Context-driven dialogue act generation

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1 Introduction

Generation of dialogue contributions is a matter of deciding which dialogue act(-s) are licensed by the preceding and current context. This paper presents a context-driven approach to the generation of multiple dialogue acts.

The theoretical framework of Dynamic Interpretation Theory (DIT) opens perspectives for developing dialogue act generators that produce utterances which are multifunctional by design by viewing participation in a dialogue as performing several activities in parallel, such as pursuing the dialogue task, providing feedback, and taking turns (Bunt, 2000).

2 Multidimensional context model

An utterance, when understood as a dialogue act with a certain communicative function and semantic content, evokes certain changes in the participant's context model that includes (1) his beliefs about the dialogue task/domain (*semantic context*); (2) his model of the participants' states of processing (*cognitive context*); (3) assumptions about available perceptual channels (*physical context*); (4) beliefs about communicative obligations and constraints (*social context*); (5) a model of the preceding and planned dialogue contributions (*linguistic context*).

3 Context update mechanisms

As a dialogue evolves, new beliefs are *created*; weak beliefs may become *strengthened* to firm beliefs; and beliefs and goals may be *adopted* or *cancelled* (Bunt, 2005).

Speakers normally expect to be understood and believed (*expected effects*). This is modelled in DIT by the speaker having 'weak belief' that the addressee believes the preconditions to hold (*understanding effects*) and the content of the dialogue act to be true (*adoption effects*). Every dialogue builds up a pressure on the addressee to provide evidence in support of or against these expectations.

A *reactive pressure* (RP) is created when a dialogue act is interpreted successfully, giving rise to the intended update of the addressee's context model. The addressee is assumed to strive to resolve RPs by performing a particular type of reactive act. Table 1 illustrates this for the example of a Question - Answer pair. The created pressures RP_1, RP_2 and RP_3 give rise to multiple reactive acts: a Turn Accepting act, a Feedback act, and a task-related Propositional Answer.

Participants are not always able to resolve pressures, e.g. the addressee may not know the answer. This cancels the relevant pressure created by the previous question immediately. Some pressures cannot be resolved in one turn, e.g. the addressee does not understand the question. In this case the pressure PR_3 cannot be relieved, consequently neither can pressure PR_2 also, because this implies PR_3. These pressures remain present until the addressee resolves the pressure PR_3, e.g. by successful processing of the repeated question.

4 Conclusions

The context-driven approach outlined here enables the construction of genuinely multifunctional dialogue contributions, and allows dialogue systems to apply a variety of dialogue strategies and communication styles, e.g. performing explicit vs implicit dialogue acts making use of different modalities.

References

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Harry Bunt. 2005. *Mechanisms for creating and updating beliefs and goals through dialogue*. Unpublished report, Tilburg University.

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Table 1: Example of updated context for Propositional Question-Propositional Answer pair
LC = Linguistic Context; SC = Semantic Context; CC = Cognitive Context; prec = preconditions;
impl = by implication; du = dialogue utterance; da = dialogue act; fs = functional segment;
exp.und = expected understanding; und = understanding; exp.ad = expected adoption; ad = adoption;
bel = believes; mbel = mutually believed; wbel = weakly believes

Context	num	source	S's context	num	source	U's context
SC				u01 u02	prec	$wants(U, knowsif(U,p))$ $believes(U, knowsif(S,p))$
LC				du1	U	Is this a large sample?
LC				fs_1 da_1 da_2 plan	current	is, this, a, large, sample Task; PropositionalQuestion Speaker:U; Addressee:S Turn-M.;Turn-Assign Speaker:U; Addressee:S $Turn\_Allocation(S)$
SC	s1 s2 s3 s4 s01	exp.und:u01 exp.und:u02 und:u1 und:u2 prec	$bel(S, mbel(\{S,U\}, wbel(U,$ $bel(S, wants(U, knowsif(U,p)))$ $bel(S, mbel(\{S,U\}, wbel(U,$ $bel(S, bel(U, knowsif(S,p)))$ $bel(S, wants(U, knowsif(U,p)))$ $bel(S, bel(U, knowif(S,p)))$ $believes(S, \neg p)$	u1 u2	exp.und:u01 exp.und:u02	$bel(U, mbel(\{S,U\}, wbel(U,$ $bel(S, wants(U, knowsif(U,p)))$ $bel(U, mbel(\{S,U\}, wbel(U,$ $bel(S, bel(U, knowsif(S,p)))$
CC	s5	und:u3	$believes(S, {}^{+}Interpreted(S, fs_1))$	u3	exp.und:fs_1	$wbel(U, {}^{+}Interpreted(S, fs_1))$
SocC	RP_1 RP_2 RP_3	prec:u01-u02 impl:da_2 exp.und:u1-u3	Task;PropositionalAnswer Speaker:S; Addressee:U antecedent: da_1 Turn-M.;Turn-Accept Speaker:S; Addressee:U antecedent: da_2 Auto-F.;Interpretation Speaker:S; Addressee:U antecedent: fs_1			
LC	da_3 da_4 da_5	plan	Turn Accept Speaker:S; Addressee:U antecedent: da_2 Auto-F.;Interpretation Speaker:S; Addressee:U antecedent: fs_1 Task; PropositionalAnswer Speaker:S; Addressee:U antecedent: da_1			
LC	du2	S	Well, this is not large sample			
LC	fs_2 da_3 fs_3 da_4 fs_4 da_5	current	well Turn Accept Speaker:S; Addressee:U antecedent: da_2 this,is,large,sample Auto-F.;Pos.Interpretation Speaker:S; Addressee:U antecedent: fs_1 this,is,not,large,sample Task; PropositionalAnswer Speaker:S; Addressee:U antecedent: da_1			
SC	s6 s7	exp.und exp.ad	$bel(S, mbel(\{S,U\}, wbel(S, bel(U, bel(S, \neg p))$ $bel(S, mbel(\{S,U\}, wbel(S, bel(U, \neg p)$	u4 u5 u6 u7	exp.und exp.ad und:s6 ad:s7	$bel(U, mbel(\{S,U\}, wbel(S, bel(U, bel(S, \neg p))$ $bel(U, mbel(\{S,U\}, wbel(S, bel(U, \neg p)$ $bel(U, bel(S, \neg p))$ $bel(U, \neg p)$
SocC	RP_1 RP_2 RP_3		cancelled cancelled cancelled	 RP_4 RP_5	 exp.und:s6 exp.ad:s7	 Auto-F.;Interpretation Speaker:S; Addressee:U antecedent: fs_2, fs_3, fs_4 Auto-F.;Execution Speaker:S; Addressee:U antecedent: da_5