

Other-initiated repair acts. Preventing and Detecting Miscommunication: Analysis of Estonian Information Dialogues.

Siiri Pärkson

1. Introduction

For a regular computer user to interact with a computer in natural language, the computer must model the operations that are typical for human mind: understanding the partner's replies, planning the answers, adequate reactions and etc. So it is necessary to model language analysis and generation. On the other side is also the process of communication itself.

Work in this direction has been started in University of Tartu from analyzing existing dialogue models, dialogue corpus and Estonian text of dialogues, to form a dialogue model which could be used as basis of realization.

Estonian information dialogues have been analyzed with the goal to find out typical ways used by an information provider in order to prevent, detect and handle miscommunication, and to model them in a dialogue system.

Successful communication requires that participants have shared knowledge – a common goal to communicate with each other, a common language, and a shared picture of the domain and communication rules, at least partially correct image of the partner.

Cooperative dialogue has been considered in many cases where the goals of participants are common or at least in accordance. In man-machine interaction the goal of the user is mostly to get information from a data base and the goal of computer is to help the user as much as possible (**Koit, Roosmaa, Õim, 1996**).

Similarly, a dialogue system that interacts with a user in a natural language must be able to cope with the possibility of miscommunication – including misunderstanding, non-understanding, and misinterpretation (**McRoy, 1998; McRoy et al., 1999**).

The goal is to develop a dialogue system that interacts with a user in Estonian and provides information about phone numbers, addresses, departure times of buses, etc. This is the reason why we are studying spoken human-human dialogues – calls for information – with the aim of finding out typical ways used by a participant in order to avoid miscommunication with a partner, to detect and solve communication problems.

One way to prevent miscommunication is to initiate an information-sharing subdialogue. Information sharing is transfer of knowledge from one participant to another.

Having detected or suspecting miscommunication, a participant can initiate a *correction* subdialogue (or clarification, as described in **McTear, 2004**).

In conversation analysis these corrections subdialogues are called *repairs*. In this study, I will focus on the strategies used by an information provider in order to prevent, detect and handle communication problems.

The first is information-sharing before answering where an information provider realizes that his understanding of a client's (C) goal and/or his knowledge are insufficient for giving a satisfactory answer, and asks adjustable questions in order to prevent miscommunication.

The second kind of subdialogue is correction where an information provider has detected a communication problem (e.g. he did not hear or did not understand a client's previous turn), and initiates a repair.

2. Fundamental terms

It is impossible to prevent every miscommunication.

Exist three types of repair initiations (**Gerassimenko et al., 2004a**).

Clarification is an initiation by which the hearer repeats exactly or with some variation some utterance, phrase etc. of the previous speaker to get confirmation that it was such (*did you say that?*).

Non-understanding is an initiation by which the initiator reports that he did not hear or did not understand the previous information, or the information contradicted with his knowledge and beliefs, and therefore must be checked.

Reformulation is an initiation by which the hearer gives her own interpretation (hypothesis, rewording, generalisation etc.) to the speaker's turn. Her aim is to get a confirmation that her understanding is correct (*did you mean that?*).

Example 1. Non-understanding and reformulation in a dialogue (marked with -->)

```
C: õelge (.) kus on Tartus ee ´Kaa sa´long. | QUF1: WH |  
tell me where Kaa salon is located in Tartu  
(1.5)  
-->P: e=´kuidas=se sa´long oli | QUF: WH | |RRF: NON-UNDERSTANDING |  
how this salon was  
-->C: ´Kaa. | QUS: GIVING INFORMATION | |RRS: REPAIR |
```

¹ See Appendix A

```

´Kaa sal[ong.] | QUS: GIVING INFORMATION | | RRS: REPAIR |
Kaa salon
-->P: [Kaa ´arvutisalong. | QUF: OFFERING ANSWER | | RRF: REFORMULATION
|
Kaa computer salon
-->C: jajah | QUS: YES | | RRS: REPAIR |
yes yes
(...)
P: näiteks=on: (0.5) ´Küüni ´kaks. | QUS: GIVING INFORMATION |
Kuuni Street two is for example

