

Fundamentals of Linguistic Interaction

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- timing coordination – turn taking
- meaning coordination – dialogue acts
- *meaning* coordination – grounding
- *style* coordination - alignment and adaptation
- language *acquisition* in interaction

Joint action



When two or more agents coordinate their actions (in space and time) to produce a joint outcome, they perform a *joint action*.

Arguably, conversation is a type of joint action (not only intention recognition).

The Joint Action model

Also called collaborative model or grounding model.

- Clark & Schaefer (1989) put forward a model of dialogue interaction that sees conversation as a *joint process*, requiring actions by speakers and addressees.
- Conversation is a continuous process of establishing common ground between speaker and addressee ⇒ *grounding*
- Speakers and addressees have *mutual responsibility* in managing the grounding process and making communication successful.

Clark & Schaefer (1989) Contributing to discourse. *Cognitive Science*, 13:259–294.

Clark (1996) *Using Language*. Cambridge University Press.

Levels of communication

Ladder of actions at different levels of communication performed by speakers and addressee with each utterance (Clark / Allwood)

Level	Actions
1 contact:	A and B pay attention to each other
2 perception:	B perceives the signal produced by A
3 understanding:	B understands what A intends to convey
4 uptake:	B accepts / reacts to A's proposal

In contrast to Austin's distinction between locutionary, illocutionary, and perlocutionary acts, the emphasis here is in the joint character of the actions performed with/by utterances

⇒ effective utterances in dialogue are *joint actions*.

Grounding criterion

Level	Actions
1 contact:	A and B pay attention to each other
2 perception:	B perceives the signal produced by A
3 understanding:	B understands what A intends to convey
4 uptake:	B accepts / reacts to A's proposal

Lack of understanding may occur at any level of action

- we may not realise we are being addressed
- we may not hear our interlocutor properly
- we may not know the meaning of a word the speaker uses
- we may fail to recognise the relevance of what is said

To achieve grounding, dialogue participants must understand each other at all levels of communication up to the *grounding criterion*:
⇒ *the appropriate degree of understanding given the communicative situation at hand (sufficient for current purposes).*

Evidence of understanding

How does it become established whether the grounding criterion has been reached?

- Addressees give constant feedback to the speaker regarding their level of understanding.
 - ▶ *positive feedback*: implicit or explicit acknowledgements
 - ▶ *negative feedback*: clarification requests
- Mechanisms to provide positive evidence of understanding:
 - ▶ acknowledgement / backchannel
 - ▶ repetition
 - ▶ demonstration (paraphrase, reformulation, completion)
 - ▶ relevant next contribution
- This need for evidence of understanding structures the dialogue into *contributions*:
 - ▶ each contribution to dialogue is made up of a *presentation* phase and an *acceptance* phase.

Linguistic interaction

A transcript fragment from the Switchboard corpus:

```
B.52 utt1: Yeah, /
B.52 utt2: [it's,+ it's] fun getting together with immediate family./
B.52 utt3: A lot of my cousins are real close /
B.52 utt4: {C and} we always get together during holidays and
           weddings and stuff like that, /
A.53 utt1: {F Uh, } those are the ones that are in Texas? /
B.54 utt1: # {F Uh, } no, # /
A.55 utt1: # {C Or } you # go to Indiana on that? /
B.56 utt1: the ones in Indiana, /
B.56 utt2: uh-huh. /
A.57 utt1: Uh-huh, /
A.57 utt2: where in Indiana? /
B.58 utt1: Lafayette. /
A.59 utt1: Lafayette, I don't know where, /
A.59 utt2: I used to live in Indianapolis. /
B.60 utt1: Yeah, /
B.60 utt2: it's a little north of Indianapolis, about an hour. /
```

Connections between levels of understanding

Level	Actions
1 contact:	A and B pay attention to each other
2 perception:	B perceives the signal produced by A
3 understanding:	B understands what A intends to convey
4 uptake:	B accepts / reacts to A's proposal

According to Clark, the levels of action are connected by two principles:

- *Upward causality*: actions at lower levels (completed successfully up to the grounding criterion) allow actions at higher levels.
- *Downward evidence*: evidence that a level has been achieved can be taken as evidence that the grounding criterion has been reached at all lower levels.

