

Clinical Narrative and Clinical Organisation: Properties of Radiology Reports

John Rooksby^a, Stephen Kay^b

^aMedical Informatics Group, University Of Manchester, UK

^bSchool Of Healthcare Professions, SHIRE, University Of Salford, UK

Abstract

Radiology reports, as a form of clinical narrative, are more than a repository of patient information but are active in patient care. They are not unique and individual to each patient but have structured content suitable for supporting the activities of care. We consider these activities of care and how they manifest in the report. This recognition of the infusion of clinical organisation in clinical narrative leads to the recognition of seven properties of radiology reports: labels, concepts, genre, structure, author, subject, reader. These properties exist across two relationships: the intertextual relationship between radiology reports and the interpersonal relationship between a radiology report and people.

Keywords:

Clinical Narrative, Clinical Organisation, Radiology Reports.

Introduction

It is important to construct electronic health records not in terms of what they *are* but what they *do* [1]. Clinical narrative remains an important form of storing information in the health record [2] (despite some efforts to eradicate it) and as we describe, contains useful properties that have not yet been fully explored. We look not at what narrative *is*¹ but what it *does*, and demonstrate that in this respect clinical narrative is not *free text* but *structured text*. Clinical narrative is shown to be infused with clinical organisation. We outline two sets of properties available from this perspective. First, we discuss the 'intertextual' properties that are internal to the narrative. Second, we discuss the 'interpersonal' properties that are external to the narrative (figure 1). The intertextual properties are internal to clinical narrative and exist across 'types' of narrative such as the radiology report. They concern content and its

expression. The interpersonal properties are external to clinical narrative and exist across organisation. They concern meaning and use of the record.

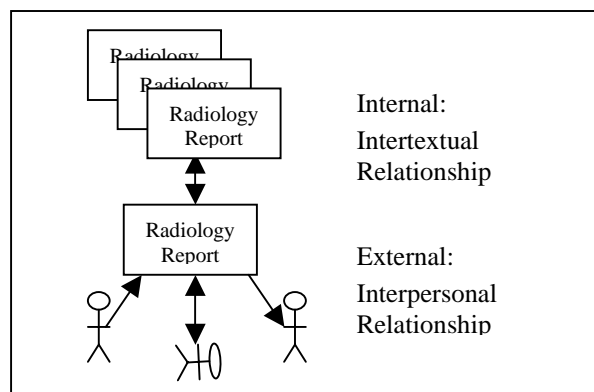


Figure 1 - The Intertextual and Interpersonal Relationships

In this paper we look specifically at neuro-radiology reports (figure 2). Much research has been carried out in Health Informatics on the relationship between x-ray images and radiology reports. Here, it is argued that there is not only a relationship between image and report, but image, report and organisation. In the construction of a multimedia report that is useful to clinicians, it is important to understand this properly. This paper demonstrates the link between organisation and narrative, and introduces the properties of this combination.

The Study

This paper presents work carried out as part of a project to develop a radiology workbench.² The work in this paper follows the authors' interests in Narratology and its application in Health Informatics. To understand the role of clinical narrative in radiology, qualitative research methods have been used. An ethnographic study took place in the neuro-radiology department of a large urban hospital over

¹ In this paper we consider narrative to be 'free text', although it can take other forms.

² EPSRC project (GR/M549/9).

MR SCAN BRAIN TECHNIQUE: Axial dual echo, sagittal T1 and coronal FLAIR images of the brain. FINDINGS: There are a number of periventricular areas of high signal intensity particularly around the posterior horns in keeping with small vessel disease. In addition, the occipital horn of the left lateral ventricle is markedly increased in size. There is no mass lesion associated with this abnormality. The ventricles are otherwise of normal configuration. CONCLUSION: Focal dilation of the occipital horn of the left lateral ventricle but no associated intracranial or choroidal lesion. The aetiology may be speculated upon, and is most likely to have been a childhood periventricular vascular event. XYZ/ABC

*Figure 2 - Example Radiology Report
(The radiologists' initials at the end of the report have been altered)*

the course of twelve weeks. We present some of the findings of that study in the next section.