```

Example 2. Clarification in a dialogue (marked with -->)

```

C: saaksite öelda `Vanemaise nelikend=`kuus `dekanaadi numbri. |
QUF: OPEN YES |
may you say number of dean's office in Vanemaise street 46
P: jaa? | QUS: YES |
yes
üks=`hetk, | QUS: POSTPONEMENT
one moment
(...) `seitse kolm `seitse, | QUS: GIVING INFORMATION |
(...) seven three seven,
(0.5)
C: [jah] | VR: CONTINUER: NEUTRAL |
yes
P: [´viis] `kaheksa kolm `kuus. | QUS: GIVING INFORMATION |
five eight three six
-->C: > viis kaeksa kolm kuus. < | QUF: OFFERING ANSWER | | RRF:
CLARIFICATION |
five eight three six
-->P: jah. | QUS: YES | | RRS: REPAIR |
yes
C: suur=tänu. | RIJ: THANKING |
thank you

```

Spoken dialogue is divided into **turns**, which are continuous phonation of one of the participants. Turns are subdivided into utterances, boundaries of turns are set by intonation or are grammatical-pragmatic.

The term **´utterance´** to refer to everything contributed by a speaker in one turn, an utterance may correspond to more than one dialogue act, and thus be multifunctional, for several reasons. First, an utterance may consist of several sentences or phrases that each express dialogue acts. So dialogue acts often relate to parts of utterances. Moreover, these utterance parts often carry more than one functional meaning (**Bunt 1999**).

One of the most noticeable things about conversation is that certain classes of utterances conventionally come in pairs (**Hutchby, Wooffitt, 2004 : 39**).

In a dialogue the turns combine in two ways. By one way they combine to **adjacency pairs** and by other they stay as free turns. The term adjacency pair (AP) comes from conversation analysis. **Adjacency pairs** are turn-pairs where the first turn

demands a certain second turn (like question and answer, greeting and return greeting), but adjacency pair consist on two turns or utterances only in ideal cases.

Ideal for communication has been a problemless fluent interaction, but practically it happens rarely. For that reasons **repair organization (Schegloff, Jefferson, Sacks 1977)** are needed. The repair organization is one of the three basic systems of communication management along with turn-taking and preference organization in CA (**Schegloff, Jefferson, Sacks, 1977: 361; Sorjonen, 1997**).

The problems can also be of many types from a language-repair to not hearing an utterance. To solve communication problems there are repair organizations which can be divided by who starts the repair and who completes it.

Problem solving AP acts are used for **other-initiated repairs** and contact control (**Hennoste, 2003**). We differentiate three types of repair initiations. In the first two types, the hearer who recognizes a problem in the previous text initiates a repair, and the partner who caused the problem carries out repair. These two types are clarification and non-understanding. The third type is reformulation (candidate understanding in CA) where the hearer initiates the repair and suggest her own interpretation of the problematic place. The partner agrees with, or rejects this interpretation (**Hennoste et al., 2004**).

Although it seems that in a dataphone it is typical solving one problem during one call it is not the only possibility. A same dialogue might include several problems. **Repair acts** – acts, which are used by dialogue partners to solve communication problems

Conversation analysis (CA) is the study of recorded, naturally occurring talk-in-interaction (**Hutchby, Wooffitt, 2004: 14**).

3. Research material

It is widely admitted that annotated corpora constitute is a crucial resource to acquire or induce linguistic knowledge about how language are used.

My study is based on the Estonian dialogue corpus EDiC (**Hennoste et al., 2005**). Estonian dialogue corpus has been compiled since 1997. The corpus contains about 600 human-human spoken dialogues, among them over 300 calls for information. Dialogue acts are annotated in EDiC using a typology which departs from the point of view of CA (**Hennoste et al., 2004**). There are about 120 dialogue acts in this

typology (Appendix A)². The dialogues were annotated separately by two different persons, and then unified.

4. Results and Statistics

For this study, 148 calls for information were selected from EDiC. In 72 dialogues (48.6 %) appear **other-initiated repair act(s)** and in 76 dialogues (51.4 %) they do not appear. It is important to mention that in one dialogue can be more than one adjacency pair (repair, the first part = **RRF**, and repair, the second part = **RRS**).

