Speech Acts and Medical Records: The Ontological Nexus

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Despite the recent advances in information and communication technology that have increased our ability to store and circulate information, the task of ensuring that the right sorts of information gets to the right sorts of people remains. We argue that the many efforts underway to develop efficient means for sharing information across healthcare systems and organizations would benefit from a careful analysis of human action in healthcare organizations. This in turn requires that the management of information and knowledge within healthcare organizations be combined with models of resources and processes of patient care that are based on a general ontology of social interaction. The Health Level 7 (HL7) is one of several ANSI-accredited Standards Developing Organizations operating in the healthcare arena. HL7 has advanced a widely used messaging standard that enables healthcare applications to exchange clinical and administrative data in digital form. HL7 focuses on the interface requirements of the entire healthcare system and not exclusively on the requirements of one area of healthcare such as pharmacy, medical devices, imaging or insurance transactions. This has inspired the development of a powerful abstract model of patient care called the Reference Information Model (RIM). The present paper begins with an overview of the core classes of the HL7 (Version 3) RIM and a brief discussion of its "act-centered" view of healthcare. Central to this account is what is called the *life cycle* of events. A clinical action may progress from defined, through planned and ordered, to executed. These modalities of an action are represented as the *mood* of the act. We then outline the basis of an ontology of organizations, starting from the theory of speech Acts, and apply this ontology to the HL7 RIM. Special attention is given to the sorts of preconditions that must be satisfied for the successful performance of a speech act and to the sorts of entities to which speech acts give rise (e.g. obligations, claims, commitments, etc.). Finally we draw conclusions for the efficient communication and management of medical information and knowledge within and between healthcare organizations, paying special attention to the role that medical documents play in such organizations.

1 Introduction

An organization can be seen as a collection of agents who interact, communicate, cooperate, coordinate, negotiate, and so on, with one another in order to achieve a common goal. Healthcare likewise can be characterized as a series of actions that are performed to benefit patients. The authors of the HL7 RIM defend an explicitly "act-centered" view of healthcare based on the assumption that any profession or business, including healthcare, primarily consists of a series of attributable, intentional actions on the part of responsible actors. The abundance of such acts in the healthcare domain attests to this. They include clinical observations, assessments of health conditions such as diagnoses, treatment services (such as medication, surgery, physical and psychological therapy), assisting, monitoring or attending, training and education services to patients and their next of kin, notary services (such as the preparation of an advanced directive or a living will), editing and maintaining documents, and many others. But there are many features of a healthcare organization that go beyond the category of action. These include the participants of the actions themselves, the *roles* that these participants play in an action, their *authority* to perform a given action, and the sorts of entities that these actions give rise to such as *obligations* and *claims*, as well as physical events such as births and deaths. All of these must be taken into consideration in a complete ontology of the healthcare domain.

We argue that efforts such as the HL7 to develop efficient means for sharing information across healthcare systems and organizations would benefit from a careful analysis of human action in this larger ontological context. Certainly we require a systematic understanding of the sorts of actions that are typical of healthcare organizations, but we also require an account of the contexts and the concomitant products of such actions and the management of information and knowledge within healthcare organizations should be combined with models of resources and processes of patient care that are based on ontology and all that is involved. Furthermore, we argue that models of healthcare that are more in line with the way people actually act in healthcare organizations will go a long way to ensuring that the right sorts of information get to the right sorts of people. Mario Stefanelli [1] notes that there is a need to investigate the dominant role of cognitive-organizational factors in adapting systems to users working practices. An important step to achieving this task is the development of a sound ontology of healthcare organizations.

2 An Overview of the HL7 RIM

2.1 The Six "Backbone Classes" of the RIM

The RIM is intended to serve as a unified framework for the sharing of information and the usage of data across different healthcare domains. As such, the authors of the RIM have organized the relevant healthcare information into what they call the six "backbone classes" of the RIM: Act, Entity, Role, Participation, Act-Relationship, Role-Link [2]. The first three classes (Act, Entity, and Role) are "high-level" classes, which means that they have specialized subclasses. The last three classes (Participation, Act-Relationship, and Role-Link) represent relations between members of the first three classes.

Act Class	Intentional actions documented by a healthcare professional in either a clinical or administrative context that has happened, can happen, is happening, is intended to happen, or is requested/demanded to happen.
Entity Class	Physical things or groups of physical things that can participate in an action as perpetrator, target or beneficiary (e.g., living subjects (including human beings), organizations, material, and places and their specializations). It does not indicate the roles played, or the acts that these entities participate in.
Role	The competency of an entity, which can participate in an Act in a particular Role.
Participation	An association between an Entity in a Role and a specific Act.
ActRelationship	Relates acts such as an order for an observation and the observation event as it occurs. Also relates an act to its component acts.
RoleLink	A connection between two roles such as 'patient' and 'provider' that expresses a dependency between those roles.