Activities Of Radiology Reporting

The example radiology report (figure 2) represents a typical, if slightly short, report from the study site. Radiology reports are consistently structured and the subject matter specialised. The report as presented in this paper is static. It is our aim to model radiology reports *in use* to explore their structure and content. The term 'organisation' is perhaps misleading when talking about medicine; we prefer 'activities of care'. To understand the activities of care in neuro-radiology reporting we are employing multiple methods of representation, including:

- Process models
- Stakeholder specification
- Rich Descriptions
- Norm models

All four emphasise different features of the activities of care. Process models (such as workflow) in particular are useful in Health Informatics and often used. We find however that they gloss over the messy realities; trying to follow first hand what is happening with reference to a process model is often impossible. In this paper we will present a (brief) rich description. We wish to avoid using process models here to demonstrate the infusion of clinical organisation in clinical narrative because they emphasise only the routine of activities. We use rich descriptions from our study to give a flavour of what really goes on in neuro-radiology. We give an overview of a particular radiologist's reporting activities and setting, and then the activities of scanning. We also give a specific example of each.

Reporting

The production of the report itself takes place in the radiologist's office. A pile of red folders on the desk containing images, and with the referral notes attached to the front, are those awaiting reporting. A pile on the seat on the right are those that have been reported. A pile on

the floor to the left is of those from other institutions. Behind the radiologist is a computer that runs software allowing existing reports to be looked up, use of email, and access to an internet radiology journal. Beside it is a phone that rings frequently. At the back of the room are journals, reference materials and files. The radiologist reports during the day when he has time, unlike some of the others who prefer to report during the quieter evening time. The images are taken out of the folder (there may be one, but are usually several), looked at individually and arranged upon a lightbox. The report is dictated onto tape. This is usually not a continuous dictation, unless it's an obviously 'normal scan', but involves pauses, examination of images, rewinding and re-recording and consultation of previous reports and reference materials. The radiologist will also dictate requests and letters to the transcriber. This is an activity fraught with interruptions. It is also an activity that involves collaboration, cases will be discussed with other radiologists and neuro-surgeons either if the cases are interesting or if that person happens to be present for any reason.

Scanning

To get the images to the desk a number of activities, which often involve the radiologist, take place. Out patients arrive for a scheduled appointment. In-patients are fitted in when requests for them to be scanned arrive. Many patients are returning for follow up scans and so are known to the radiologists. Many patients are elderly, many are ill, some are drunk which means dealing with them is often far from straightforward. From a waiting room they are lead by a radiographer and possibly a nurse into the scan room. The scan is made in an adjacent room by the radiographer using pre-set protocols and positioning to produce the set of images. If 'contrast' (dye) is needed a radiologist will be present. The completed images are usually checked by a radiologist before they are transferred to a different computer to prepare them for printing, and the patient is released. The scans are printed, placed in the red folders that are in turn placed into baskets ready to be retrieved by, or delivered to the radiologist.

Table 1 - Differences between the Static and Active Views of Language (With Reference to Figure 2)

	Static	Active
Ambiguity	Does “no mass lesion associated with this abnormality” mean no mass lesions?	What lesions (etc.) does the reader need to know about?
Omission	Does the report cover all the relative information of the brain scan?	Does the report cover all the information needed by the reader for their activities?
Inconsistency	Is “markedly increased in size” relative to other increases?	Does “markedly increased in size” have significance between communicators?

Reporting Example

Radiologist A returns to his office talking to Radiologist B about golf. Radiologist A takes a set of x-ray films out of a folder and arranges them on the lightbox. Radiologist B reads a referral letter. Radiologist A: “Its impossible to tell...” Radiologist B: (reads) “Eye muscles are swollen.” Radiologist A: “who says that? Its impossible to tell.” A continues: “They’re saying... Surely not... Let me see the report.” Radiologist B reads it out. Radiologist A: “I think it’s impossible to say from...” Radiologist B: “I agree.” Radiologist A calls to Radiologist C who is walking by and asks him to deal with a patient he has no time for. A radiographer brings more folders of films: “Here”.

Scanning Example

The next patient is on a trolley. Radiographer X, Radiographer Y and a nurse all help the patient onto the scanner. Radiographer X comes out to enter the patient details into the scanner. Radiographer Y returns a bit later. Radiographer X begins the scan and then reads out a previous report of the patient to Y. Radiographer X and Radiographer Y discuss medical terms. The scanner beeps to signify the initial scan complete. Radiographer X: “What’s all this? he’s got a blobby head” (referring to white marks). Radiographer Y “He was fiddling round with his hands.” Radiographer X starts the scanner. They work in silence. A secretary puts her head through the hatch behind them and says the last patient is still in the waiting room. Radiographer X phones the hospital porters. The scan finishes and Radiographer X goes into the scan room “Alright [name], how you doing? We’ll get a trolley okay?”

