Revisiting the ISO standard for dialogue act annotation

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Abstract

Based on experiences using the ISO standard for dialogue act annotation (ISO 24617-2:2012), this paper proposes to correct certain deficiencies in the standard, and discusses some extensions that would increase the standard usefulness and usability. More specifically, it is suggested to add the annotation of non-functional segments that are relevant for the accurate annotation of some feedback acts and speech editing acts, and to import devices from the newly established ISO standard for the annotation of discourse relations (ISO DR-Core) in order to improve the annotation of rhetorical relations between dialogue acts. The latter kind of extension is argued to be interesting for also joint annotation of different kinds of semantic information by combining different annotation schemes.

1 Introduction

ISO standards are examined every five years for the need of corrections, extensions, or other updates. This means that the ISO standard for dialogue act annotation, ISO 24617-2,[1] which was published in September 2012, is up for possible revision in September 2017. Application of ISO 24617-2 in annotation efforts in recent years, for example in the construction of the DialogBank,[2] has brought some deficiencies to light, as well as some unwelcome limitations. So far, the following issues have been identified as deserving discussion and possibly revising (and discussions with users and analysts of the annotation scheme may be expected to give rise to further issues):

- the treatment of segments that are relevant for dialogue act annotation but that do not carry a communicative function;
- the addition of certain dimensions and communicative functions that are felt to be missing;
- the accurate annotation of rhetorical relations between dialogue acts or their semantic contents;
- the status of functional and feedback dependence relations;
- the combination of dialogue act annotation with that of other semantic information, such as semantic roles, time and space;
- the use of representation formats other than the reference format of the standard.

Section 2 of this paper gives a very brief summary of the ISO 24617-2 standard. Section 3 discusses some limitations and deficiencies, and outlines possible corresponding changes. Section 4 discusses the combination of dialogue act annotations with the annotation of other semantic information, e.g. using other standard ISO annotation schemes. Section 5 discusses the use of representation formats other than the XML format defined in ISO 24617-2.

[1] ISO 24617-2, Language Resources Management, Semantic Annotation Framework, part 2: Dialogue acts.
[2] See https://dialogbank.uvt.nl and Bunt (2016)

2 The ISO 24617-2 Standard

ISO 24617-2 provides a comprehensive, application-independent annotation scheme, building on previously designed annotation schemes such as DAMSL, DIT^{++}, MRDA, HCRC Map Task, Verbmobil, SWBD-DAMSL, and DIT.[3] For most of these annotation schemes, dialogue act annotation consists of segmenting a dialogue into certain grammatical units and marking up each unit with one or more communicative function labels. The ISO 24617-2 scheme is intended for semantically more complete annotation, including the following aspects:

1. 'Dimension', or category of semantic content: the annotation scheme supports multidimensional annotation, i.e. multiple communicative functions may be assigned to dialogue segments; different from DAMSL and other multidimensional schemes, an explicitly defined notion of 'dimension' is used that corresponds to a certain category of semantic content. The nine ISO scheme distinguishes nine dimensions: (1) *Task:* dialogue acts that move the task or activity forward which motivates the dialogue; (2-3) *Feedback*, divided into *Auto-* and *Allo-Feedback*: acts providing or eliciting information about the processing of previous utterances by the current speaker or by the current addressee, respectively; (4) *Turn Management:* activities for obtaining, keeping, releasing, or assigning the right to speak; (5) *Time Management:* acts for managing the use of time in the interaction; (6) *Discourse Structuring:* dialogue acts dealing with topic management, opening and closing (sub-)dialogues, or otherwise structuring the dialogue; (7-8) *Own-* and *Partner Communication Management:* actions by the speaker to edit his current contribution or a contribution of another current speaker, respectively; (9) *Social Obligations Management:* dialogue acts for dealing with social conventions such as greeting, introducing oneself, apologizing, and thanking.

2. 'Qualifiers' may be added for expressing that a dialogue act is performed conditionally, with uncertainty, or with a particular sentiment.