2.2 The Act-Centered View of Healthcare

Of the six classes of the RIM, the Act class plays the central role, since all information and processes in the healthcare domain are represented primarily in terms of the acts that can be attributed to someone within the context of a healthcare organization. The Act class plays an even more expansive role, since, from the perspective of the RIM, documents or "collection of information" is considered as a collection of *attributed*, intentional acts and not as one might expect from the above an Entity. By an attributed act, they mean that every statement in the medical record is about what they have *said* about what they have heard, seen, thought and done.

Following Rector [3], the authors of the RIM view *faithfulness* to the clinical history and care of the patient as the fundamental criterion for the record:

> The first consequence of our view of *faithfulness* is that the information in the medical record itself is not about what was "true" of the patient but what was observed and believed by clinicians.

Medical records, then, need not document what actually occurs in a given situation; they may document only what the physician thought was true on the basis of his or her observations. The RIM documentation employs in this connection a philosophical view according to which the truth of the real world is "constructed" through a combination (and arbitration) of attributed statements only, so that there is no class in the RIM whose objects represent "objective states of affairs" or "real processes" independent of attributed statements. It is for this reason that every act in the RIM must be an attributed act. No direct reference is made to natural events such as a patient's heartbeat: a patient's heartbeat may be recorded as observed, but there is no record of the event itself; but there is a record of the observation by, say, a physician.

Unlike the approach adopted by Nolen, which remains limited to observation statements, the Act class embraces the full range of speech acts:

> The notion of speech-act includes that there is pragmatic meaning in language utterances, aside from just factual statements; and that these utterances interact with the real world to change the state of affairs, even directly cause physical activities to happen. For example, an order is a speech act that (provided it is issued adequately) will cause the ordered action to be physically performed [1 (3.1.1)].

The act of *observing* a resident *attend* to a patient is not linked to any other acts in the same way that, say, the act of *ordering* a blood test is linked to the act of *performing* the blood test. The authors of the RIM recognize the importance of paying special attention to the ways that speech acts such as orders and requests are a kind of doing that goes beyond the simple reporting of facts and they recognize also that these acts stand in systematic relations to other acts within the framework of a healthcare organization and that the more accurately a healthcare model captures these systematic relations between (speech) acts the more information will be made available to its users.
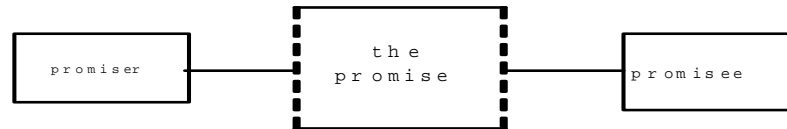
2.3 The Act Life Cycle

The life cycle of an act is divided-up into what are called moods. An activity is said to progress from defined, to planed and ordered, to executed. The *definition* mood of an act provides definitions of possible service actions and service action plans. An action may be represented as a single instance of the

Act class, in which case the definition mood code specifies the major type of act (e.g. a clinical observation) and determines the sorts of participants involved (physician, patient), the required objects (e.g. specimen, facility, equipment) and so on. An action can also be decomposed into sub-acts, i.e., as a "collection" of (partially ordered) instances of act each of which is a finer granularity than the entire procedure, e.g. obtain consent, administer pre-op medication, administer anesthesia (throughout the surgical procedure), make the incision, etc. In turn, for any of the more finely granulated actions just mentioned, further granulation/decomposition may occur [(A 1.4)]. The *Intent* mood represents an intention or plan to perform a service action and specifies whom the people involved in the intended act, especially the author of the intended action or any individual assignments if the action involves a group, and the objects actually or supposedly involved in the act (e.g., specimen sent, equipment requirements, etc.). A promise is an example of an intention to perform a service that has the strength of a commitment. An order or a request is an intent directed from a placer of an order (request author) to a fulfiller of an order (service performed). The *Event* mood represents the execution of the promised deed, the requested action, and the ordered service.

3 Speech Acts in Healthcare Organizations

J. L. Austin [4] and John R. Searle [5] were the first to emphasize that what we can do with words goes well beyond uses of language of the statement-making sort. We can make requests, ask questions, give orders, make promises, give thanks, offer apologies, and so on, all of which are kinds of actions and are such that their utterance brings about some result. The variety of speech acts within the context of a healthcare organization is immense. Our analysis of speech acts will begin with a discussion of one sort of speech act, namely the promise, and then broaden to a discussion of speech acts in general.