Clinical Narrative as Agent

We have described (briefly) the activities of radiology reporting. We claim that the neuro-radiology report is relative to these activities, not just the patient’s body. The report is of the patient’s condition, but in terms of the activities of neuro radiology: the categorisation, communication, discussion, examination of images, referrals to papers etc. The Radiology Report (figure 2) contains a description of the “TECHNIQUE” which is referential to the activities of care. The “FINDINGS” and

“CONCLUSION” of the report are referential to the patient but relative to this technique. The categories in the “FINDINGS” and “CONCLUSION” are categories of the patient’s body relative to the activities of care. The task of producing an x-ray involves getting an ill, sometimes confused, often frightened patient to lie still to get the images deemed relevant to the radiologist. In our study the radiologists were seen to be sympathetic to patient needs and have them give input into the plans for further treatment, but at the time of reporting these ‘human aspects’ are marginalised. The radiology report is a narrative supporting standard, and standards of care. It is not unique to each patient, but relative to its authors and readers.

Berg [3] describes the health record as an ‘active agent’ in care, rather than a ‘passive mirror’. We have shown that the radiology report actively structures and organises patient information. It is necessary for the unique patient to be placed within this framework to allow efficient, high quality care. Berg’s concept is more than an active structuring of information but extends to its active influencing of subsequent decisions involving it. Natural language presents complex problems to Health Informatics, including ambiguity, inconsistency and omission. Clinical narrative is often only understood as static, but by changing our perception of it to an active agent, further insight into these problems is gained (table 1).

Properties of Radiology Reports

The previous two sections have shown the relationship between clinical narrative and clinical organisation in the radiology report. This relationship opens properties that can be exploited for a multimedia radiology report. Two questions asked are:

- 1) What properties of a radiology report make it a radiology report?
- 2) What properties of a radiology report represent its use in care?

These represent enquiry into the intertextual and interpersonal relationships respectively (figure 1). We now answer those questions, and later go on to discuss how these properties tie together.

Internal Properties

We have described the intertextual properties of radiology reports as the properties internal to them that thus exist across them. They concern content and its expression. The properties that we propose as making a radiology report a radiology report are: labels, concepts, genre and structure.

Labels are terms, words or phrases used in the report. We can talk about individual words, but it is often more useful to consider statements “There is no mass lesion associated with this abnormality”. This is free text in its basic sense. These labels have meanings, which can stretch beyond their basic medical definition. At the study site radiologists knew particular phrasings would effect particular actions by readers such as neuro-surgeons. Stock phrases such as “normal scan” also have special significance. “Normal scan” means ‘do nothing’, but not necessarily ‘patient is healthy’ or ‘absent of any condition’. It is likely “normal scan” means something different to the patient than the radiologist.

Concepts are used in Health Informatics to be language independent, medical constructs. They are defined, organised and related in terminology systems. They continue to be explored in depth in much of the Health Informatics literature, and so we will not spend too much time on them here. Concepts are essential to many goals of medical systems, and thus essential to a useable narrative representation.

Genre has many definitions, for example similarities in narrative and discourse, similarities in audience, similarities in modes of thinking, similarities in rhetorical situations [4]. Radiology reports are recognisably ‘radiology reports’. The genre makes provisions for what should be recorded and how. Familiarity with the genre helps efficient use, both in authoring and reading. The radiologist knows what to dictate and how. They know to order the information and what is relevant in each section. Genre perhaps does not fit comfortably into the intertextual relationship but as we discuss in the next section these divisions are arbitrary and the properties all interrelated.

Structure is a relation to genre but is more specifically the layout of the narrative. There is a linguistic structure, but we are more concerned with large-scale segmentation, ordering and expression. Radiology reports have a story structure. Elsewhere we present the six phase story structure of radiology reports [5]. The example report (figure 2) has an implicit abstract, an orientation [MR SCAN ... the brain], a complicating action [FINDINGS ... Of normal configuration], a resolution [CONCLUSION ... vascular event], a coda [XYZ/ABC] and an evaluation that permeates through the complicating action and conclusion. The structure is not simply an ordering of the text but a strategy to meaningfully present information [5][2].

External Properties

We have described the interpersonal properties of the radiology report as the properties external to them and existing between them and actors. The main actors in our study of neuro-radiology are: ‘Clerical Receptionist’, ‘Diagnostic Radiographer’, ‘Neuro Radiologist’, ‘Neuro Radiology Consultant Radiologist’, ‘Neuro Radiology Secretary’, ‘Neuro Surgeon’ and ‘Patient’. Others might include students, patients’ companions, cleaners, ethnographers and administrators who all contribute to the character and activities of the department. We do not examine the specific actors here but specific activities. The properties we propose as representing the use of radiology reports are authoring, ‘subject’, and reading.

