

Case Sharing and Ontology Structuring in an Online Oral Medicine Community

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Abstract. The Swedish Oral Medicine Web (SOMWeb) is an online system built to support knowledge sharing among oral medicine practitioners who hold monthly telephone conferences to discuss difficult and interesting cases. Semantic Web technologies are used to model the templates used for case entry, the ontology of values used in filling in cases, and community data. To study the practitioners' use and perceptions of the collaboration and the SOMWeb system, we have used observations of teleconferences, interviews with participants, and an online questionnaire. These are analyzed to provide an understanding of the participants' opinions about the structured case entry and why they do or do not contribute. This is followed by a discussion on future work where the value ontology is made available for community editing and structuring, and incentives for user contributions to this process.

1 Introduction

Oral medicine is a small but growing subdiscipline of dentistry, with geographically distributed practitioners. To enable distance consultations and promote learning, the Swedish Oral Medicine Network (SOMNet) has been holding monthly telephone conferences for over ten years, where difficult and interesting cases are discussed. In 2006, the Semantic Web-based Swedish Oral Medicine Web (SOMWeb) system [1] was introduced to support these meetings and case entry, browsing, and analysis. Use and perceptions of SOMWeb have been studied through interviews, observations, and a questionnaire. Before the introduction of SOMWeb, cases were e-mailed as PowerPoint-presentations among participants before meetings. With SOMWeb, user-defined templates are used to generate forms for entering data for different kinds of consultations. When filling in such a form, values that may be selected for each question are taken from a user-defined value ontology, to which the user may add a value if it is missing. In this paper, we present the users' thoughts on the structured case entry introduced with SOMWeb. We also outline future work on an online tool for structuring the value ontology and discuss its possibilities and limitations, especially with respect to incentives.

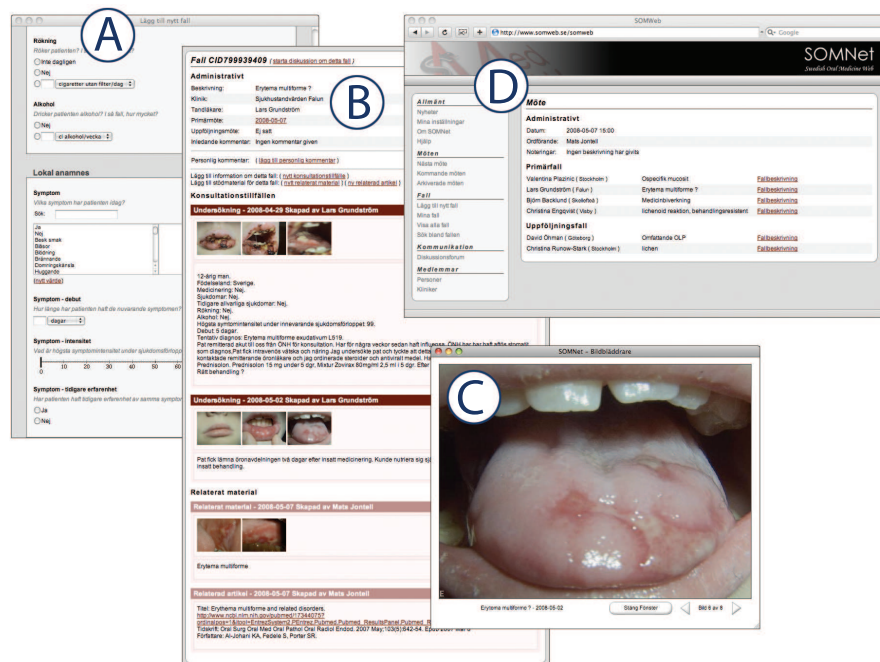


Fig. 1. The figure shows screenshots of key parts of SOMWeb: part of an examination data entry form (A), case presentation with pictures and text description generated from examination data (B), image browser (C), and a meeting page with case brought up for initial and follow-up consultation (D). All text is in Swedish.

2 The SOMWeb System

In September 2008, SOMWeb had 102 registered users located at 59 clinics. It has been used at 20 meetings and the case repository contains 105 cases. Currently, ten to fifteen clinics participate in each meeting. All members do not participate on each occasion, and there are meeting participants that are not SOMWeb members. The members are mostly dentists working in hospitals, primary care facilities, and private practice. Members provide their real names and workplace.

