Story Telling in Medical Imaging

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Abstract

Story telling was not used explicit during the development of the medical imaging workstation. Two stories which did have a great impact of the development of the product are described: “The sales story” and “The radiologist at work”.
The relation of the stories to the requirements and design is shown.

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1 Introduction

Stories have not been used explicitly in the development of the medical imaging workstation. Informally however a few stories were quite dominant in creating insight and focus. These informal stories do not meet all criteria described in Chapter **??**, especially the specificity is missing. The typical case, as described in Chapter **??** is complementary to the stories. We now add the required specific quantitative details.

The main stories dominating the development were:

The sales story how to capture the interest of the radiologist for the product, see Section 2.

The radiologist at work describing the way a radiologist works. This story explains why the radiologist is **not** interested in viewing, but very interested in films, see Section 3.

The gastro intestinal examination how the URF system is used to examine patients with gastro intestinal problems. This story is not described here, because it is outside the scope of the discussed thread of reasoning

Section 4 relates the stories to the CAFCR model and discusses the criteria for stories as described in Chapter **??**.

2 The Sales Story

The main function of the medical imaging workstation is rather invisible: layout and rendering of the medical images on film. To support the sales of the product more attractive appealing functionality was needed. The medical community is a rather conservative community, as far as technology is concerned: computers and software are mostly outside their scope. The sales approach was to provide an easy to use product, showing recognizable clinical information.

At the European Congress of Radiology the system was shown to the radiologist. The radiologists were immediately challenged to operate the system themselves, see Figure 1.

The frequently used operations were available as single button operations on the remote control, see Figure 2: Select the examination, by means of previous/next examination buttons; Select image by previous/next image buttons; Adapt contrast and brightness by increase/decrease buttons.

Note that this is a nice sales feature, but that in day-to-day life the radiologist does not have the time to stand behind the workstation and view the images in this way. The viewing as described in Section 3 is much faster and efficient.

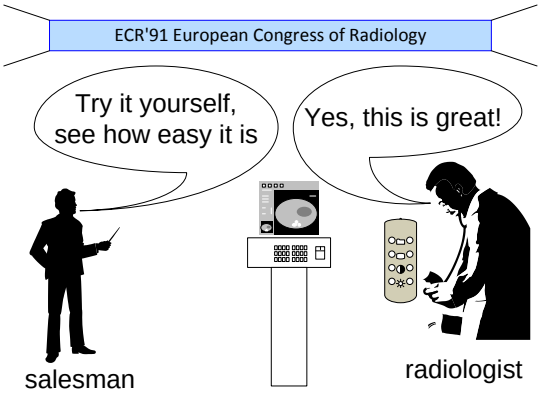

Figure 1: The main sales feature is easy viewing

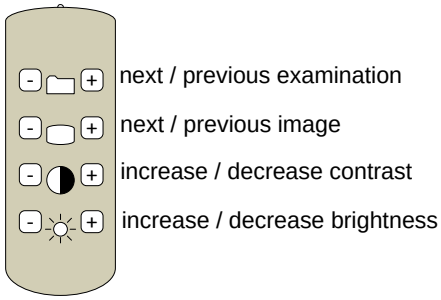

Figure 2: The simple remote control makes the viewing easy

3 The Radiologist at Work

The radiologist has the following activities that are directly related to the diagnosis of a patient: supervising the examination, viewing the images to arrive at a diagnosis, dictating a report and verifying and authorizing the textual version of the report. Figure 3 shows these activities.

The radiologist is responsible for the image acquisition in the examination room. The radiologist is not full-time present in the examination rooms, but supervises the work in multiple rooms. The radio technicians and other clinical personnel do most of the patient handling and system operation.

The films with examinations to be viewed are collected by clinical personnel and these films are attached in the right order to carriers in the auto-loader. The auto-loader is a simple mechanical device that can lift a set of films out of the store to the front of the lightbox. Pressing the button removes the current set of films and retrieves the next set of films.

The activity of viewing and determining the diagnosis takes an amazingly short

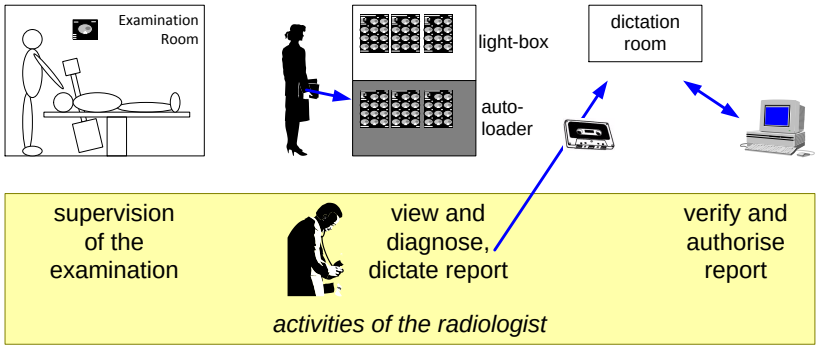

Figure 3: Radiologist work-spots and activities

time. Figure 4 shows this activity in some more detail. A few movements of the head and eyes are sufficient to get the overview and to zoom in on the relevant images and the relevant details. The spoken report consists of a patient identification, a few words in Latin and or some standard medical codes. The recorded spoken report is sent to the dictation department; the transcription will be verified later. The radiologist switches to the next examination with a single push on the next button of the auto-loader. This entire activity is finished within tens of seconds.

The radiologist performs this diagnosis sometimes in between patients, but often he handles a batch of patient data in one session. Later on the day the radiologist will verify and authorize the transcribed reports, again mostly in batches.