Authoring is the structuring of concepts or labels within the confines or provision of genre. An author has intentions but does not necessarily control meaning. Meaning lies in the arrangement and content of the report in which we have seen the individual author works with tightly constrained frameworks. We must also understand that meaning is gained through reading. The author will have an intended or ideal reader, in the case of the radiology report: another radiologist or neurosurgeon, normally one that is known to them. The author is not an innovator but an executor. The term ‘intertextual’ sometimes has a stronger meaning than we use here; it can mean text is just a reorganisation and perpetuation of other texts.

The subject is the patient; it is useful to think of ‘subject’ as a patient role. The relationship between report and person is problematic. Rees [6] argues that medical records tell us more about clinicians than patients. If we consider that the radiology report is the standard arrangement of standard content we see that the information has its root in radiology and is applied to the patient. To the patient ‘their’ story is unique and individual, to the radiologist this unique story must be medicalised and thus routinised to allow efficient execution of care. The subject is the ‘patient’, but perhaps not the ‘person’. This opens ethical issues.

The reader interprets a text, but does not gain all information directly from the text. They read with intentions, not only interpreting but also elaborating [7]. Consider that a reader may already be familiar with the subject. Reading is within the provisions of genre as authoring is, but the two are not symmetrical. Just as there is an intended reader there is an imagined author. Neuro-radiologists and neuro-surgeons are readers of radiology reports, who could also have been involved in the authoring. Other readers include General Practitioners (Family Physicians), radiographers, and possibly patients.

Narrative and Organisation

The seven properties outlined are properties of the radiology report (and we claim clinical narrative) *in use*. The intertextual and interpersonal relationships do not represent two separable halves, and neither is primary to the

other, the two are interrelated and interdependent. To look at the interrelationships and interdependencies of these properties we look at what dominates *use*. There has been much interest in Narratology on 'institutional discourse'. The 'institution' is not seen as a macro body issuing rules from above but as the network of relationships of those inside it. In healthcare guidelines and standards are arguably set from above but in examining their implementation, their social, collaborative use is revealed [8]. It is this network of people that accounts for the standards of information presentation and use and also the variations over a broader scale. Elsewhere [5] we consider a 'network of communication'. Shared by communicators is a 'code'. This code allow successful communication, it is the knowledge about what is said and how it is said, shared between communicators. In terms of the radiology report, the author knows how to present information and the reader to interpret it because of the shared code. A patient however does not share this code, and so while they can read the same words of the same report they do not gather the same information. In the study site the patients were not shown their reports but 'told' them in special patient clinics. Similarly, in the UK General Practitioners (Family Physicians) do not read the radiology report in the same way a radiologist might. They do share a code with the author, but not the same code as a neuro-radiologist or neuro-surgeon's shared code with the authoring neuro-radiologist. General Practitioners often receive only the conclusion of the report, and thus a slightly different story (suited to their own activities of care). Radiographers too read radiology reports in a different way. A multimedia report taking account of the different information needs of different readers should adhere to this code in order to be *useful*.

Conclusion

In this paper we have described the infusion of clinical organisation in clinical narrative. This brings to the foreground narrative properties that have thus far received little attention in Health Informatics. These properties, we have recognised as a part of the 'intertextual' and 'interpersonal' relationships. These seven properties are interrelated by an institutional code. The consequence of this description is a view of clinical narrative not as static 'free text' but active 'structured text'. We have provided a holistic but necessarily general account of the structured text. The purpose of this paper is to raise these issues to the foreground in Health Informatics and discuss the framework of our novel work being carried out toward a multimedia radiology report.

The individual properties outlined have been the attention of much work in Narratology. Each represents a complex area of debate. It is the authors' interest to bring Narratology to Health Informatics to give an understanding of the role of clinical narrative in the Health Record. The radiology report in itself does not guarantee quality,

completeness, accuracy or clarity but the fact is they work well in care. The authors believe that clinical narrative houses many properties exploitable by the electronic health record and it should not be so quickly dismissed as 'free text', a misleading title. More common problems at the study site appear to be images and reports going missing. We do recognise that humans need support to effectively use the wealth of information available. There is a great need for computer support of healthcare information but the values of existing technologies, in this case dictated or written narrative, should be explored and harnessed to support the activities of the human experts.

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Address For Correspondence:

John Rooksby, Medical Informatics Group, Dept of Computer Science, University of Manchester, M13 9PL, UK.

Rooksby@cs.man.ac.uk

<http://www.cs.man.ac.uk/mig>