Before the development of SOMWeb began, meetings were observed and an online questionnaire was distributed. Several problems with the previous approach were identified, such as no shared record of discussed cases, that relevant information may be missing from the case presentation, and lack of written record of what was decided at the meetings. All these problems also make the use of entered case descriptions and results from meeting discussions as a basis for further analysis hard. The SOMWeb system was developed iteratively, including a selected group of users in the design process.

The functionality of SOMWeb is currently centered on cases and meetings. Figure 1 shows screenshots of important parts of SOMWeb. Meetings are added

to the system by users with an administrator role. Any member can enter a case and select a meeting for discussion. A link to the case presentation is automatically added to the page for that meeting. The owner can add more information about a case as it becomes available. All members can add information about relevant articles and information about related cases. The chairperson of a meeting can add case notes of what was suggested at the meeting. A user may also add private notes to any case. Cases in the repository can be viewed from the meeting pages, a list of all cases in the system, and via free text search.

The structured case entry form is generated from a user-defined OWL template of the examination. A template consists of categories (e.g., *PatientData* and *MucosAnamnesis*), with associated questions (e.g., current symptoms of the patient). The values that may be used in answering questions are instances of classes (e.g., *Diagnosis* and *Allergy*) in a value list ontology. The value list ontology was generated from a previous system of the research group, and all lists were initially flat, i.e., there were no subclasses of e.g., *Diagnosis*. Individual cases are stored in RDF. When viewing the case presentation, a case summary is generated from the RDFS labels. OWL is also used to model community aspects such as users, meetings, and cases, and data related to these are stored in RDF.

3 Methods for Studying Participants' Use and Perceptions

As part of a larger effort to study the use of SOMWeb and the communication of SOMNet, we have used an online questionnaire, interviews, and meeting observations. The online questionnaire had both open-ended and closed-ended questions, including a comparison of the SOMWeb system with the previous PPT-based approach. Responses were collected during one month in the spring of 2007, and 24 out of the at the time 60 members responded. From late 2007 to early 2008 nine members of SOMNet were interviewed to increase our understanding of how SOMWeb is used and of how it has affected SOMNet. The semi-structured interviews included questions on how the members perceived the new method for entering cases and the values list used. Of the interviewees, three had been members more or less from the start, three had been members for at least four years, and three had joined more recently. Each interview lasted between 35 and 85 minutes. Ten teleconferences have been observed by sitting at five different clinics during the meeting. These were carried out with the aim of seeing how cases were presented, how the participants behave locally, and how the system is used locally during meetings.

4 Case Entry

In reply to the questionnaire, 88% found viewing old cases better in SOMWeb, and 12% were neutral. Of the 24 persons answering the questionnaire, 29% had added cases. Of these, 87% thought adding cases was better in SOMWeb,

and 13% were neutral. Interviewees stated that SOMNet’s collaboration has improved with the SOMWeb system. Motivations were e.g., easier and less time-consuming case entry, more uniform case data, and the collected view of a case over time. Of the interviewees, six out of nine have added cases. Four find case entry easier with the new system compared to using PowerPoint. Two had difficulties: One used only the free text entry of the form, finding that it took too much time to fill in the form. The other brought up difficulties in deciding which data to enter for patients with complex clinical situations. An interesting conflict was identified where one interviewee thought duplicate and misspelled entries in the value list were problematic, while others found the breadth of values good and believed it impossible to have lists with no odd values. One interviewee thought questions were missing from the form. There is a tool in the system where administrators can upload new examination templates, which has not yet been used. It is probably the case that the community does not yet have processes in place to handle this issue and the current template is “good enough”. While one respondent had areas of interest that they wanted to be included, others voiced concern that they form would become too long.