3. Dependence relations are defined for expressing semantic relations between dialogue acts, e.g. for indicating which question is answered by a certain answer act (functional dependence relation), or which utterance a feedback act responds to (feedback dependence relation).

4. Rhetorical relations may be annotated to indicate for example that one dialogue act explains the performance of another dialogue act.

The ISO 224617-2 schema defines 56 communicative functions, which are listed in Appendix A. Some of these are specific for a particular dimension; for instance *Turn Take* is specific for Turn Management; S͡talling is specific for Time Management, and *Self-Correction* is specific for Own Communication Management. Other functions can be applied in any dimension; for example, *You misunderstood me* is an *Inform* in the Allo-Feedback dimension. All types of question, statement, and answer can be used in any dimension, and the same is true for commissive and directive functions, such as *Offer, Suggest,* and *Request*. The later functions are called *general-purpose* functions, as opposed to the former ones which are *dimension-specific* functions.

ISO 24617-2 annotations assume that a dialogue act has one sender, one or more addressees, zero or more other participants, one semantic content category (or 'dimension'), one communicative function, zero or more functional and feedback dependence relations, possibly one or more qualifiers, and possibly one or more rhetorical relations to other dialogue acts.

ISO 24617-2 includes the markup language DiAML (Dialogue Act Markup Language), designed in accordance with the ISO Linguistic Annotation Framework (LAF)[4] and the ISO Principles of Semantic Annotation ('SemAF Principles').[5] LAF makes a fundamental distinction between *annotation* and *representation*: 'annotation' refers to the linguistic information that is added to segments of language

[3] See Allen & Core (1997); Bunt (2007); Shriberg et al. (2004); Anderson et al. (1991); Alexandersson et al. (1998); Jurafsky et al. (1997); and Bunt (1994; 2000), respectively.

[4] ISO 24612:2012; see also Ide & Romary (2004).

[5] ISO 24617-6; see also Bunt (2015).

data, independent of format; 'representation' refers to the rendering of annotations in a particular format. Following SemAF Principles, this distinction is implemented in the DiAML definition in the form of an *abstract syntax* that specifies a class of abstract *annotation structures*, which are set-theoretical constructs like pairs and triples, and a *concrete syntax* that specifies a rendering of these annotation structures using XML. This format is called DiAML-XML. It uses abbreviated XML-expressions, and is complete and unambiguous relative to the abstract syntax, i.e. (1) the concrete syntax defines a representation for every structure defined by the abstract syntax; and (2) every expression defined by the concrete syntax represents one and only one structure defined by the abstract syntax. A format with these properties is called *ideal*. Any ideal representation format can be converted through a meaning-preserving mapping to any other ideal format (see Bunt, 2010 for formal definitions and proofs).

According to ISO 24617-2, dialogue acts correspond to 'functional segments', defined as *minimal stretches of communicative behaviour that have a communicative function and a semantic content*, 'minimal' in the sense of not including material that does not contribute to the expression of the function or the semantic content of the dialogue act. Functional segments are mostly shorter than turns, may be discontinuous, may overlap, and may contain parts contributed by different speakers. A segment carrying a feedback function for instance frequently overlaps with a segment that carries a task-related function.

The requirement of being 'minimal' has been added in order for communicative functions to be assigned as accurately as possible to those stretches of behaviour which express these functions. The following example illustrates this:

(1) Can you tell me what time the train to *ehm,...* Viareggio leaves?

The small interrupting segment *ehm,...* is not really part of the question, so according to the minimality condition it does not belong to the corresponding functional segment. The utterance in (1) is thus analysed as consisting of two functional segments: the discontinuous segment *"Can you tell me what time the train to Viareggio leaves?"*, and the segment *"ehm,..."* corresponding to a Stalling act. This can be annotated in DiAML as follows:

(2) <dialogueAct xml:id="da1"target="#fs1" speaker="#s" addressee="#a"
dimension="task" communicativeFunction="request" conditionality="conditional"/>
<dialogueAct xml:id="da2" target="#fs2" speaker="#s" addressee="#a"
communicativeFunction="stalling" dimension="timeManagement"/>

Example (3b) illustrates the annotation of relations among dialogue acts for the dialogue fragment in (3a), which contains a rhetorical relation (Elaboration) between the dialogue acts in utterances 1 and 3, and a feedback dependence between the dialogue acts in utterances 3 and 4.