Speech acts are social acts and as such they involve at least two people. In this sense, speech acts are opposed to solitary acts (e.g. the rehearsal of a difficult medical procedure in one's head). Every promise requires a *promiser* and a *promisee*. We represent this relation in the diagram below:

```
+-----------+        +---------------+        +-----------+
|           |        :               :        |           |
| promiser  |--------:    the        :--------| promisee  |
|           |        :    promise    :        |           |
+-----------+        +---------------+        +-----------+
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The broken lines on the edge of the box with 'the promise' written inside indicate that there exists a dependence relation between the promise and the two boxes on its left and right. The picture should be read: the promise depends for its existence on the promiser (and not vice versa) and on the existence of the promisee (and not vice versa). The promise is said to be *one-sidely dependent* on both the promiser and the promisee, since without these the promise could not exist, whereas the converse is not the case [6]. The promiser and promisee as persons do not require the existence of the promise in order to exist.

Having said this, there are certain things that must be present, call them *founding relations*, in order for there to be a successful issuance of a promise:

1. The act of speaking (on the part of promiser)
2. Promiser must intend to perform the action F
3. The act of registering (on the part of promisee)
4. Promisee must desire that the promiser perform F.

On the one side, the promiser must 1) utter something to the effect of 'I promise to do F' and 2) actually mean what he says, that is, actually intend to do F. The first condition states that a promise is an act that can be publicly apprehended. This is important for no other reason than that the promisee has the right to decline or accept a promise, as the case may be, and if the act were not made public, the promisee would be denied this right. Simply put: intending to do F is not the same thing as promising to do F. The second condition states that just uttering the words 'I promise to do F' is not enough. If one does not actually mean what one says, it is a sham promise or a lie. On the other side, the promisee must 3) recognize the utterance as a promise—Austin referred to this as uptake—and 4) desire that the promiser do F (otherwise it is not a promise but a threat). There are many ways that a promise can be made. In each case, there must be a rule to the effect that

uttering 'I promise to do F' in the appropriate context counts as a promise. Context here is important, since uttering these words in jest or to a non-English speaker would not count as making a promise.

In addition to these conditions there are some additional background conditions. In some cases the promiser must have the *authority* to promise to do F and, likewise, the promisee must have the authority to accept or decline F. For instance, only some healthcare personnel have the authority to promise a patient a certain medical procedure and only under certain circumstances does the guardian of a patient have the authority to grant permission for a medical procedure or treatment. Another condition is that there should exist no previous commitments on the part of the promiser or the promisee that would *vitiate* the promise. For example, a previous obligation to perform a medical procedure can vitiate a subsequent promise to perform some other medical service at that time. And finally, there must be a general background of trust for the promise to hold. Without this the entire social practice of making promises would not work.

If all these conditions are meet, then the promise gives rise to a corresponding *obligation* (on the part of the promiser) and *claim* (on the part of the promisee). Call these the *successor states* of a promise. The diagram below represents those elements involved in a promise.
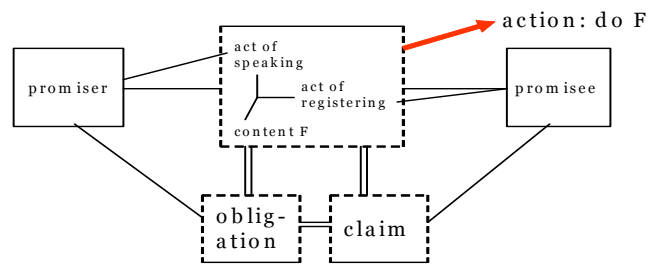
As before the broken lines on the edge of a box represent the existence of a dependence relation. If there is a line drawn from a solid edge of a box to a broke edge of a box (e.g., between the promiser box and the obligation box), it indicates a one-sided dependence. If on the other hand there are two lines drawn from a box with a broken edge to another box with a broken edge (e.g., between the obligation and claim boxes), it indicates that there exists a *mutual dependence* [6]. Two objects are mutually dependent on one another if neither one can exist without the other. The promise itself is composed of a three-part structure: the act of speaking, the act of registering, and the content of the promise F. The promiser and promisee as well as the obligation and claim are

not part of the promise. A promise is an event in time that exists only so long as it takes for the promiser to utter the statement and the promisee to register it. The obligation and claim, which are states and not events, exist from the time of the successful issuance of the promise until the content of the promise F is fulfilled. Promises, it should be noted, do not cause this fulfillment. Rather, the relation involved is something weaker than causation. We can talk here in terms of a tendency to be realized. Just as genes have a tendency to be expressed in the form of proteins and bodies have a tendency to fall when dropped, so promises have a tendency to be fulfilled—and in all such cases the tendencies in question can be blocked.

4 Some Ontological Distinctions

One of the principal goals of this paper is to see how speech acts, their successor states and documents are, ontologically speaking, tied up with one another. In order to fully appreciate this it will be important to make a few ontological distinctions.

4.1 Substances and Processes

