

## Collaborative Construction of Multimodal Utterances

Edwin Hutchins & Saeko Nomura

### Field trips

|             |          | Revenue Flights |                     | FFS Training   |             |
|-------------|----------|-----------------|---------------------|----------------|-------------|
|             |          | # of flights    | #of pilots observed | Hours observed | # of pilots |
| Japan       | Aug 2005 | 22 legs         | 22 pilots           | 15 hours       | 7 pilots    |
|             | May 2007 | -----           | -----               | 8              | 4           |
| N. America  | Oct 2005 | -----           | -----               | 37             | 3           |
| New Zealand | Nov 2005 | 21              | 14                  | 4              | 2           |
|             | Oct 2006 | 11              | 12                  | 8              | 4           |
| Brazil      | Aug 2007 | 16              | 16                  | 10             | 6           |

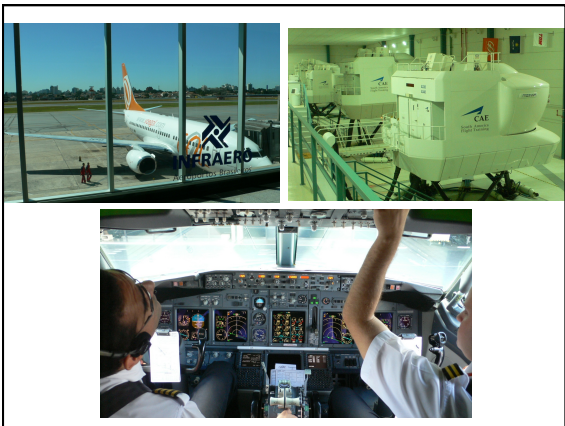
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### Field Notes

Field Note: FLS-1037 on July 14, 2005  
Saeko Nomura and Edwin Hutchins

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### Utterance Types in the Wild

- Multimodal utterances
- Collaboratively constructed utterances
  - Verbal Continuations
- Collaboratively constructed multimodal utterances

### Relations between Gesture and Speech

|                   |               | Temporal Relation    |        |           |
|-------------------|---------------|----------------------|--------|-----------|
|                   |               | Concurrent           | Offset | Unrelated |
| Semantic Relation | Congruent     | Lexical Affiliate    |        |           |
|                   | Complementary | Co-expressive Speech | ???    |           |
|                   | Unrelated     |                      |        | ???       |

**#1: FLAPS 5**  
**20° Bank**

- Start: Flaps 5. **FLAPS 5 speed**
- N1 45% (approx 1 knot/sec decel)
- Establish 20° bank (PF check VSI, ALT, PLI)
- Stick shaker
  - Smoothly apply MAX Power (PM adjust to GA)
  - Level wings, do not change config, retract SB
  - Power comes up, apply nose down trim
  - Airspeed increases, lower pitch to 5 - 6°
  - Approaching **Flaps 5 speed** - 65%
- Finish: **FLAPS 5 speed**

## Let's see a movie

I: Level the wings 1.  
[models airplane roll attitude with right hand palm down]

PF: Hmmmm

I: right,  
 I: don't change your flap or landing gear configuration.  
[raises fingers of right hand and wags to right]

PF: Hmmmm, hmmm

I: right 2  
[drops hand to table. Pilots nod]


Retract speedbrake.  
[right hand models pushing speedbrake lever forward and down]

Hopefully that's not (0,1), not gonna be a problem, (1)  
[raises right hand wags to right, then drops to table]  
[PF shakes his head side to side]

I: (reading) PM verifies thrust is set,  
monitors altitude and airspeed,  
[PM raises his left hand and spreads his fingers and thumb]  
 calls out any trends towards terrain.


|                   |               | Temporal Relation    |        |           |
|-------------------|---------------|----------------------|--------|-----------|
|                   |               | Concurrent           | Offset | Unrelated |
| Semantic Relation | Congruent     | Lexical Affiliate    |        |           |
|                   | Complementary | Co-expressive Speech |        |           |
|                   | Unrelated     |                      |        |           |