(3)
1. G: go south and you'll pass some cliffs on your right
2. F: uhm...
3. G: and some adobe huts on your left
4. F: oh okay

<diaml xmlns="http://www.iso.org/diaml">
<dialogueAct xml:id="da1" target="#fs1" sender="#g" addressee='#f"
dimension="task" communicativeFunction="instruct"/>
<dialogueAct xml:id="da2" target="#fs2" sender="#f" addressee="#f"
dimension="turnManagement" communicativeFunction="turnTake"/>
<dialogueAct xml:id="da3" target="#fs2" sender="#f" addressee="#g"
dimension="timeManagement" communicativeFunction="stalling"/>
<dialogueAct xml:id="da4" target="#fs3" sender="#g" addressee="#f"
dimension="task" communicativeFunction="inform"/>
<rhetoricalLink dact="#da4" rhetoAnteceden="#da1" rhetoRel="elaboration"
<dialogueAct xml:id="da5" target="#fs4" sender="#f" addressee="#g"
dimension="autoFeedback" communicativeFunction="autoPositive"
feedbackDependence="#da1 #da4"/>
</diaml>

It should be noted that the DiAML format is just a compact way of using XML. The compactness of the representation is an obvious advantage, still, its equivalence with a full XML form is important for the possible combination of dialogue act annotation with other semantic or pragmatic information. This is discussed in Section 4.

3 ISO 24617-2 Limitations and Extensions

3.1 Annotating Feedback Dependence Relations

Feedback acts are about the processing of something that was said earlier in the dialogue; this 'something' is indicated by the value of the 'feedbackDependence' attribute. The nature of this 'something' depends on the kind or 'level' of the feedback. The DIT^{++} taxonomy of communicative functions, which has been a major source of inspiration for ISO 24617-2, distinguishes between feedback at five different levels of processing: (1) attention; (2) perception; (3) understanding; (4) evaluation; and (5) execution.

Feedback about paying attention to another speaker is mostly given in nonverbal form, such as by eye contact. Positive feedback at the level of perception can be expressed by echoeing what the previous speaker said; negative feedback by repeating part of what was said with a questioning intonation, like *Tuesday?*, or *"John WHO?"*. Feedback at the level of understanding can be expressed for example by *"I see"* or by paraphrasing something that was expressed. Positive feedback at the level of evaluation can be expressed by *"Excellent!", "True"*, or *"Good question"*. Negative feedback, e.g. by *"Really?"* Positive feedback at the level of execution can be expressed by *"Sure"*; negative feedback by *"I don't know"* in response to a question.

Feedback by means of expressions such as *"OK"*, *"Uh-huh"*, or *"Really?"* says something about a previous dialogue act, while feedback by means of *"Tuesday?"* or *"John WHO?"* is about a particular word or dialogue segment. The ISO 24617-2 annotation scheme therefore allows both dialogue acts and functional segments as antecedents for feedback dependence relations.

The ISO scheme is not quite correct at this point, since segment-related feedback is not necessarily about a *functional* segment; it may be about *any* previous segment, functional or not, such as a single word. The DBOX annotations (see Petukhova et al., 2014) in the DialogBank deviate in this respect from the ISO standard, since for feedback dependences special non-functional segments have been introduced. The ISO standard should be corrected in this respect, and should include segments ('reference segments') in their segmentation, to allow more accurate markup of feedback dependences.

