An Analysis of Conditional Responses in Dialogue

Elena Karagjosova and Ivana Kruijff-Korbayová

Saarland University, Saarbrücken, Germany,
{elka,korbay}@coli.uni-sb.de,
WWW home page: http://www.coli.uni-sb.de/

Abstract. In the context of collaborative dialogue, we analyze conditional responses of the form "Not (if) **c**/Yes if **c**" in reply to a question under discussion "**q**". A conditional response is used when the validity of **q** depends on a condition **c**: when **c** is established in the context, the response indicates a possible need to revise **c**, and thus opens negotiation; otherwise, the response raises the question whether **c**. We discuss appropriateness conditions for conditional responses, and propose a uniform approach to their generation and interpretation.

1 Introduction

The work presented in this paper originates from our interest in collaborative dialogue turns, for example responses which contain more than just a positive or negative response particle, e.g. *yes, no* or *ok*. In order to get a picture of what such responses are like, we looked at the Verbmobil appointment-scheduling corpus (Verbmobil-Corpus, 1995) and SRIs American Express (AMEX) travel agency data (AMEX, 1989).

We encountered cases where the additional material in the response restricts the validity of the reply (cf. (1:9) and (2:8)). We call these *conditional yes/no responses* (CRs): They provide a positive or negative response that is *contingent* on some *attribute value* (A/V), thus restricting the validity of the response. In addition, a CR seems to suggest the contrapositive that for another A/V the response would have the opposite polarity, which we propose to consider as an *implicature* (rather than part of the assertion expressed by the CR).

(1) 1.A: uh, let's see what would get you there then leaving probabl- the seventh. from San Jose or San Francisco?

2.C San Francisco. actually Oakland would be good too on that

3.A: I don't know if there are any red eyes from there let's see

4.C: ok

5.A: there is one on United that leaves Oakland at eleven thirty p.m. and arrives Chicago five twenty five a.m.

6.C: so that's a two hour hold there

7.A: yes

8.C: waiting for that flight ok any others?

9.A: uh not from Oakland.

10.A: departing from San Francisco it's about the same

(1:9) gives a negative answer to the question in (1:8): there are no flights with a shorter hold from Oakland. This answer is contingent on the A/V of departing from Oakland, and leaves open, or even seems to suggest, the possibility of a flight with a shorter hold from another departure city, namely the previously mentioned San Francisco. This possibility is addressed and refuted in (1:10).

(2) 1.C: there's a hundred dollar fine

2.A: okay

3.C: and p- penalty plus ahh we pay for the going rate

4.A: yeah if ther- if it's going to be a higher rate

5.C: it's going to be a higher rate, ok now if we wait and the Lufthansa flight does come up what rate do we get that eleven twenty four or something close to that

In (2:8) a CR occurs as a reply to an assertion, not a question. (2:4) gives a positive response (a confirmation) to (2:3): a penalty plus the going rate must be paid. But this response is contingent on the A/V of the rate being higher. This implies the negative response for the same or lower rate. This possibility is addressed and refuted (2:5).

The assertions and implicatures corresponding to CRs are summarized in Figure 1. The utterance to which the CR replies may be either a yes/no question (whether **q** holds) as in (1:8), or an assertion proposing **q** for acceptance or rejection, like (2:3). In the approach to dialogue modelling we are using, **q** is represented as the current *question under discussion* (QUD, (Ginzburg, 1996)).

QUD	**q**	**q**
Response	Not (if) **c**	Yes if **c**
Assertion	If **c**, not-**q**	If **c**, then **q**
Implicature	Possibly, if not-**c**, then **q**	Possibly, if not-**c**, then not-**q**

Fig. 1. Patterns of conditional responses

The goal of our research is to understand better under which conditions CRs are appropriately used and what dialogue moves they perform. The idea is to provide the basis for understanding and generation of CRs in a dialogue system, namely the GoDiS system based on the information-state update approach to dialogue as proposed in the TRINDI (Cooper et al., 1999) project and its successor SIRIDUS (Lewin et al., 2000). GoDiS is an experimental system initially designed to handle information-seeking dialogues in the travel domain. Our work focuses on aspects that increase the flexibility and functionality of the initial system.

Overview. The rest of the paper is organized as follows. In §2 we discuss the interpretation and appropriatess conditions of CRs. In §3 we discuss the dialogue moves corresponding to CRs. We end the paper with conclusions, where we briefly address issues of future interest.

2 Uses of conditional responses

Examples (1) and (2) show that CRs can be used both in contexts where the A/V on which the CR is contingent is determined and in contexts where it is not. In the present section we briefly address these two cases.[1] The distinction turns out to be important for the *dialogue move* that such responses perform (cf. §3).

CR with not-determined A/V (NDCR) . A CR can be contingent on an A/V **c** which has not yet been determined in the preceding context, as in (2).

