# Non-verbal Information in Communication: A Study of Interaction in a Tourist-information Setting

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A preliminary analysis is done to characterize the overall tendency of communication by the occurrences of non-verbal behaviors throughout an entire interaction event. Based on the previous findings in cross-modal interaction(Argyle et al. (1976), Kendon (1967), Clark (1996), etc), we analyze the occurrences of non-verbal behaviors such as gaze, pointing, nodding, and body-posture in a tourist-information setting. Analyses show that an interaction event can be categorized by the occurrence pattern of non-verbal behaviors of the participants.

## 1 Tourist-information Experiment

An experiment was conducted in a tourist-information setting. Subjects (22 university students) who played the "customer" role were asked to obtain information on sightseeing spots from a professional information clerk (female, 30 years old). The information was given through the communication between a customer and a clerk in front of 7 information display panels with short descriptions and pictures of the spots. Subjects were able to walk around freely within the area. Nineteen successfully recorded sessions were analyzed in this paper.

Body motions and locations were measured by a set of Vicon Motion Capture System. The directions of the subjects' gazes were measured by EMR-8B head-mount eye-trackers of Nac Image Technology Inc.. Each subject wore an eye-tracker, a close proximity microphone, and markers for the motion capture device.

The number and total duration of the following situations were recorded for each subject: a) utterances, b) gazes at the parter or gazes at a panel, c) followed gaze in which a gaze at a panel was overlapped or followed within 0.5 seconds by the partner's gaze.

Also the number of the following situations were recorded for each subject: a) eye movements within each panel, b) nods, c) finger-pointings, d) occurrences of states when the distance between the head and a panel was less than 1000 mm.

## 2 Analysis1: Correlation between Non-verbal Behaviors

The correlation of the non-verbal behaviors of the customers and the clerk is analyzed from the viewpoint of mutual effects in joint activities.

Strong correlations are found between customers' gaze at the clerk and the clerk's gaze at the customers, both in number ($\rho = .664$, p < .01) and total duration($\rho = .637$, p < .01).

On the other hand, strong negative correlations were found between the total duration of joint gaze at display panels and gaze at the partner, again both in number (customer's gaze: $\rho = -.732$, p < .01; clerk's gaze: $\rho = -.562$, p < 01) and total duration (customer's gaze: $\rho = -.746$, p < .01; clerk's gaze: $\rho = -.635$, p < 01). Although joint gaze and gaze at a partner are both considered to play important roles in establishing common ground in communication, these activities are imcompatible, and so the participants must choose one of them in each occasion according to their communication styles and information aquisition strategies in this task setting.

Strong correlations were observed between the number of gazes at the partner and the number of the gazer's nods (customer's gaze: $\rho = .631$, p < .01; clerk's gaze: $\rho = .678$, p < .01). This is due to the tendency of people to nod while looking at their partner.

No strong correlations were found between the customers' utterances and the clerk's, either in number or total duration. This may be a result of the asymmetry in the amount of information between the customers and the clerk produced by the task setting.

A strong negative correlation was observed between the number and the total duration of the



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clerk's utterances($\rho = . - .546$, p < .01), whereas a strong positive correlation was observed between the number and the total duration of the customers' utterances. ($\rho = .955$, p < .01) This may be due to the fact that the customers' utterances are mainly spontaneous ones like questions or answers, while the clerk's utterances are mainly well-planned ones following the script. A large number of clerk utterances likely indicates that she felt some difficulty in communication and her speech was cut into short utterances; otherwise, it would have been long and fluent.

The number of the clerk's gazes at the customers as well as that of the clerk's nods also shows a strong negative correlation with the number of the clerk's utterances(gaze: $\rho = -.645$, p < .01; nods: $\rho = -.612$, p < .01) , and these results also support the possibility of difficult communication.

## 3 Analysis 2: Factor Analysis

In this section, we conduct a factor analysis of the occurences of their non-verbal behaviors based on the results. The number of occurrences of the behaviors that showed significant correlations were identified and standardized by the time of interaction. Factors were extracted by the principal factor method, and promax rotation was adopted. The factors with loading value of more than 0.5. were subjected to interpretation, and four factors were extracted by giving consideration to the decay of the eigenvalues. These factors were named as follows.

**Customer-led:** The Customer-led Factor is characterized by high loading of the customers' positive interaction activities such as utterances(.567), gaze at the clerk(.530), nods(.742), and closing up(.492). High loading on the Clerk's pointing(0.871) means active information exchange involving obvious non-verbal cues. The number of customer gaze movements also shows high loading(.838), and this indicates the customers' active attitude in interaction.

**Cooperative:** The Cooperative Factor is characterized by strong negative loading on the number of the clerk's utterances(-.932). The analysis in the previous section suggests that the small number of the clerk's utterances indicates fluent interaction between the clerk and the customer. The numbers of customers' gazes at the clerk(.627) and the clerk's gazes at the customers(.677) also show high loading. The number of the clerk's nods shows high loading(.579) only in this factor, and this could be regarded as a sign of smooth and cooperative interaction between the clerk and the customers.

**Non-interactive:** The Non-interactive Factor can be characterized by high loading on the customers' gaze at a display panel(.898). The numbers of followed gazes also show high loading in both directions, but especially high in the customer-first case(customer-first: 0.893; clerk-first: .559). This shows the customers' tendency to acquire information at their own pace. On the other hand, the number of customers' pointings shows strong negative loading(-.610). This indicates that the customers are not active in interacting with the clerk.

**Clerk-led:** The Clerk-led Factor can be characterized by high loading on the numbers of clerk's gazes at a panel(.855), at a customer(.601), the clerk's moving her face close to a panel(.763), and the clerk's gaze movements(.693). This shows the clerk's positive attitude in appealing to a customer.

## 4 Summary

We have analyzed the nonverbal behaviors in a tourist-information setting. A factor analysis of non-verbal behaviors revealed four factors of communication style from the viewpoint of interaction. These results shed some light on how to characterize communication based on the activity level and the initiative-taking pattern of interaction by analyzing the non-verbal cues of the participants.

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