3.2 Functional and Feedback Dependence Relations

Besides the feedback dependence relation, ISO 24617-2 defines the functional dependence relation as the *"relation between a given dialogue act and a preceding dialogue act on which the semantic content of the given dialogue act depends due to its communicative function.* An example is the relation between an answer and the question that was answered. The importance of this relation is semantic: the meaning of an answer cannot be determined fully if one doesn't know the question that was asked. This is because an answer is inherently responsive in character (as opposed to a question). The ISO scheme includes the following responsive types of dialogue acts: Answer, Confirm, Disconfirm, Agreement, Disagreement, Correction, Accept Request, Address Request, Reject Request, Accept Suggest, Address Suggest, Reject Suggest, Accept Offer, Address Offer and Reject Offer.

ISO 24617-2 is not entirely clear about the assignment of functional and feedback dependence relations, partly due to a certain vagueness in the definition of the feedback dependence relation, which reads as follows: *"relation between a feedback act and the stretch of communicative behaviour whose processing the act provides or elicits information about"*. The vagueness is in the term 'feedback act', which is sometimes understood as "dialogue act in one of the two feedback dimensions" and sometimes as "dialogue acts with a feedback-specific communicative function". In the former interpretation, feedback acts include feedback questions and requests, such as *"What did you say?", "Do you mean THIS Saturday?"*, or *"Could you please repeat that?"*, which are all response-eliciting acts, the responses

to which have a functional dependence relation to their elicitations, and could also be said to have a feedback dependence relation. More precisely, the assignment of functional and feedback dependence relations can be specified as follows:

1. if the communicative function is a responsive one, then assign a functional dependence relation to the corresponding response-eliciting act;

2. if the communicative function is dimension-specific for Auto- or Allo-Feedback, assign a feedback dependence relation to the dialogue act(s) or to the dialogue segment that the feedback is about;

3. in all other cases do not assign any dependence relation.

According to this specification, no feedback dependence relation is assigned to a question like *"John WHO?"*; this can be justified by the consideration that the semantic content of such an utterance is sufficient to make clear what the feedback is about,

We may also conclude that a dialogue act can have a functional or a feedback dependence relation, but not both. This would make it possible to drop the terminological distinction and just speak of 'dependence relation'.

3.3 Annotating Rhetorical Relations

ISO 24617-2 supports the marking up of rhetorical relations between dialogue acts, without specifying any particular set of relations to be used; it only specifies *how* a rhetorical relation may be marked up as relating two dialogue acts.

In 2016 the ISO standard 24617-8 has been established for the annotation of rhetorical relations in discourse. This standard, also called "DR-Core", defines a set of 18 'core' relations that are shared by many annotation schemes. This set of relations has been used in most of the dialogues in the DialogBank. However, two problems were noted when doing so.

First, many rhetorical relations have two arguments that play different roles, for example, a Cause relation has a "Reason" (or "Cause") argument and a "Result" (or "Effect") argument. ISO 24617-2 has a provision for indicating that a Cause relation exists between two dialogue acts, but not for indicating their roles.

DR-Core annotates relations with argument roles as follows, using the reference format 'DRelML' of DR-Core:

(4) John pushed Tim. He fell on the ground.

```
<drArg xml:id="a1" target="#s1" type="event"/>
<dRel xml:id="r1" rel="cause"/>
<drArg xml:id="a2" target="#s2" type="event"/>
<implDRLink rel="r1" reason="#a1" result="#a2"/>
```

By contrast, ISO 24617-2 provides just a single slot for specifying a rhetorical relation, and has no provisions for marking up argument roles, as illustrated in (5):

(5) A: Have you seen Pete today?
B: He didn't come in; he has the flu.

```
<dialogueAct xml:id="da1" target="#fs1" sender="#a" addressee="#b"
  dimension="task" communicativeFunction="propositionalQuestion"/>
<dialogueAct xml:id="da2" target="#fs2" sender="#b" addressee="#a" dimension="task"
  communicativeFunction="answer" functionalDependence="#da1"/>
<dialogueAct xml:id="da3" target="#fs3" sender="#b" addressee="#a"
  dimension="task" communicativeFunction="inform"/>
<rhetoricalLink dact="#da3" rhetoAntecedent="#da2" rhetoRel="cause"/>
```

This limitation could be overcome by using the <implDRLink> element of DRelML in DiAML, instead of the <rhetoricalLink>, thus replacing the last line of (5) by:

(6) <dRel xml:id="r1" rel="cause"/>
<implDRiLink rel="r1" reason="#da3" result="#da2"/>

Second, many if not all rhetorical relations may occur either between two dialogue acts or between their semantic contents. This phenomenon is known in the literature as the 'semantic-pragmatic' distinction. Example (7) illustrates this.

