jaana et al. (2014) developed an automated behavioral analysis system using a **“single omnidirectional camera.”** This system analyzed facial expressions, head nods, utterances based on facial features extracted from the camera [2].

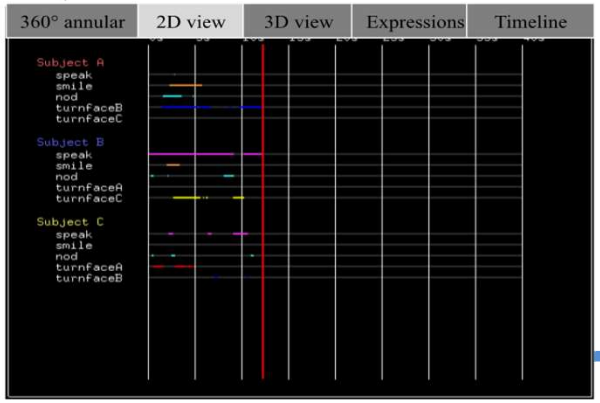
While the system is not specifically designed to detect mirroring, it opens a way to simplify the video recording process during face-to-face communication by using an omnidirectional camera to analyze all participants in a conversation.

■ Background :: Automated Behavior Analysis During Conversation

Jaana et al. (2014)







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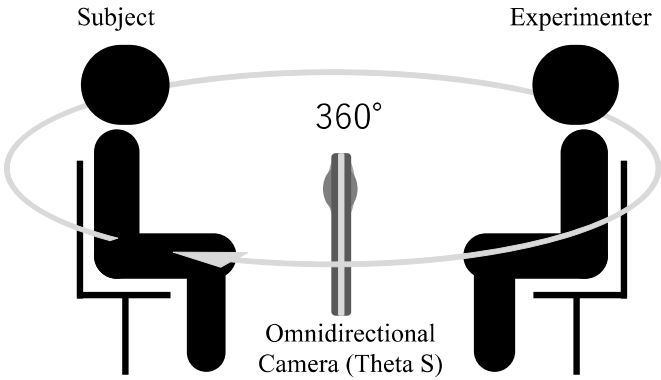
Research Aims

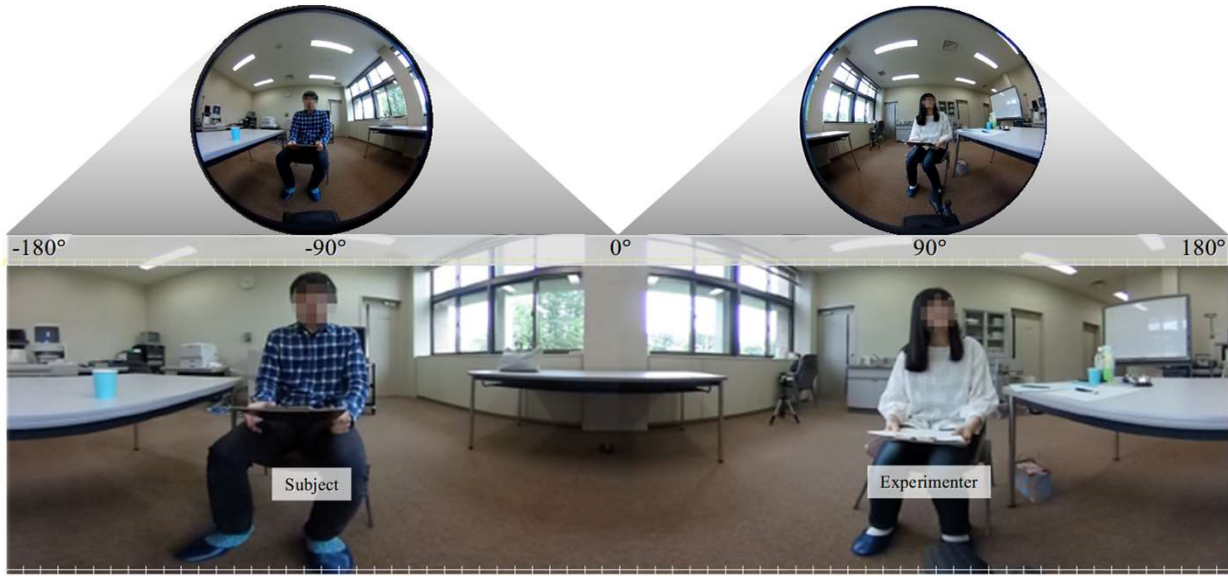
This study proposes a framework that can automatically detect the presence of mirroring motion in hand gestures during a conversation between two people using an omnidirectional camera.

Here, each image is converted to a panoramic image to extract the posture information of the conversation participants.

■ Communication Mirroring Detection



We built a framework to detect communication mirroring that occurs in a conversation scene by using an omnidirectional camera to capture an image of the whole bodies of the two communication participants.