Almost half dialogues include other-initiated repair act, therefore it is very essential research, and how information provider (P) can prevent or repair miscommunication. In this study my interest is only other-initiated repair acts. From 72 dialogues in 31 dialogues (it's 43.1%) appear more than one other-initiated repair act.

Clarification appears 82 times (66.1 % of all other-initiated repair acts) in 59 dialogues.

Non-understanding appears 27 times (21.8 %) in 23 dialogues.

Reformulation appears 13 times (10.5 %) in 13 dialogues.

Others (Others – group of acts which are not systemized.) become 2 times in 2 dialogues.

More than half of cases initiate other-initiated repair acts (clarification, non-understanding or reformation) by client.

Clarification and non-understanding are used more by client, but reformulation are used mostly by information provider (P).

A client's request or question may contain different information about the institution which he/she is looking for. I have found the following data in analyzed requests and questions:

- name of the institution (*e.g. trade center Eeden*)
- location (*e.g. town, square, street*)
- name of the institution which represents its function/ field of activity (*e.g. an*

² The acts are divided into two big groups – adjacency pair (AP) acts (e.g. question–answer) and single (non-AP) acts (e.g. continuer). Names of dialogue acts consist of two parts separated by a colon: the first two letters give abbreviation of the name of act-group, e.g. QU – questions, FR – free reactions; the third letter is used only for AP acts – the first (F) or second (S) part of an AP act; 2) full name of the act, for example, QUF: WH-QUESTION, QUS: YES, FR: CONTINUER. The act names are originally in Estonian.

hospital)

- description of function, without a name (*e.g. ma paluks=ee mingit `telefoninumbrit mingi (.) `prügikastiauto, `prügiteenust. /I would like to have the phone number of a dustcart, garbage removal ser-vice/*)

- an idiomatic name (*e.g. a phone of ground maintenance*)

- which kind of information is needed (*phone number, address, opening hours etc*).

A client may give different data in different combinations. The most frequent combination is institution/ function + location (*ma paluksin `Näituse `seitse `juuksurisalong /I would like to get the beauty salon in Naituse Street seven/*).

A risk of miscommunication arises if a client's request does not express her goal exactly. Then the information provider (P) will ask adjusting questions before answering in order to get additional information and thus prevent miscommunication.

4.1 Clarification

Clarification is often formulated when speaker (in my analyzed dialogues mostly client) believes or seems to believe that he/she does not hear correctly. In fact, only in 3 of cases client really hears incorrectly. Client's clarification expresses mostly phone (or fax) number or part of phone (or fax) number repeating. Clarification of P is used when information provider is unsure that he/she hears, understands or remembers correctly an essential information which was given before.

Formally clarifications can be divided into two groups:

1) direct clarification – previous turn stays the same

For example:

```
P: `six `zero. | DIS: GIVING INFORMATION |
C: £ six `zero.= £ | QUF: OFFERING ANSWER || RRF:
CLARIFICATION |
P: =yes= | QUS: YES | | RRS: REPAIR |
```

2) modified clarification – if speaker repeats previous turn then he/she makes some grammatical or/and lexical changing. Speaker can add some essential phrase or opposite, can abbreviate previous turn. (Humans often use short elliptical

constructions for clarification.)

```

C: > =I have one < `faxnumber, (.) six zero? (.) six two? (.)
seven      five five.      | DIF: REQUEST |
(0.5)
      P: six zero six two seven five five [yes.]      | QUF:
OFFERIN    ANSWER || RRF:    CLARIFICATION |
C: [yes] .yes      | QUS: YES | | RRS: REPAIR |
(2.5)

```

Most of the repair initiations are formulated as questions that offer an answer and therefore expect a *yes* or *no* answer (Table 1). Answer *yes* indicates that the problem has been solved.

Table 1. How repairs are performed (RRF: CLARIFICATION)

Initiation	Repair	# cases
QUF: OFFERING ANSWER	QUS: YES	70
	QUS: NO	3
	QUS: OTHER	6
	QUS: AGREEING NO	1
	Without answer	2
Total		82

66.1% of repair initiations are clarifications which are mostly used for checking data which must be exact (addresses, names, phone numbers).