(7) a. A: Have you seen Pete today?
B: He didn't come in. He has the flu.
b. A: Have you seen Pete today?
B: He didn't come in. He sent me a message saying that he has the flu.

B's utterances in (7a) are causally related in the sense that the semantic content of the second utterance expresses the reason why the content of the first utterance, which answers A's question, is true. In (7b), by contrast, there is a 'pragmatic' causal relation, in the sense that the second utterance expresses why B says that Pete is not in - in this case B's utterance is causally related to the dialogue act of answering A, rather than to the content of this dialogue act.

In DR-Core this distinction is represented by indicating the types of the arguments, where 'dialogue act' is one of the possible types, and the possible types of the semantic content of a dialogue act are the other. This is illustrated in example (8), which shows the annotation of the examples in (7) represented in DRelML, the markup language of DR-Core.

(8) a. <drArg xml:id="a1" target="#fs2" type="event"/>
<dRel xml:id="r1" rel="cause"/>
<drArg xml:id="a2" target="#fs3" type="state"/>
<implDRLink rel="r1" result="#a1" reason="#a2"/>

b. <drArg xml:id="a1" target="#fs2" type="dialogueAct"/>
<dRel xml:id="r1" rel="cause"/>
<drArg xml:id="a2" target="#fs3" type="event"/>
<implDRLink rel="r1" result="#a1" reason="#a2"/>

In both (8a) and (8b) a Cause relation is marked up between the arguments expressed by the markables fs2 (*"Pete did not come in today"*) and fs3 (*"He has the flu"*; *"He sent me a message saying that he has the flu"*, respectively), but in (8a) the first argument is the event of Pete not coming in which is caused by the second argument, while in (8b) it is the dialogue act of B answering A that Pete did not come in which is caused by the second argument. This distinction cannot be expressed in DiAML.

Again, a solution could be found by importing in DiAML the use of DRelML's <implDRLink> element, plus the DRelML way of identifying the event that forms the reason for the Cause relation, thus building the annotation in (9):

(9) c. <dialogueAct xml:id="da2" target="#s2" sender="#b" addressee="#a"
dimension="task" communicativeFunction="answer"
functionalDependence="#da1">
<dialogueAct xml:id="da3" target="#s3" sender="#b" addressee="#a"
dimension="task" communicativeFunction="inform" >
<drArg xml:id="e3" target="#s3" type="event" />
<implDRLink rel="cause" reason="#e3" result="#da2" />

The mixed DiAML/DRelML representations in (6) and (9) are perfectly well-formed as XML expressions, but from a semantic point of view it isn't clear that they make any sense, since DiAML and DRelML each have their own separate semantics. This issue, which arises more generally when annotations of different semantic phenomena is combined, is discussed in Section 4.

3.4 Additional Dimensions and Communicative Functions

The ISO 24617-2 annotation scheme has taken its nine dimensions from the DIT^{++} annotation scheme, which has an additional tenth dimension called 'Contact Management', for those dialogue acts that serve

to establish and maintain contact and attention. This dimension was not included in the ISO standard because contact management does not play a significant role in every type of dialogue situation, where the other nine dimensions all do. Gilmartin et al. (2017) suggest the addition to ISO 24617-2 of communicative functions related to greeting and leavetaking in casual dialogues that may fit best in the Contact Management dimension

Another dimension that was not included in ISO 24617-2 is that of 'Task Management', which is available in DAMSL and some other annotation schemes. Task Management acts differ from dialogue acts in the Task dimension in that the latter serve to move a certain task or activity forward, whereas Task Management acts are concerned with discussing or explaining a certain task. In spontaneous conversations, task management acts hardly seem to occur, but they do occur in television debates, in parliamentary debates, and in dialogues in game situations, as for example in the DBOX dialogues. A DBOX example is the following, in which participant A explains the rules of the guessing game that they two are going to play. The 'task' in these dialogues is to play the game; the early part of the dialogue, where the game is explained, does not contribute to the task proper and contains Task Management acts (and other ones, such as feedback acts).