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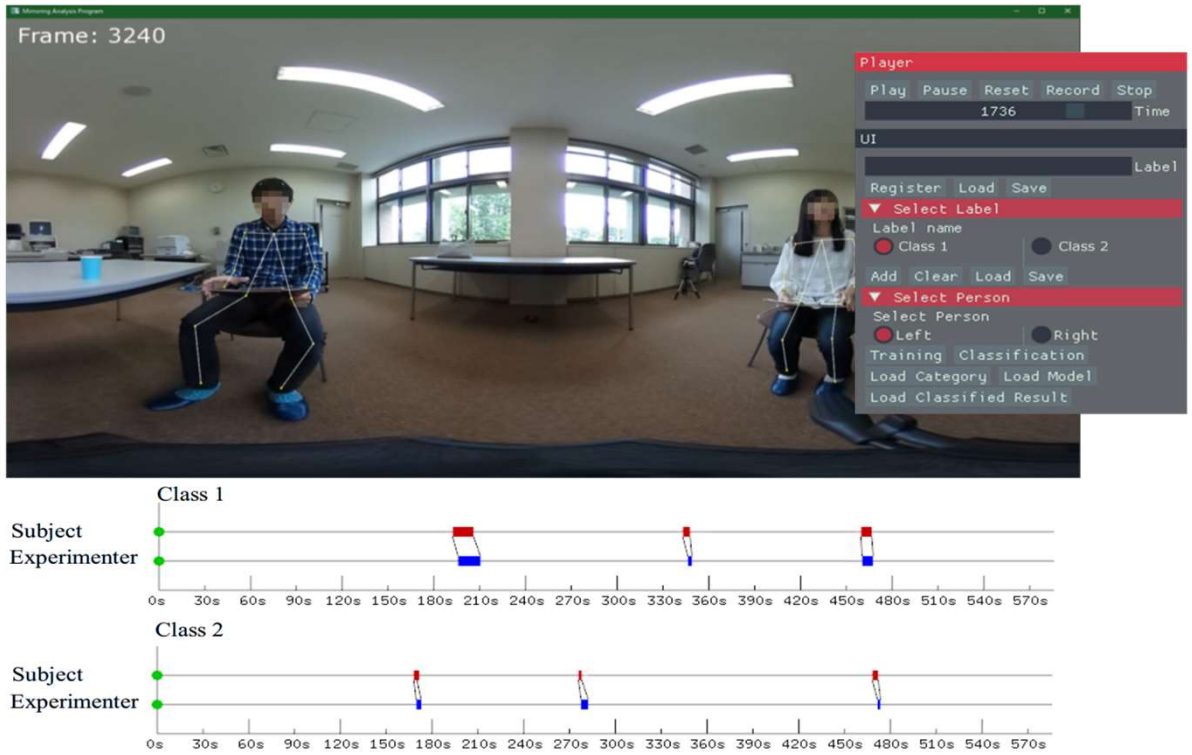
■ Communication Mirroring Detection

We built a framework to detect communication mirroring that occurs in a conversation scene by using an omnidirectional camera to capture an image of the whole bodies of the two communication participants. The OpenPose library was used to estimate the body posture of the communication participants. A Graphical User Interface (GUI) was provided to facilitate the selection and visualization of the training dataset.



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■ Experiments & Results

a. Imitation of distinctive gestures

The experimenter mimicked four different hand gestures of the subject. These data were trained using the Gesture Recognition Toolkit (GRT) [3] to determine the degree of matching between the experimenter's and subject's hand gestures.

The experimenter was shown to have correctly mimicked the subject's hand gestures (Table 1).

TABLE I. MAXIMUM LIKELIHOOD BETWEEN GESTURES OF THE SUBJECT AND THE EXPERIMENTER .

No.	Subject's Gesture	Interviewer's Gesture	Maximum Likelihood
1.	A	A	0.563
2.	B	B	0.688
3.	C	C	0.660
4.	D	D	0.558

Accuracy: 100%

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■ Experiments & Results

a. Imitation of distinctive gestures

A successful case of similar gestures detected in this experiment.

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Experiments & Results

b. Imitation of subtle gestures

During the interview, subject spoke expressively but made only subtle gestures. The experimenter mimicked three different hand gestures of the subject. These data were also trained using the Gesture Recognition Toolkit (GRT) to determine the degree of matching between the experimenter's and subject's hand gestures.

One of the gesture made by the experimenter did not resemble the subject's gesture (Table II).

TABLE II. MAXIMUM LIKELIHOOD BETWEEN GESTURES OF THE SUBJECT AND THE EXPERIMENTER.