I: For us, if we start out flaps five (1 sp.)  
 [looks to computer monitor and right index point to it]  
Let's go to flaps five.  
 [raises right arm and opens right and left palms to make "five"]  
flaps five speed  
 [PF positions his hands as if to hold a yoke and pushes forward]  
that's what we are gonna go to, okay?  
 [shakes right and left hands rhythmically]  
 [scratches left elbow with right hand]




|                   |               | Temporal Relation    |        |           |
|-------------------|---------------|----------------------|--------|-----------|
|                   |               | Concurrent           | Offset | Unrelated |
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|                   | Unrelated     |                      |        |           |

PM: Yes, I know difference between Boeing and (Company X)'s procedure.  
 Our procedure just trim out at flap five speed (0.2)  
 and then  
 [makes two fists to represent holding yoke and pulls toward his chest]  
 PM: keep back pressure only.  
 [continues holding his two fists near his chest]  
 not applying any more trim.




|                   |               | Temporal Relation    |        |           |
|-------------------|---------------|----------------------|--------|-----------|
|                   |               | Concurrent           | Offset | Unrelated |
| Semantic Relation | Congruent     | Lexical Affiliate    |        |           |
|                   | Complementary | Co-expressive Speech |        |           |
|                   | Unrelated     |                      |        |           |

PM: But a, it's realistic the Boeing way. (0.5)  
Because, ah  
 [I makes trim gesture]  
 PF: Hmm.  
 PM: We always manage to keep our trim...  
 [I nods continuously]  
 I: Uh, huh.  
 [nods continuously]  
 PM: ( ) you know, forward out of habit.  
 [I nods continuously]




|                   |               | Temporal Relation    |        |           |
|-------------------|---------------|----------------------|--------|-----------|
|                   |               | Concurrent           | Offset | Unrelated |
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|                   | Complementary | Co-expressive Speech |        |           |
|                   | Unrelated     |                      |        |           |

PM: It's very really difficult  
 [models pushing the yoke]  
 [I stops modeling nose up trim]  
to get Ah. (0.5) back to normal (0.2)  
 [right hand offer shape]  
nose down  
 [models pushing the yoke]  
 PF: To ah... to recover from  
 [looks toward and flicks right fist toward PM]  
 PM: because I I you have to push  
 [models pushing the yoke again]  
 [I nods and points at PM with his right index finger]



|                   |               | Temporal Relation    |        |           |
|-------------------|---------------|----------------------|--------|-----------|
|                   |               | Concurrent           | Offset | Unrelated |
| Semantic Relation | Congruent     | Lexical Affiliate    |        |           |
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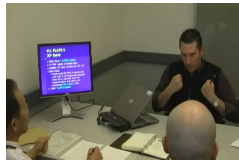
I: once those engines.  
 [cupped hands at side below shoulders]  
they are under slings engines.  
 [two beats with cupped hands at side below shoulders]  
right?  
The engines, these.  
 [arms extended out above previous engine gesture location]  
 PF: [unintelligible]  
 [fingertips of both hands rotate up quickly]  
 I: So, it's gonna  
 [bends forward bringing wing gesture down]  
 PF: tend to, yeah  
 [flicks fingertips up again]  
 I: huh.  
it's gonna tend to (0.3)  
 [bends at waist and lowers arms]  
slings this airplane up.  
 [entire body and arms come up again]



|                   |               | Temporal Relation    |        |           |
|-------------------|---------------|----------------------|--------|-----------|
|                   |               | Concurrent           | Offset | Unrelated |
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|                   | Complementary | Co-expressive Speech |        |           |
|                   | Unrelated     |                      |        |           |

## Coherence of gesture

- Gestures presuppose the fine details of the imagined situation



### Conceptual Anticipation

- Gesture provides evidence that imagination can run ahead of talk
- One consequence of repeating the “push” gesture is that it keeps the main point active while the verbal preamble is delivered
- Participants anticipate each other’s conceptual projects

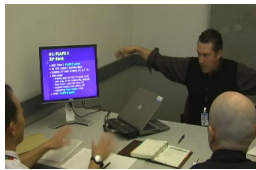


### Mutual elaboration of talk and gesture.

- Gesture, talk, printed words and objects all have different representational affordances.
- Gestures may enter into relations of mutual elaboration with a variety of other semiotic resources in the activity system.
  - As co-expressive speech and/or as lexical affiliates.
  - And across participants.
- Very complex semiotic fields emerge from interaction.

### Collaborative construction

- The production of multi-author multimodal utterances with precise temporal and conceptual alignment indicates that the participants inhabit jointly imagined worlds.



### How a paper is born and grows to publication