(10) A: First let me explain the rules. I am a very famous person.
G: Okay.
A: You need to guess my name.
G: Okay.
A: You can ask several questions except for one about my name.

The decision to not include certain common though not ubiquitous dimensions should perhaps be revisited, since one of the attractive features of the ISO scheme is that its dimensions are 'orthogonal', and there is no obligation to use *all* the dimensions in a given annotation task.

Communicative functions have been felt to be lacking in ISO 24617-2 in the Discourse Structuring dimension, in which only two functions have been defined: 'Opening' and 'Interaction Structuring', the latter functioning as a catch-all term for all forms of discourse structuring other than opening a dialogue. DIT^{++} and some other annotation schemes have other discourse structuring functions, that may be added to the ISO scheme.

It may also be useful to be more specific in the revised ISO standard document concerning the deliberate absence of any Task-specific functions, and the possibilities of adding those.

4 Including Elements from Other Annotation Schemes

In Section 3.3 we concluded that for an adequate annotation of rhetorical relations in dialogue one would like to somehow combine DiAML- and DRelML annotations. At the level of XML-based representations this is no problem, since both DiAML and DRelML representations are a compact way of using XML. However, this flexibility of XML is due to the fact that XML by itself does not have a semantics; one reason for defining DiAML and DRelML, besides the compactness of their representations, is that they both have a well-defined semantics (see Bunt et al., 2012 and Bunt, 2014 for the semantics of DiAML, and Bunt & Prasad, 2016 for that of DRelML). Combining elements from different annotation schemes only makes sense if the semantics of the combination is well-defined.

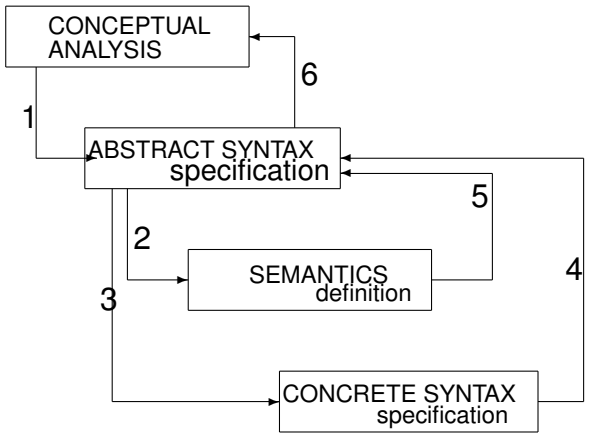

Figure 1: CASCADES design method (Bunt, 2015).

Dealing with this issue is an interesting application of the CASCADES design method for annotation schemes (Bunt, 2015), which forms part of the ISO Principles of semantic annotation - see Figure 1 - in 'reverse engineering' mode (rather than 'top-down' mode). The reverse engineering could in this case start at the concrete syntax specification, describing the combined use of ingredients of DiAML and DRelML representations. Feedback step 4 leads to the construction of a combined abstract syntax specification, which in turn (step 6) calls for the (re-)construction of a combined metamodel. Once a stable combined metamodel has been constructed and an abstract syntax specification, step 2 (possibly iterated, via feedback step 5), calls for the specification of a semantics of the abstract annotation structures.

Appendix B shows the result of constructing a combined metamodel that combines the conceptual views underlying the ISO schemes for dialogue act annotation and discourse relation annotation. In the latter, DR-Core, a discourse relation (called a 'rhetorical relation' in ISO 24617-2) is a binary relation between two 'situations', which is a very general term that covers events, states, facts, beliefs, dialogue acts, as well as possible and negated events, facts and so on. We noted above that rhetorical relations in dialogue may occur between two dialogue acts, or between their semantic contents, or between one dialogue act and the semantic content of another. In the combined metamodel a 'semantic content' box is therefore introduced, as well as a rhetorical relation between two semantic contents, so that all three types of rhetorical relation can be annotated and can be distinguished.