No.	Subject's Gesture	Interviewer's Gesture	Maximum Likelihood
1.	A	C	0.641
2.	B	B	0.582
3.	C	C	0.525

Accuracy: 67%

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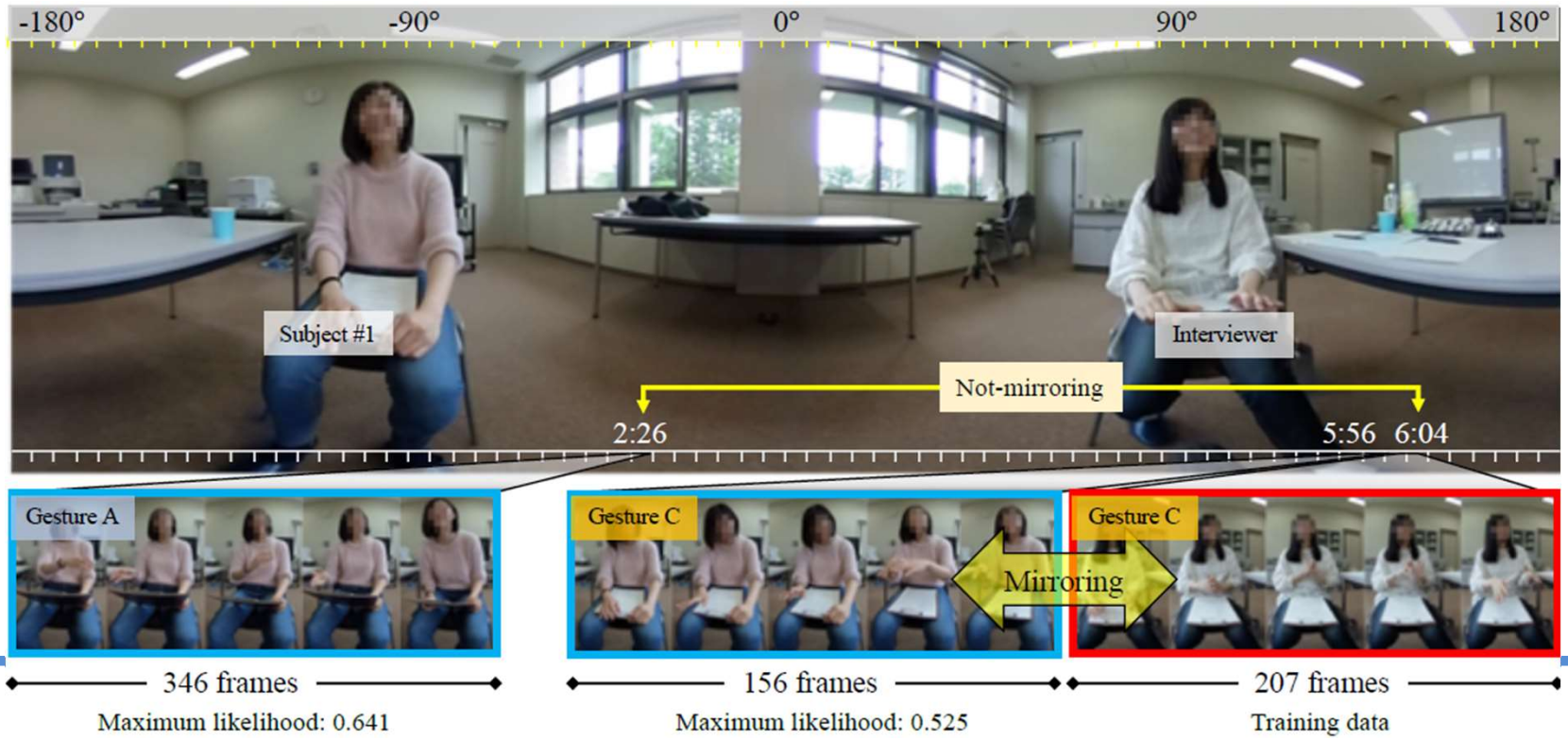
■ Experiments & Results

b. Imitation of subtle gestures

An example of a subtle gesture that failed to classify.



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Conclusion

In this study, we proposed a framework for determining whether communicative mirroring is established from recorded video scenes.

The results of experiments using this framework confirmed that DTW can detect mirroring acts with distinctive gestures.

The framework proposed in this study provides new implications for the development of an integrated behavioral analysis system that allows for the assessment of communicative mirroring.

References

1. BECO2, https://www.dkh.co.jp/product/behavior_coding_system/ [retrieved: February 20, 2020]
2. Y. Jaana, O. D. A. Prima, T. Imabuchi, H. Ito, and K. Hosogoe, “The development of automated behavior analysis Software,” Proc. SPIE 9443, Sixth International Conference on Graphic and Image Processing (ICGIP), pp. 1-5, 2014.
3. N. Gillian and J. A. Paradiso, “The gesture recognition toolkit,” Journal of Machine Learning Research, 15, pp. 3483–3487, 2014.