T-(538|725)-MALV, Natural Language Processing
The Role of Nonverbal Behaviour in Communication

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Outline

1 Nonverbal Behavior and Communication

2 Mapping Nonverbal Devices to Functions

3 Relevance to Computer Systems

Outline

Nonverbal Behavior

Multimodal Communication (í. marghátta samskipti)

When we have a conversation face-to-face, the entire body is constantly in motion. We seemlessly integrate the movements of our bodies into the flow of conversation without much thought. When we examine this behavior that goes beyond the words spoken, we start seeing things like:

- Gestures
- Head Movements
- Gaze Shifts
- Posture Changes
- Pitch Accents
- And more...

Nonverbal Behavior

Does This Serve a Communicative Purpose?

Is this symphony of observed behavior actually part of the communication or is it superfluous and simply part of some unrelated need for the body to stay in motion? Does the spoken text carry the communication completely?

Face-to-Face Dialog is Significant

Compared to text only, face-to-face dialog is considered the basic and primary use of language. We can therefore imagine that the verbal is most naturally in the context of the nonverbal, and that the two modes evolved together.

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Nonverbal Behavior

Comprehensive Communicative Act

- One should not consider face-to-face dialog to simply be verbal communication plus nonverbal communication.

- In fact, it would be better to describe the verbal and nonverbal as belonging to **a seamless and comprehensive communicative ac**t. This is one reason many researchers prefer the term *Dialog Act* to the more verbally oriented *Speech Act* when describing intension in the discourse of dialog.

Nonverbal Behavior

Evidence of Communicative Purpose

A range of behavior can be seen when we observe people having a conversation. How do we know that some of these behaviors are actually communicative?

Nonverbal Behavior

Evidence of Communicative Purpose

- **Social**: They correlate with the availability of a receiver (note that the same behavior may have different functions, like the "smile").

- Form: They can take on an unnatural form for symbolically conveying abstract or concrete things.

- Synchrony: They are very tightly synchronized with the verbal stream during conversation (providing both redundant and nonredundant information).

- Context: Their meaning/function becomes apparent in the current discourse context (this meaning/function affects receivers).

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Nonverbal Behavior

Devices Carrying out Functions

- If the nonverbal behaviors communicate, they are carrying out a *Discourse Function*.

- They can therefore be considered a set of available *Discourse Devices*, expanding the range of devices provided by text-only communication.

Outline

Studying the Correlation

The possible connection between nonverbal behavior as a discourse device and some discourse function can be formally studied. Such study begins with audio-visual data collection from a face-to-face encounter, typically involving a conversation.

Mapping Nonverbal Devices to Functions

Method

1. The speech is transcribed and the discourse functions arising from linguistic devices identified.

2. All observed behavior of interest is annotated in isolation from the speech and text.

3. The temporal correlation between identified discourse functions and annotated behavior is examined and high predictability considered a discovery of a useful mapping.

Mapping Nonverbal Devices to Functions

Tools

Audio transcription, behavior annotation and the examination of correlation can take place in a specialized **multimodal annotation tool** where multiple channels can hold information about each modality.

Mapping Nonverbal Devices to Functions

Multimodal Annotation Tool: Anvil

Some Results

Some Results

These kinds of studies have uncovered various interesting relationships. One can find them in a myriad of published science articles typically categorized as dealing with *Communicative Behavior*, *Multimodal Behavior*, *Social Behavior* or *Psychosocial Behavior*.

Some Results

Eye Gaze

Where people look, i.e. eye gaze, can indicate various things like:

- Speakers usually select next speaker with gaze near the end of their own turn (Kendon, 1990).

- Speakers generally break eye-contact at turn beginning (Argyle and Cook, 1976).

- Speakers perform grounding by looking at listener and/or listener looks up at speaker from task if explanation is needed (Nakano et al., 2003).

Some Results

Gestures

Conversational gesture is a very complex phenomenon. The general gesture activity has some clear correlations:

- Gestures are almost exclusively made by speakers, while listeners do not gesture unless asking for the floor.

- Gestures are more likely to occur with new, *rhematic*, material than given material (Cassell et al. 1994).

Some Results

Main Categories of Conversation Gesture

- **Beats**: Emphasis
- **Deictics**: Referring Expression
- **Iconics**: Depicting Concrete Shape
- **Metaphorics**: Depicting Abstract Concept
- **Emblems**: Conventional Signs

Some Results

Posture

People often change posture when they change the topic of conversation (Cassell et al. 2001). In fact, the one wishing to initiate the topic change will lead with a shift in posture and if the listener accepts the change, the listener will shift as well, mirroring the speaker. This is an example of a silent negotiation that takes place nonverbally.

Outline

Example of Use

Speech Understanding

Looking at both verbal and nonverbal behavior may provide redunancy which is helpful if the environment is noisy. One could say that with more discourse devices available behind each function, the more likely the function will correctly be decoded.

Animated Characters

If the computer is represented by a graphical character, it is very important that the character's nonverbal behavior is appropriate and well synchronized with the character's verbal behavior, otherwise inconsistent communication results. If done correctly, the user or audience will be able to make use of the nonverbal discourse devices to improve their understanding of what is said.

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Computer Mediated Communication

A narrow communication channel, like text chat, can be augmented with nonverbal behavior if the discourse functions from the textual devices are known (see "Augmenting Online Conversation through Automatic Discourse Tagging").