Crucial in applying the CASCADES method is defining a combined semantics. The dialogue act theory that underlies the ISO scheme views a dialogue act conceptually as an 8-tuple consisiting of: (1) a sender; (2) one or more addressees; (3) a communicative function; (4) a semantic content; (5) a dimension; (6) functional dependence relations; (7) feedback dependence relations; and (8) rhetorical relations. Since an articulate annotation of the semantic content is considered to be beyond the scope of dialogue act annotation, the ISO 24617-2 annotations are, according to the abstract syntax, 7-tuples rather than 8-tuples, without a semantic content. However, the underlying theory does define the semantics of dialogue acts including their semantic content (see Bunt, 2011; 2014), namely as a mechanism for updating the dialogue participants' information states with that semantic content. Therefore, from a semantic point of view, an extension to DiAML with the semantic content of dialogue acts is well within reach. This would correspond in the concrete syntax to the introduction of a <semanticContent> element that can be used as follows (for annotating example (7a)) :

(11)
```
<dialogueAct xml:id="da2" target="#s2" sender="#b" addressee="#a"
   dimension="task" communicativeFunction="answer"
   functionalDependence="#da1">
  <dialogueAct xml:id="da3" target="#s3" sender="#b" addressee="#a"
   dimension="task" communicativeFunction="inform" >
  <event xml:id="e3" target="#s3" type="ill" />
  <semanticContent dialogAct="#da3" content="#e3"/>
  <implDRLink rel="cause" reason="#e3" result="#da2" />
```

The <event> element introduced in (11) for specifying information about the semantic content of a dialogue act could be the same as the element with the same name that is used in the ISO standards for time and events (ISO 24617-2, see also Pustejovsky et al., 2010), for annotating semantic roles (ISO 24617-4, see also Bunt & Palmer, 2013), and for spatial information (ISO 24617-7, see also Pustejovsky et al., 2013), and that has also been proposed for the annotation of modality (Lapina & Petukhova, 2017) and quantification (Bunt, 2017). This suggests that the introduction of <semanticContent> and <event> elements, with their underlying abstract syntax and semantics, may open the possibility to specify quite detailed information about the semantic content of dialogue acts.

5 Alternative Representation Formats

Developing the DialogBank, intended to be a collection of dialogues with 'gold standard' quality ISO 24617-2 annotations, involved the inspection and correction of previously annotated material. Editing annotations represented in the XML-based format of DiAML turned out to be extremely hard, since XML

may be a good format for machine application, but is not fit for human consumption. Exploiting the fact that DiAML was defined following the ISO 24617-6 principles of semantic annotation, with an abstract syntax underlying the XML representations, two alternative tabular DiAML representation formats were defined and implemented that are more suitable for human use. One of these formats makes use of one column per dimension, as illustrated in Table 1; the other puts all annotations in one column, with a specification of their dimension. Both formats were proven to be complete and unambiguous, and thus semantically equivalent to the XML format, and were useful for spotting annotation errors and making improvements (Wijnhoven, 2016). Conversion programs for reformatting DiAML annotation using one format or the other, are available in the DialogBank.

In order to enhance the usefulness of the ISO 24617-2 scheme for studies of spoken discourse phenomena, the use of alternative representation formats may be made explicit in a new edition of the ISO 2461-2 standard.

funct. segment	sp	segment text	turn transcription	Task	Auto-Feedb.	Turn Man.	Time Man.	Discourse Structuring	SOM
			hello, can I help you						
TR1-f1	s	hello							da1: Initial Greeting
TR1-fs2	s	can I help you						da2: Offer	
			uhm, yes hello, maybe, I'd like to takea tanker..						
TR1-fs3	u	uhm				da3: Turn Take	da4: Stalling		
TR1-fs4	u	yes hello			da5: Positive (da1)				da6: Return Greeting (da1)
TR1-fs5	u	yes maybe						da7: Accept Offer (da2) [uncertain]	
TR1-fs6	u	I'd like to take a tanker..		da8: Inform					

Table 1: DiAML annotation of TRAINS dialogue fragment in multi-column format.
Targets of dependence relations are in parentheses; qualifiers in square brackets.