A: How would you like to be contacted?

B: By email, please. At john.smith@email.com

A: OK. Thank you very much and have a good day

B: Goodbye.

Feedback

Feedback mechanisms have been classified according to the level of communication at which the evidence of understanding is given.

A: I know a great tapas restaurant in Utrecht.
B: Pardon?
A great what?
Utrecht?
Should I consider this an invitation?

However, there is not a one-to-one correspondence between the form of feedback utterances and their function.

yeah ~> level 1 / 2 / 3 / 4 ?
Utrecht? ~> level 2 / 3 / 4 ?

Note also that one single utterance can give positive and negative feedback simultaneously:

B: A tapas restaurant where?

Refining the uptake level

Julian J. Schlöder and Raquel Fernández. Clarifying Intentions in Dialogue: A Corpus Study. IWCS 2015.

- (1) A: I think that's all. (2) A: Just uh do that quickly. (3) A: I'd say two.
B: Meeting's over? B: How do you do it? B: Why?

	Level	Joint Action	Example Clarification
1	contact	A and B pay attention to each other	<i>Are you talking to me?</i>
2	perception	A produces a signal and B perceives it	<i>What did you say?</i>
3	understanding	A conveys a meaning and B recognises it	<i>What did you mean?</i>
4.1	intention recognition	A intends a project and B understands it	<i>What do you want?</i>
4.2	intention adoption	A proposes a project and B accepts it	<i>Why should we do this?</i>

Grounding and Metacommunication

- The primary function of feedback acts is to manage the grounding process
- They are **meta-communicative**: while other types of acts deal with the topic of the conversation, the subject matter of feedback utterances are the basic acts of communication.

Layer 1: basic communicative acts

Layer 2: meta-communicative acts

B: There is not one ticket left in the entire planet! So annoying!

C:

Where for?

B:

Crowded House.

B: My brother is going and he doesn't even like them.

A: Why doesn't he sell you his ticket?

implicit positive evidence

B: Cos he's going with his work. And Sharon.

implicit positive evidence

A:

Oh, his girlfriend?

B:

Yes.

B: They are gonna come and see me next week.

Feedback timing

Skantze, G. (2012). A Testbed for Examining the Timing of Feedback using a Map Task. In *Proceedings of the Interdisciplinary Workshop on Feedback Behaviors in Dialog*.

“we present a fully automated spoken dialogue system that can perform the Map Task with a user. By implementing a trick, the system can convincingly act as an attentive listener, without any speech recognition. An initial study is presented where we let users interact with the system and recorded the interactions. Using this data, we have then trained a Support Vector Machine on the task of identifying appropriate locations to give feedback, based on automatically extractable prosodic and contextual features.”

▶ Video demonstration

Referential communication

The joint action model has taken referential communication as a case study: how do participants refer to objects in dialogue? Are the Gricean Maxims a good model of the referring process in conversation?

Maxim of Quality: be truthful

- Do not say what you believe to be false.
- Do not say that for which you lack adequate evidence.

Maxim of Quantity:

- Make your contribution as informative as is required
- Do not make your contribution more informative than is required.

Maxim of Relevance: be relevant Maxim of Manner: be perspicuous.

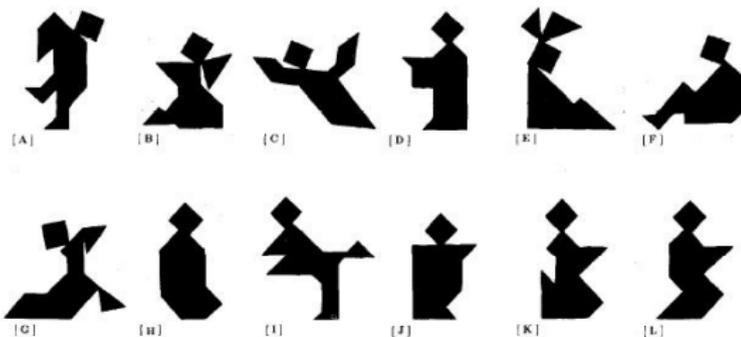
- Avoid obscurity of expression / Avoid ambiguity.
- Be brief / Be orderly.