Some examples when client initiated clarification:

- Phone number

```

C: `seven `three `six `six `seven `seven `seven.      | QUF:
OFFERING    ANSWER || RRF:    CLARIFICATION |
      P: yes.      | QUS: YES | | RRS: REPAIR |

```

- location

```

C: `crossing of `Mere avenue or.      | QUF: OFFERING ANSWER ||
RRF: CLARIFICATION |
      P: yes.      | QUS: YES | | RRS: REPAIR |
(0.8)

```

- name of the institution

C: Oi- `Oiri yes? | QUF: OFFERING ANSWER || RRF:
 CLARIFICATION |
 P: yes. | QUS: YES | | RRS: REPAIR |

If clarification is longer or formulation complicated then formulation of repair is too long or/and complex.

4.2 Non-understanding

Another significant group of repair initiations is formed by non-understandings mostly in form of open questions. Most repairs are formulated as giving information. The reason of a repair is that P or C did not hear (noise, bad audibility) or did not remember C's or P's essential previous turn because of richness of information.

Table 2. How repairs are performed (RRF: NON-UNDERSTANDING)

Initiation	Repair	# cases
QUF: OPEN QUESTION	QUS. GIVING INFORMATION	24
DIF: REQUEST	DIS: GIVING INFORMATION	2
QUF: ALTERNATIVE	QUS:ALTERNATIVE:ONE	1
Total		27

2/3 of non-understandings are initiated by client, 1/3 by information provider (respectively 18 and 9). Main source of problem for client is phone (or fax) number: 14 of cases (77.7% of client trouble-sources). Miscommunication is emerged when information provider says in previous turn the whole number combination or more than 3 numbers once or when information provider has said the number in some unusual way.

For example:

P: .hh `beginning is `the same, `ending is six [zero zero.] |
 QUS: GIVING INFORMATION |
 C: > [seven four four] < n- õ `zero? | QUF: OPEN | | RRF:
 NON- UNDERSTANDING |
 (.)
 C: six zero zero.= | QUS: GIVING INFORMATION | | RRS:
 REPAIR |

Main source of trouble for P is addresses/ location.

For example:

```

P: [I look] here are further different addresses one=moment,
| DIS: POSTPONEMENT |
(0.5) .hh (2.0) > another was Vikerkaare < | KYE: AVATUD |
| RRF: NON-UNDERSTANDING |
C: Vikerlase four`teen is here i=don't=know [{---}] | QUS:
GIVING INFORMATION| | RRS: REPAIR |

```

Table 3. Reasons of non-understanding

Act	Reason	# cases
RRF:NON-UNDERSTANDING	phone(/fax) number	14
	address/location	6
	name of firm	5
	other	2
Total		27

In my analyzed dialogues, non-understandings are often used to refer non-hearing (*kuidas see oli?* / how it was?).

Non-understanding can be caused by just a fact that one of speakers finds that the other said something untruthfully or inappropriately.

4.3 Reformulation

10.5 % of repair initiations are reformulations which mostly are used for checking of an uncertain request or of a request that has been changed by C.

Table 4. How repairs are performed (RRF: REFORMULATION)

Initiation	Repair	# cases
QUF: OFFERING ANSWER	QUS: YES	12
QUF: CLOSED WH-QUESTION	QUS: AGREEING NO	1
Total		13

10 of reformulations are initiated by information providers, 3 by clients.

A reformulation typically begins with a question offering answer. Information provider constructs it typically with word/phrase (+ yes). Client forms reformulation with sentence (+yes), it means C uses (on the average) longer construction.

Typically reformulation is shorter than previous turn because information provider

has summarized previous turn. She/he has put previous data in order.