The interpretation of an NDCR as a response to a QUD **q** is that (i) it is still not determined whether **q**, because (ii) the answer (specified in Figure 1) is contingent on **c**, and thus (iii) the question whether **c** holds is implicitly raised. Consider (2:4) which raises the question whether the property "higher rate" applies. This question is resolved in the next turn (2:5).

From the production point of view, we observe that it is appropriate to produce NDCR when (i) responding to a QUD **q**, where (ii) the response is either **q** or **not-q**, depending on some additional A/V **c** which has not yet been established in the context.

CR with contextually-determined A/V (CDCR) . Another context in which a CR is appropriate is when a response to a QUD **q** is contingent on an A/V **c** that has already been established in the preceding context, as in (1).

The interpretation of a CDCR is that (i) it is determined whether **q** or **not-q** holds, because (ii) the answer (specified in Figure 1) is contingent on **c** and **c** is established. Moreover, (iii) the CDCR indicates the reason for the answer. There is an additional aspect of a CDCR which distinguishes it from NDCR. Namely, by reminding of the A/V on which the response is contingent, a CDCR (iv) proposes to reconsider the earlier made decision by implicitly re-raising the question whether **c** should hold. Thus, a negotiation phase is opened in which either the conflicting A/V is revised, or is confirmed. In the latter case a different solution to the overall goal needs to be sought.

Re-raising **c** differs from raising a "new" question at least in two aspects: **c** must be *negotiable*, and the re-raised **c** requires not only a positive or negative reply but also some kind of acknowledgment whether or not the A/V is to be revised (and how).

From the production point of view, we observe that it is appropriate to produce a CDCR when (i) responding to a QUD **q**, where (ii) the response is either **q** or **not-q**, depending on some A/V **c** which has been established in the context prior to the QUD **q** and is negotiable.

For both NDCR and CDCR, the choice between a positive or a negative one depends on which one is more cooperative in the context; this in turn depends on what the preferred answer to the question whether **q** is assumed to be.

3 Conditional response dialogue moves

As we have seen, CRs provide a response contingent on an A/V: A CDCR makes a proposal for revising the contextually determined A/V (cf. (1:9)), and a NDCR raises the question whether the A/V holds (cf. (2:4)).

[1] Due to space constraints, we cannot go into much detail here.

Current dialogue move classifications like the DAMSL (Allen and Core, 1997) or the Verbmobil (Alexandersson and et al., 1998) annotation schemes do not seem to account for CRs.[2] The difficulty with CRs is that they perform multiple dialogue acts: they are a response (backward-looking function) and a question or a proposal (forward-looking function) at the same time. The Switchboard annotation scheme (Jurafski et al., 1997) (which is a version of DAMSL (Allen and Core, 1997)) provides elaborated subcategories for different kinds of responses. However, they do not cover the full range of aspects involved in CRs. For example, a CDCR would be labeled as *open option* and a NDCR as *open question* and both as *statement expanding y/n answer*. However, as we pointed out, a CRs need not be replies to y/n-questions. What is needed is separate labels like *yes/no plus open option* for CDCR and *yes/no plus open question* for NDCR. Another possibility would be to label NDCRs as *hold* moves in which "the participant does not address the proposal but performs an act that leaves the decision open pending further discussion" (Allen and Core, 1997). NDCRs seem similar to *hold* in that the response to **q** remains pending due to its contingency on an unknown A/V **c**. Once **c** is determined, **q** is responded. However, this label does not apply to CDCR which is different from *hold* and a NDCR in that it proposes to reconsider a contexually-determined **c**. (Allen and Core, 1997) provide no suitable characterization for this case. More work on the role of CRs in dialogue is needed to solve these problems.

4 Conclusions

In this paper we proposed an analysis of *conditional responses*, which arise naturally in dialogues allowing for mixed initiative and negotiation, but seem insufficinelty covered in existing dialogue move annotation schemes. We proposed two types of conditional responses: One type describes the case where the answer is contingent on an attribute/value that has not yet been determined in the context (NDCRs). The other type deals with an attribute/value that has already been set in the context, and which now needs to reconsidered (CDCRs). The distinction properly clarifies the different effects on dialogue context conditional responses may have.

The distinction also seems relevant for the appropriate prosodic realization of this kind of responses in English. For example, NDCR seems appropriate with a neutral prosodic pattern, whereas the CDCR seems to require prosodically marked contrast. We plan to investigate the prosodic properties of CRs with respect to context in our future research.

We also encountered other surface forms expressing CRs, such as *only (if), but only (if), unless*. It is a matter of future research to investigate how various CR realizations relate to each other and how they fit the pattern in Figure 1.

We are also currently developing an implementation in the GoDiS system, which will enable us to practically evaluate our proposal.

[2] The reason why common annotation schemes do not account for CRs may be their low frequency in the respective dialogue corpora. For example, we found only 11 instances of conditional responses out of about 60 dialogues (1814 turns) in the AMEX corpus.

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