6 Conclusions and Future Work

In this paper we have discussed some deficiencies and limitations of ISO 24617-2: 2012, which may be good to tackle when this standard is considered for revision.

An incorrectness in ISO 24617-2 was noted for annotating the 'antecedent' of feedback acts that refer to a non-functional stretch of dialogue - an incorrectness that also makes an accurate annotation of speech editing acts (acts in the Own Communication Management or in the Partner Communication Management dimension) impossible. This error should be corrected, which can be done by introducing relevant non-functional segments into the dialogue segmentation.

Experiences with applying the ISO 24617-2 scheme in various annotation efforts, such as the creation of the DBOX corpus (Petukhova et al., 2014) and the ADELE corpus (Gilmartin et l., 2017), show that it may be convenient to add the DAMSL dimension of Task Management and the DIT^{++} dimension of Contact Management to the ISO annotation scheme, as well as certain communicative functions that allow more fine-grained annotation of feedback and discourse structuring acts.

Limitations of the ISO 24617-2 scheme were brought to light by the development of ISO standard

24617-6 ('DR-Core', 2016) for discourse relations, of which rhetorical relations between dialogue acts or their semantic contents are a special case. These limitations concern on the one hand the lack of a possibility to indicate the roles of the two arguments of a rhetorical relations, and on the other hand the impossibility to indicate whether a rhetorical relation applies at the level of dialogue acts or at that of their semantic content. The possibility was discussed to import elements from DR-Core into the annotation scheme for dialogue acts and to merge the underlying metamodels. Doing so could be the first step towards a more general merging of elements from annotation schemes for different semantic information, such as time and events, spatial information, semantic roles and quantification.

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Appendix A Dimensions and Communicative Functions in ISO 24617-2:2012

The table below lists the 56 communicative functions defined in ISO 24617-2.

Table 2: ISO 24617-2 communicative functions

General-Purpose	Dimension-Specific Communicative Functions	
Communicative Functions	Function	Dimension
Inform	AutoPositive	Auto-Feedback
Agreement	AutoNegative	
Disagreement	AlloPositive	Allo-Feedback
Correction	AlloNegative	
Answer	FeedbackElicitation	
Confirm	Staling	Time Management
Disconfirm	Pausing	
Question	Turn Take	Turn Management
Set-Question	Turn Grab	
Propositional Question	Turn Accept	
Choice-Question	Turn Keep	
Check-Question	Turn Give	
Offer	Turn Release	
Address Offer	Self-Correction	Own Communication Man.
Accept Offer	Self-Error	
Decline Offer	Retraction	
Promise	Completion	Partner Communication Man.
Request	Correct Misspeaking	
Address Request	Interaction Structuring	Discourse Structuring
Accept Request	Opening	
Decline Request	Init-Greeting	Social Obligations Man.
Suggest	Return Greeting	
Address Suggest	Init-Self-Introduction	
Accept Suggest	Return Self-Introduction	
Decline Suggest	Apology	
Instruct	Accept Apology	
	Thanking	
	Accept Thanking	
	Init-Goodbye	
	Return Goodbye	

Appendix B. Possible Extended Metamodel for ISO 24617-2

The metamodel below deviates from the one in ISO 24617-2 in the following respects:

- 'referential segments' have been introduced, and feedback dependence relations can now relate dialogue acts not only to other dialogue acts or to functional segments, but also to referential segments
- the semantic content of a dialogue act is introduced, and rhetorical relations can now relate dialogue acts not only to other dialogue acts but also to the semantic contents of other dialogue acts.