We begin with the ontological distinction between *substances* and *processes* (a distinction that corresponds roughly to the RIM's Act class and Entity class) [7]. Substances are entities which continue to exist through time: they preserve their identity from one moment to the next, even while undergoing a variety of different sorts of changes. The principal mark of a substance is that, if it exists at a time, then so also do all of its parts. Typical examples from the healthcare domain include the healthcare organization itself, the physicians, administrators, the patients and their family members, medical supplies and records, drugs, etc. A healthcare organization, for instance, continues to exist through time even as it undergoes changes in personnel or structural changes such as the reorganization of departments. Even though a healthcare organization may change over time, at any given time at which the organization exists at all it exists *in toto*. Processes (also called events, activities, occurrents) are in contrast never such as to exist in full in a single instant of time; rather, they are such as to unfold themselves in their successive phases, in the way in which, for example, the performance of a medical procedure unfolds itself through time. Processes characteristically have a beginning, a middle, and an end. Typical examples within the context of a healthcare organization include but are not limited to the diagnosis of a patient, the treatment of a disease, the circulation of blood and speech acts.

4.2 Abstract Entities

Within the context of a healthcare organization there are documents that record, for example, the existence of an insurance *claim*, a *request* for a

medical test, an *obligation* to perform a surgical procedure and so on. The associated claims, requests, and obligations coincide with no part of physical reality but serve to hold the organization together as a social object. Abstract entities such as these are brought into existence by the appropriate corresponding speech acts. They are truly such that, as the HL7 RIM might put it, 'there is no distinction between the entity and its documentation'. For other sorts of entities, however, this is not the case. Some social entities such as doctors and clinical wards coincide with physical objects or events and provide the scaffolding which supports those abstract entities that bind together an organization – entities which are not real, but which are yet tied to contexts of human behavior.

4.3 Speech Acts and Documents

A speech act—whether it is in the form of an utterance or physical marks on paper—in every case coincides with physical reality. But not all entities coincide with physical reality; once the promise is successful there arises the corresponding obligation and claim (the successor states). At this point there exist no portion of physical reality with which the successor states can be said to coincide. The question is in virtue of what do these entities exist? The answer is records or documents. In informal contexts, the memories of the participants is often enough, but in formal, legal contexts the records must be publicly verifiable as is the case with documents, whether they be paper based or electronic.

4 An Assessment of the Act Center View of Healthcare

The fundamental difference between the HL7's act-centered view of healthcare and the one defended here is as follows: Where we distinguish between the speech act (an event), the successor states (which endure through time), and the document (a physical entity) that records the existence of the state into a single class, the RIM collapses these ontological distinctions into the single class, the Act class. In order to make the difference clearer consider the act of making a contract.

According to the RIM a contract is an act and is defined as follows: an agreement of obligation between two or more parties that is subject to contractual law and enforcement. The *intent* mood of a contract would involve an intention or plan to draw up a contract and specifies the participants involved. The *event* mood would represent the actual act of drawing up the contract and the coming to agreement.

The problem with this account is not its definition of a contract. Instead, the problem is with the framework in which this definition is placed. It is not uncommon for contracts to be modified or even nullified. The modification of a contract is a distinct act from the initial act that brought the contract into existence, and subsequent modifications would be distinct from both. How are

we to understand the relations between these acts from the perspective of the RIM? No reference can be made to an entity that *endures* through time and undergoes changes, since the contract in question is not an entity but an act. One possible answer is to argue that the act of coming to agreement and the latter modifications are all linked together via relationships specified as an ActRelationship in the RIM. The problem with this answer is that there is no basis for linking these acts together, since they are all distinct acts, unless there is some underlying entity that unites one act to the next.

This is exactly what we argue. A contract is a document that records the existence of an obligation that is the result of two or more parties agreeing to place themselves under that obligation. The speech act is an event that exists for a certain amount of time and gives rise to a successor state. The successor state may endure so long as all the parties involve continue to endure or until such time as another act is performed which modifies or nullifies the previous agreement.

Similar difficulties face the classification of such items as clinical document, insurance policies, financial accounts, consent forms and diet as members of the Act-class.

5 Conclusion

There exists, then, a definite need to pay closer attention to the ways that humans in healthcare organizations interact, pick-up and share information and knowledge. Attempts to develop standards for interoperability between healthcare information services will be aided by an ontology of social interaction that is maximally representative of organizational reality. Attempts such as the HL7 to develop socio-technical environments will be greatly improved if more effort is brought to bear onto the ontological nature of healthcare organizations. The neglect of objective states of affairs and real processes, the failure to distinguish properly between acts and documents and more generally the neglect of the *context* within which messages are conveyed places obstacles in the way of an adequate ontology of healthcare organizations of the sort which is needed for effective knowledge management. This paper has been but a small contribution to the larger project of developing a sound ontology of organizations.

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