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How to Represent the Medical Annotations?

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Abstract

The medical practice needs an important collaboration of the health care professionals. This collaboration must be improved by efficient exchanges of information. Annotations (post-it, comments) are one of the strategies used by the practitioners to communicate in an informal way. In this paper, we want to describe precisely these annotations. This model can be used to design electronic settings (indexing or laying out annotations according to various points of view).

Keywords:

annotation, collaboration, electronic health record, knowledge engineering, patient safety, quality of care

Introduction

Health care professionals (HCP) use the paper and electronic documents of the health records to keep traces of their communications and of their acts. Most of the time, on paper, the documents are annotated. Indeed, the documents are structured and they are not sufficient for all the comments. Consequently, practitioners use annotations (post-it, comments) to communicate in an informal way. They have similar difficulties with the electronic documents but unfortunately the existing annotation tools are not sufficient. The purpose of this paper is to describe precisely these medical annotations for integrating them in the electronic settings.

Methods

In the DocPatient[1] project, we studied the existing annotation tools. We compared their functionalities with the paper practices of annotations. We chose 6 functionalities and we implemented them in the DocAnnot model [1]. We evaluated this tool with 20 practitioners. This evaluation allowed us to improve our tool and to understand how annotations are necessary for the HCP' collaboration. But we still need a better description of these annotations to represent and display them in our system.

We also collaborated with the LAMIH[2] who have similar problems when they study the semi structured information written in a textbook by the nurses during home care activities. We described in [2] a conceptual model of these communication notes. We propose four interpretation levels (contextual, perlocutory, locutory/illocutory and collaborative) to organize the concepts used when a note is produced or read.

In this paper, we apply this model to describe more in detail the annotations, which are a particular type of communication notes. Our aim is to answer to the following questions basing us on the notion of discourse structure, speech acts and collaborative activities:

- **Contextual level:** What is the context which leads the author to produce an annotation? Who is speaking or writing or drawing? when? Where? for who?
- **Perlocutory level:** In which way does the author want his annotation to be used and how the reader uses it?
- **Locutory/illocutory level:** What are the means used by the author's annotation to transmit his message? Which target? anchor? form?
- **Collaborative level:** What is the impact of the annotation on the activities?

Results

Contextual level: A medical annotation is written in a *spatio-temporal framework of creation* and is read in a *spatio-temporal framework of reading* (at a particular date, in the patient's room...). The *annotator* is a writer who belongs to the medical team (a physician, a nurse...). The annotator writes the annotation for one or more *targeted readers* (the annotator himself, several member of the medical team...) but, as the health record remains in the patient's box, all the medical workers are *potential readers*. The *real readers* are readers which can be targeted, potential or *collateral readers*. The *collateral readers* have not been envisaged by the annotator as a computer scien-

1 The DocPatient project (2002-2005 University of Amiens) is financed by the Picardy region. We worked with a pilot site (paediatric intensive care and neonatal medicine) and an industrial partner (UNI-MEDICINE).

2 http://www.univ-valenciennes.fr/LAMIH/

tist who studies the health records. An annotation deals with an *object of communication*, a topic.

Perlocutory level: The annotator produces a note according to an *intention of use*. We distinguished two objectives: (i) *the annotator writes the note for himself* but he can communicate the note according to the needs of the organization members (memos, personal notes, reports of actions, links); (ii) *the annotator writes the note according to an intention of communication for one (or several) targeted readers* (daily instructions, transmissions, requests for information, emphases of information). In addition, an annotation can correspond to several intentions of use. For example, a physician wants to *draw the attention* of the fellows by *linking* documents. Moreover, in the medical context, most of the annotations are written to collaborate. Consequently, most of them are *incidental reflections* which are not inevitably related to the documents but to the activities described in them.

Locutory/illocutory level: To annotate, the practitioners choose a *target* which can be can be a collection of documents, a document, a part of a document (a paragraph, an image…), or another annotation. He also chooses an *anchor* which links the annotation to the target (a line, a surrounded sentence…). Finally, he writes a *contents* which is a trace of one of his mental representations elaborated about the target. He adds a layout, a *shape* to this content (bold, coloured sentences...). The content of the annotation has an *illocutory force*, it can be used to achieve an act. Austin distinguishes the constative and performative utterances. The constative utterances assert or state something that can be judged as true or false and the performative utterances perform the actions mentioned rather than express a proposition about it. In the medical annotations, we rarely find constative utterances, but we find them in the documents to describe the patient's state. On the contrary, we find performative utterances in the annotations and in the documents because the practitioners use the annotations to keep traces of the actions which have been carried out or which will be carried out.

Collaborative level: To describe the annotations, we also used a collaborative point of view: the Hoc's architecture of collaboration [4] which proposes three levels: action, plan and meta-collaboration. We use the example of a physician who sticks a post-it "BG in two hours" to describe this three levels.

- **Action level:** When the physician sticks the post-it, he deliberately *creates a local interference*. The post-it facilitates his own task. The others worker are aware of his activity and will not schedule a care at the same time. The post-it also make easier the tasks of the others practitioners, who can be disturbed by this new task. A nurse reads this annotation and *detects the interference*. She had scheduled the bath of the child at the same time. She *identifies the goal of the annotator*. He wants to supervise the evolution of the blood gas. She *solves the local interference* by delaying the bath.
- **Planning level:** The nurse *updates her representation* of the child. She understands that the physician wants new blood gas because the child is ill. She also *updates her representation of the controlled process* (the evolution of the child's state) and *her representation of the controlled activity* (the cares). For that, she readjusts her *representation of the common goal* (to keep the child in a stable state), of the *common plan* (the blood gas have priority on the other cares) and of the *distribution of the tasks* (she must prepare the material for the physician).
- **Meta level:** The nurse uses the vocabulary of the field, a *common code*, to associate the abbreviation "BG" with the meaning "blood gas". In order to have a *representation* compatible with the physician's representation, she translates the post-it which is written according to the physician's level of expertise in her own level of expertise. To finish, she *updates his own representation and his representation of her partners*. She's used to work with the physician, so she can infer on the aim of this new BG. She also knows what the physician expects from her (to prepare the material).

The complexity of the collaborative activities must be underlined. A fellow analyses the same comment from another point of view and this note can induce others activities.

Discussion and conclusion

Usefully managing and laying out annotations is a challenge because their informal and unforeseeable nature makes them difficult to handle. Their description according to multiple points of views is a solution to consider their multiple facets. Our model is coherent with the implementation of our annotation tool dedicated to the electronic health record and will be easily integrated. Moreover, this representation is also satisfactory in respect of the evaluation carried out with the HCP. We of course need to collect more data to evaluate this model with various medical specialties. The following step consists in building a computational model directly usable by electronic settings, for example, to index the annotations or to lay out them according to various points of view. We evoke the possibility of building an ontology to represent this model. To conclude, a detailed modeling of these annotations allows not only their computerization but also their integration in the complex process of medical information management. The originality of our modeling comes from the way we take into account of some collaborative knowledge.

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