TOWARDS A MODEL OF FACE-TO-FACE GROUNDING

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Empirical Study

- Face-to-face condition (F2F)
- Shared Reference condition (SR)
Empirical Study

<table>
<thead>
<tr>
<th></th>
<th>Shift to within UU</th>
<th>Shift to pause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgement</td>
<td>$gMwN/gM (0.495)$</td>
<td>$gM/gM (0.888)$</td>
</tr>
<tr>
<td>Answer</td>
<td>$gP/gP (0.436)$</td>
<td>$gM/gM (0.667)$</td>
</tr>
<tr>
<td>Info-req</td>
<td>$gP/gM (0.38)$</td>
<td>$gP/gP (0.5)$</td>
</tr>
<tr>
<td>Assertion</td>
<td>$gP/gM (0.317)$</td>
<td>$gM/gM (0.418)$</td>
</tr>
</tbody>
</table>
MACK

- Interactive public information ECA kiosk
- Can answer questions about the MIT Media lab
MACK I/O

- Input operates on parallel threads
  - Speech
  - Pen gesture via a paper map
  - Head nod and eye gaze via camera

- Output
  - Speech synthesis using Text-to-Speech API (TTS)
  - A graphical figure with hand and arm gestures and head and eye movements (AM)
  - LCD projector highlighting the paper map
MACK system architecture
MACK

- Generation module (GM)
  - Converts UU into speech, gesture and projector output
- Discourse Model (DM)
  - List of grounded UUs
  - List of ungrounded UUs
  - The current UU
- The Understanding Module
  - Converts input to dialogue moves
Dialogue Manager (DM)

- The Response planner
  - Determines next action
  - Creates a sequence of utterance units (UU)
- Grounding Module (GrM)
  - Updates the Discourse Model
  - Passes UUs to the Generation module
  - Look up nonverbal information to judge a UU
MACK grounding

- Verbal evidence is stronger than nonverbal

<table>
<thead>
<tr>
<th>Target UU Type</th>
<th>Evidence Type</th>
<th>NV Pattern</th>
<th>Judgment of ground</th>
<th>Suggested next action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assertion</td>
<td>positive</td>
<td>within: map pause: map /nod</td>
<td>grounded</td>
<td>go-ahead: 0.7 elabor.: 0.30</td>
</tr>
<tr>
<td>Assertion</td>
<td>negative</td>
<td>within: gaze pause: gaze</td>
<td>ungrounded</td>
<td>go-ahead: 0.27 elabor.: 0.73</td>
</tr>
<tr>
<td>Answer</td>
<td>positive</td>
<td>within: gaze pause: map</td>
<td>grounded</td>
<td>go-ahead: 0.83 elabor.: 0.17</td>
</tr>
<tr>
<td>Answer</td>
<td>negative</td>
<td>pause: gaze</td>
<td>Ungrounded</td>
<td>go-ahead: 0.22 elabor.: 0.78</td>
</tr>
</tbody>
</table>
[1] U: How do I get to Room 309?

[2] M: To get to Room 309, go to that door and make a right. look at map

[3] M: Walk down the hall and make a left at the door. gaze at MACK

[4] M: It’s the glass door with red couches right outside. look at map


[6] U: That’s great. look at map
The End