The collaborative model emphasises the *collaborative aspect of referring*:

Matching referring tasks

The classic “*Tangram experiments*” by Clark & Wilkes-Gibbs:

- *matching referring task*: an instruction giver (director) and an instruction follower (matcher)
- the task is to get the matcher identify the tangram figures
- the task is repeated (in different orders) over several trials



This facilitates investigation of the referring process as participants accumulate *common ground* and precedents for referring expressions.

Minimizing collaborative effort

- Clark & Wilkes-Gibbs' *Principle of Least Collaborative Effort*
“*Our proposal is that speakers and addressees try to minimize collaborative effort, i.e. the work both speakers and addressees do from the initiation of the reference process to its completion*”
- There is a trade-off in effort between initiating an expression and refashioning it: the more effort the speakers put in the initial expression, the less refashioning it is likely to need.
- Initial expressions are not always optimal due to time pressure, complexity, ignorance, ...
- *Speakers* deal with these constraints minimizing collaborative effort with repairs, instalments, and trial and error.
- *Addressees* minimize collaborative effort by indicating quickly and informatively what is needed for mutual acceptance.

Referring as a collaborative process

Basic exchange:

- (1) A: Number 4's *the guy leaning against the tree*.
B: Okay.

Refashionings:

- (2) A: OK, the next one is the rabbit.
B: Uh—
A: That's asleep, you know, it looks like it's got ears and a head pointing down?
B: Okay.
- (3) A: Um, the third one is the guy reading with, holding his book to the left.
B: Okay, kind of standing up?
A: Yeah.
B: Okay.

Basic exchanges occur seldom on early trials (6%) but often on later trials (84%). Refashionings decline in later trials once a RE has been mutually established.

Establishing Conceptual Pacts

When speakers and addressees arrive at a successful expression (*ground* a reference), they create a **conceptual pact**, a temporary agreement about a conceptualisation for a particular entity.

A: A docksider.

B: A what?

A: Um.

B: Is that a kind of dog?

A: No, it's a kind of um leather shoe, kinda pennyloafer.

B: Okay, okay, got it.

⇒ Thereafter “the pennyloafer”



Conceptual pacts

- overwrite quantity maxims: they will continue to call it *'the pennyloafer'* even when it does not need to be distinguished from other shoes
- are **partner-specific**: they will do so only when interacting with the dialogue partner with whom the expression had been grounded.

Brennan & Clark (1996) Conceptual Pacts and Lexical Choice, *Jrnl. of Experimental Psychology*, 22(6):1482–1493.

The Dynamics of Referring Expressions

Ways of referring are not static but evolve during dialogue:

- expressions are modified according to interlocutors' feedback,
- they become shorter as grounding is more firmly established.

Utterances by one director referring to the same figure on trials 1 to 6:

1. All right, the next one looks like a person who's ice skating, except they're sticking two arms out in front.
2. Um, the next one's the person ice skating that has two arms?
3. The fourth one is the person ice skating, with two arms.
4. The next one's the ice skater.
5. The fourth one's the ice skater.
6. The ice skater.

Experiments by Krauss & Weinheimer (1966) showed that this happens when talking to responsive partners, but not to a tape recorders.

Krauss & Weinheimer (1996) Concurrent feedback, confirmation, and the encoding of referents in verbal communication, *Journal of Personality and Social Psychology*, 4:343–346.