Table 5. How reformulations are formed (QUE: OFFERING ANSWER)

Dialogue act	Linguistic form	Cases (C; P)
QUF: OFFERING ANSWER	word/ phrase	4 (P)
	word/phrase + <i>jah</i> / <i>yes</i> /	4 (P)
	word/phrase + <i>võ</i> / <i>or</i> /	1 (C)
	sentence	1 (C)
	sentence + <i>jah</i> / <i>yes</i> /	1 (C)
	(<i>tähendab</i> / it means /) phrase + <i>jah</i> / <i>yes</i> /	1 (P)
QUF: CLOSED WH-QUESTION	phrase + <i>jah</i> / <i>yes</i> /	1 (P)
Total		13

In reformation speaker does not just repeat previous turn and does not solve the problem finally, but expects problem-causer is affirmation that problem is solved.

One of the most elementary cases of reformulations are when client is not sure about the name of company. For example:

```
(.) a `tell me please: vot=e company (.) `Ekoros (.) `Ekaras
or, £ | DIF: REQUEST |
V: `Ekarus. | QUF: OFFERING ANSWER || RRF: REFORMULATION |
(.)
H: £ jah. | QUS: YES | | RRS: REPAIR |
```

OR:

```
Tell me (.) where Kaa salon is located in Tartu. | QYF: OPEN
|
(1.5)
P: e=`how=this sa`lon was | KYE: OPEN | | RRF: NON-
UNDERSTANDING |
C: `Kaa. | QUF: GIVING INFORMATION | | RRS: REPAIR |
`Kaa sal[on.] | QUF: GIVING INFORMATION | | RRS: REPAIR |
P: [Kaa] `computer salon. | QUF: OFFERING ANSWER | | RRF:
REFORMULATION |
C: yes yes | QUS: YES | | RRS: REPAIR |
(...)
```

5. Conclusion and Future Work:

For this study, 148 calls for information were selected from EDiC. In 72 dialogues (48.6 %) appear other-initiated repair act(s) and in 76 dialogues (51.4 %) they do not appear.

The aim of this paper was to present how/why other-initiated repair acts like clarification, non-understanding and reformulation appear. Clarifications appear 66.1%, non-understandings 21.8 %, reformulations 10.5 % of all other-initiated repair acts (and Others 1.6% of repair acts).

Clarification and non-understanding are used more by client, but reformulation is used mostly by information provider (P). Clarification is often formulated when client believes or seems to believe that he/she does not hear correctly. In fact, only in 3 of cases client hear really incorrectly. Client's clarification mostly expresses in repeating the phone (or fax) number or part of phone (or fax) number.

After analyzing a range of cases from the corpus, it can be argued if information provider says only two or three numbers at once, miscommunication grows less.

Most of the repair initiations are formulated as questions that offer an answer and therefore expect a *yes* or *no* answer.

If clarification is longer or formulation complicated then formulation of repair is too long or/and complex.

Non-understandings are mostly formed as open questions. Majority repairs are formulated as giving information. The reason of a repair is that information provider or client did not hear (*kuidas* / how /) or did not remember C's or P's essential previous turn because of the richness of information. The main trouble-source for the client is phone (or fax) numbers.

A reformulation typically begins with a question offering the answer. Initiator is mostly information provider. In reformation the speaker does not just repeat the previous turn and does not solve problem finally, but expects problem-causer's affirmation that problem is solved. Information provider constructs it typically with word/phrase (+ yes). Client forms reformulation with sentence (+yes), it means C uses (on the average) longer construction.

In this study I reported only main tendency, but the aim of future work is more

detailed research of dialogues (syntax) and also to listen to recordings (prosody).
Then it is maybe possible to give some rules how prevent other-initiated repair acts.

References

Bunt, Harry. 1999. *Dynamic interpretation and Dialogue Theory*. The Structure of Multimodal Dialogue II. By M. Martin Taylor (Editor), F. Neel (Editor), Don G. Bouwhuis (Editor), D.G. Bouwhuis (Editor). John Benjamins Publishing Co.

Hennoste, Tiit; Lindström, Liina; Rääbis, Andriela; Toomet, Piret; Vellerind, Riina. 2000. *Eesti suulise kõne korpus ja mõnede allkeelte võrdluse katse*. Tartu Ülikooli üldkeeleteaduse õppetooli toimetised 1. Arvutilingvistikalt inimesele. Tartu 2000.