4 Towards Design

The sales story provides a lot of focus for the user interface design and especially the remote control. The functions to be available directly are defined in the story. Implicit in this story is that the performance of these functions is critical, a poor performance would kill the sales. The performance was not specified explicitly. However the implied response times were 1 second for image retrieval and 0.1 seconds for a contrast/brightness change. These requirements have a direct effect on the pipeline design and the user interface design.

Figure 5 shows the flow from both stories to requirements and design. It also shows the inputs that went into the stories: at the commercial side the *ease of use* as sales feature and the *film efficiency* as the main application value. The gain in film efficiency is 20% to 50% relative to the screen copy approach used originally, or in other words the typical use of 3 to 5 film sheets is reduced to 2 to 3 film sheets. These numbers are based on the typical case described in Section **??**.

The a priori know-how that the response time in a *software only* solution would

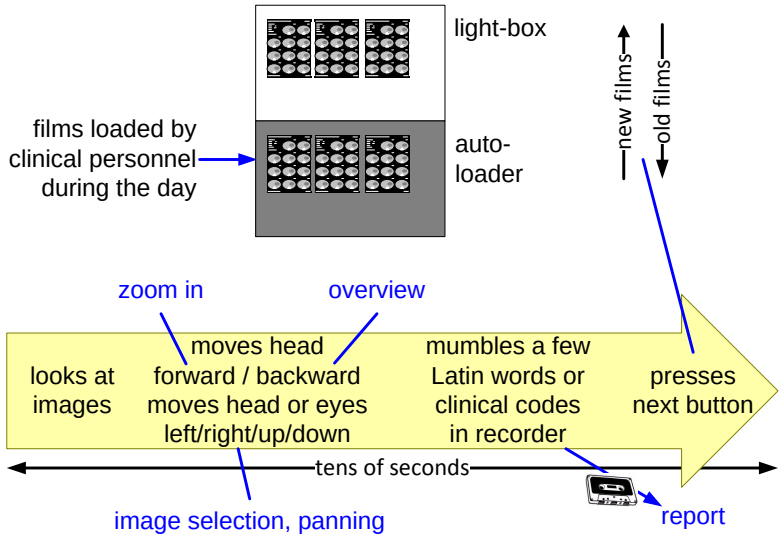

Figure 4: Diagnosis in tens of seconds

be difficult, makes this a challenging story. The technical challenge in this story is to achieve the desired image quality and throughput, also in the *software only* solution.

The minimal user interface is also a design challenge. Without the sales story the user interface provided would have been much too technical, an overwhelming amount of technical possibilities would have been offered, without understanding the clinical world view.

The story of the radiologist at work, in combination with the typical case, is the direct input for the throughput specification. The throughput specification is used for the memory and disk budgets and the CPU and network loads. The image quality requirements, in combination with the loads and budgets, result in algorithmic choices.

The original software completely ignored the need for printing images on film, it was not even present! The developer crew assumed that radiologists would use the workstation for “soft” diagnosis. Soft diagnosis is diagnosis from the monitor screen instead of film. A better understanding of the radiologist was needed to get the focus on the film printing functionality. The story immediately clarifies the importance of film sheets for diagnosis. The story also provides input for the functionality to create the layout of images and text on film. The auto-print functionality has been added in an extremely pragmatic way, by (mis-)using examination data fields to request printing. This pragmatic choice could only be justified by the value of this function as was made clear in this story.

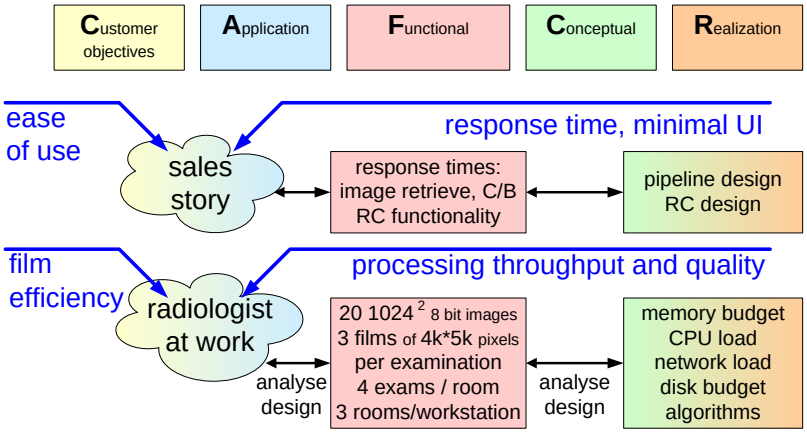

Figure 5: The stories in relation to the CAFCR views and the derived requirements and design choices

5 Conclusion

Stories have not been used explicitly in the case. Somewhat less specific oral stories were provided by the marketing manager. Quantitative information was described in a typical case. The facts for quantification were provided by application managers. The presence of a quantified typical case provided the means for design, analysis and testing. The lack of explicit story, in combination with the poor coverage of the *Customer Objectives* and *Application* views as described in Chapter **??** in general, caused the late addition of the printing functionality.

References

[1] Gerrit Muller. The system architecture homepage. `http://www.gaudisite.nl/index.html`, 1999.

History

Version: 1.2, date: March 17, 2004 changed by: Gerrit Muller

- small textual changes
- changed status in finished

Version: 1.1, date: February 27, 2004 changed by: Gerrit Muller

- added short description of batch like work by the radiologist
- added the developers assumption of "soft" diagnosis
- changed status in concept

Version: 1.0, date: November 13, 2003 changed by: Gerrit Muller
- many small textual changes
- changed status in draft

Version: 0.2, date: May 9, 2003 changed by: Gerrit Muller
- explained the film efficiency gain
- added text explaining the value of these stories.

Version: 0.1, date: April 29, 2003 changed by: Gerrit Muller
- repaired reference

Version: 0, date: April 9, 2003 changed by: Gerrit Muller
- Created, no changelog yet