Referring in Interactive Settings (summary)

- speakers don't get only one chance to produce a description – they can reformulate
- they receive online feedback from their addressees
- addressees themselves contribute to the referring process
- referring expressions do not emerge from solitary choices of the speaker (cf. Gricean maxims), but from an interactive process by speaker and addressee.
- speakers and addressees can agree on a description for a referent during the referring process – what works for a dyad may not work for another one

⇒ Referring is a *joint process* where speakers and addressees try to *minimize collaborative effort*.

Clark & Wilkes-Gibbs (1986) Referring as a collaborative process. *Cognition*, 22:1-39.

Brennan & Clark (1996) Conceptual Pacts and Lexical Choice, *Journal of Experimental Psychology*, 22(6):1482–1493.

Constraints on grounding

Principle of least collaborative effort: try to ground with as little combined effort as needed. \rightsquigarrow *what takes effort changes with the communication medium.*

Eight constraints that a medium may impose on communication:

1. **Copresence**: A and B share the same physical environment.
2. **Visibility**: A and B are visible to each other.
3. **Audibility**: A and B communicate by speaking.
4. **Cotemporality**: B receives at roughly the same time as A produces.
5. **Simultaneity**: A and B can send and receive at once and simultaneously.
6. **Sequentiality**: A's and B's turns cannot get out of sequence.
7. **Reviewability**: B can review A's messages.
8. **Revisability**: A can revise messages for B.

Clark, H. H., & Brennan, S. E. (1991). Grounding in communication. In L. B. Resnick, J. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 127–149). Washington, DC: APA.

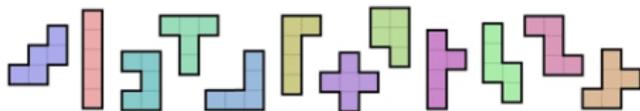
Constraints on Grounding

Table 1

SEVEN MEDIA AND THEIR ASSOCIATED CONSTRAINTS

Medium	Constraints
Face-to-face	Copresence, visibility, audibility, cotemporality, simultaneity, sequentiality
Telephone	Audibility, cotemporality, simultaneity, sequentiality
Video teleconference	Visibility, audibility, cotemporality, simultaneity, sequentiality
Terminal teleconference	Cotemporality, sequentiality, reviewability
Answering machines	Audibility, reviewability
Electronic mail	Reviewability, revisability
Letters	Reviewability, revisability

Clark, H. H., & Brennan, S. E. (1991). Grounding in communication. In L. B. Resnick, J. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 127–149). Washington, DC: APA.



- B: it's a block of three . and then one tagged on . to the edge
A: oh it's like . . a symmetrical L and then another two blocks . attached
on to another end kind of thing
B: What? [laughter]
A: Okay, uhm you've got . . uh (t- + two) blocks
B: Yeah.
A: Uhm and then on the end of those two blocks
B: Yeah.
A: you've got .. . another . block (it's like + it's) kind of making an L
B: u:hm.
A: and then . . on that block . on that edge . uhm
B: I think I know what you're talking about, so there's three blocks up and one block
across but in the middle block . of the one that's going up there's one sticking out
[...]
A: One by one block that's been taken out and it's been moved
B: Yes and this has been put in the middle. Yeah yeah yeah yeah.
A: In the middle. Yeah?
B: Yeah, got it.
A: Yeah, OK.

R. Fernández, D. Schlangen, & T. Lucht (2007) Push-to-talk ain't always bad! Comparing Different Interactivity Settings in Task-oriented Dialogue. In *Proc. of SemDial*.

R. Fernández, T. Lucht, & D. Schlangen (2007) Referring under Restricted Interactivity Conditions. In *Proc. of SIGdial*.

- Joint action model: mutual responsibility of speakers and addressees
- Levels of communication
 - ▶ sufficient grounding required at all levels
 - ▶ need to provide evidence
 - ▶ clarification requests help to pinpoint levels of understanding by indicating sources of failure
- Referential communication as case study
 - ▶ principle of least collaborative effort
 - ▶ partner-specific referring expressions

Tomorrow: style coordination