Hennoste, Tiit. 2003. *Question-answer adjacency pairrelations in information dialogues: Estonian case*. In P.J. Henrichsen (Ed.), *Nordic Research on Relationsbetween Utterancies*. Proceedings of the NordTalkSymposium at CMOL (CBS) December 2002. Copenhagen Working Papers in LSP 3-2003 (pp. 171-185).

Gerassimenko, Olga; Hennoste, Tiit; Koit, Mare; Rääbis, Andriela. 2004a. *Other-initiated self-repairs in Estonian information dialogues: Solving communication problems in cooperation*. Proceedings of the 5th SIGdial Workshop on Discourse and Dialogue, Cambridge, AprAI 30 – May 1, 2004. Ed by M. Strube, C. Sidner. Cambridge, 39–42.

Hennoste, Tiit; Gerassimenko, Olga; Kasterpalu, Riina; Koit, Mare; Rääbis, Andriela; Strandson, Krista; Valdisoo, Maret. 2005. *Information-Sharing and Correction in Estonian Information Dialogues: Corpus Analysis*. Proc. of the second Baltic Conference on Human Language Technologies. Tallinn, 249-254.

Hennoste, Tiit; Koit, Mare; Rääbis, Andriela; Valdisoo, Maret. 2004. *Developing a Dialogue Act Coding Scheme: An Experience of Annotating the Estonian Dialogue Corpus*. LREC 2004 Satellite Workshop Compiling and Processing Spoken Language Corpora. Ed. Nelleke Oostdijk, Gjert Kristoffersen, Geoffrey Sampson. Lisboa, Portugal, 40-47.

Hutchby, Ian; Wooffitt, Robin. 2004. *Conversation Analysis: principles, practices, and applications*. Published in the USA by Blackwell Publishing Inc.

Koit, Mare; Roosmaa, Tiit; Õim, Haldur. 1996. *Implementing a Dialogue Model on the Computer*. University of Tartu Department of General Linguistics. Estonian in the Changing World. Tartu 1996.

Hennoste, Tiit; Koit, Mare; Kullasaar, Maret; Rääbis, Andriela; Vutt, Evely. 2002. *Problems of Estonian dialogue corpus*. Publications of the Department of General Linguistics 3. University of Tartu. Catcher of the Meaning. Tartu 2002.

Schegloff, Emanuel, Jefferson, Gail, Sacks, Harvey 1977. *The preference for self-correction in the organization of repair in conversation*. Language 52(2), 361-382.

Strandson, Krista. 2006. *Kõneleja reaktsioon vestluskaaslase parandusalgatusele*. University of Tartu Department of General Linguistics. Language and computer. Tartu 2006.

Appendix A. Edict Typology of Dialogue Acts

Other-initiated repair acts

RRF: REFORMULATION

RRF: CLARIFICATION

RRF: NON-UNDERSTANDING

RRF: OTHER

RRS: REPAIR

RRS: OTHER

Adjusting the condition of answer acts

ACF: ADJUSTING THE CONDITIONS OF ANSWER

ACF: OTHER

ACS: ADJUSTING THE CONDITIONS OF ANSWER

ACS: OTHER

Directive acts

DIF: REQUEST

DIF: PROPOSAL

DIF: OFFER

DIF: WAIT

DIF: OTHER

DIS: GIVING INFORMATION

DIS: MISSING INFORMATION

DIS: REFUSAL

DIS: AGREEING

DIS: DISAGREEING

DIS: RESTRICTED AGREEING

DIS: ACTION

DIS: POSTPONEMENT

DIS: OTHER

Question acts

QUF: WH

QUF: OPEN YES/NO

QUF: CLOSED YES/NO

QUF: OFFERING ANSWER

QUF: ALTERNATIVE

QUF: OTHER

QUS: GIVING INFORMATION

QUS: YES

QUS: NO

QUS: AGREEING NO

QUS: NON-AGREEING YES

QUS: ALTERNATIVE ONE

QUS: ALTERNATIVE BOTH

QUS: ALTERNATIVE THIRD CHOICE

QUS: ALTERNATIVE NEGATIVE

QUS: MISSING INFORMATION

QUS: REFUSAL

QUS: POSTPONEMENT

QUS: ALTERNATIVE

QUS: ACTION

QUS: OTHER