From the observations and interviews we see mainly three purposes for adding and presenting a case: seeking advice regarding diagnosis or treatment, unusual cases, and where the presenter wants to raise an issue for discussion. Seeking advice is most common. About 25% of the members have submitted at least one case. Of the 105 cases in the repository, five people have submitted about 50%. One person has submitted 20 cases, which may be attributed to chairing (the chairpersonship of the meeting rotates among a several active members) meetings where few cases had been entered. There have been discussions among the core members of the group of how to get those less active to add cases and to speak at meetings. They have speculated that one issue is concern over revealing gaps in one’s knowledge. Some replies to the questionnaire, upon the question if they had considered adding a case but had not, indicated worry that it was not “advanced enough”. It has been suggested that one way to alleviate this is for senior members to add straightforward cases. Further, contrary to the worries of junior members, the experts find that what appear to be straightforward cases often lead to interesting discussions. Finally, a lack of time was an issue often raised by participants, either due to a heavy load of patients or teaching. This indicates the importance of easy to use tools.

5 Community Ontology Editing and Structuring, and Incentives for User Contributions

The interviewees find that as the number of cases in the system increases, more advanced methods of browsing and searching the cases are needed. One way of providing this is by adding more detail to the ontology from which instances are selected in entering case data. The current value list ontology contains no subclasses of e.g., *Diagnosis*. We are therefore interested in providing a tool to let the users provide more structure and detail to this ontology to enable

improved exploration of case data. In developing such a tool, there are several concerns. A major one is how to motivate users to contribute to the ontology structuring. Another is how to accommodate different conceptualizations of the domain.

In our research group's previous work to support oral medicine practitioners, a data analysis tool was developed. In the tool, the user may create aggregates of values to be used in grouping data, e.g., diagnosis categories. These aggregates are taken as a starting point for a more fine grained ontology for use in the case browser, but they do not cover the whole new value list, and some aggregates have been created with a certain analysis task in mind. Since diagnosis subcategories are well-covered by the aggregates, the users can use the case browser to get a more detailed view of subgroups of diagnoses. Through using this tool, a user may then discover that certain values are missing from e.g., a diagnosis subclass, and needs to be given the opportunity to add the value.

We are also considering adding a separate tool to SOMWeb to make groupings of values (subclassing) to be used in the browser. Initially the user may only want to "scratch their own itch", but that they can then decide to make the grouping public. This approach would both increase benefit for the structure provider, as well as permitting the user to create and test it in a way that does not lead to apprehension of exposing gaps in one's knowledge. A drawback of this approach is of course that users may opt mostly for the private approach.

6 Discussion

The purpose of introducing structured case entry is to attempt to gather all relevant data for cases. An immediate benefit of this is that this data is at hand for meetings. Further, it makes possible the case browser tool described above, which is currently under development. However, we also view structured case entry as a prerequisite for learning from clinical data. Our study of the use and perceptions of SOMWeb have lead us to find that its users enjoy the collaboration and find it useful, have slightly different opinions of on the goals of this collaboration and how it should be carried out, but agree that more people should be encouraged to participate and that lack of time is a barrier to most members. That only 25 % of members have submitted cases can be compared with the findings of Nonnecke and Preece [2] that lurkers often make up at least half of the subscribers of discussion lists. If we look at the reasons that two interviewees found the structured case entry unsatisfying (see Sec. 4), we see an inclination for narrative and reservations with distilling a patient's case to the structure of the form. While it may be possible to alleviate such issues with e.g., another interface, it also points to more general problems in deciding between structured data versus a narrative form. Related to this is the trade-off between completeness and complexity. If a more detailed form was provided, or maybe different forms for different diagnoses, then a more complicated clinical situation could be captured. However, filling in such a form would be more time-

consuming, which is also the case if more questions are added to cater to different interests.

Siorpaes and Hepp [3] observe that in ontology building the effort and benefits are often separate. In an approach where the structuring is done to perform analyses relevant to the user, some of this may be overcome. Another issue that often arises with knowledge sharing is that of trust, and such is the case here as well. For example, there has to be trust in the structures provided by others, and participants must trust that their contributions are taken seriously. Connected with trust is provenance, in this case knowing who contributed e.g., a new class to the ontology. This makes it possible to trace thoughts and find explanations for added structures. The creation of trust is a complex psychological and sociological issue. We believe that persons in a community with leadership roles are important in creating and maintaining trust in the community process and products. Thus, these people will probably be central in the structuring of the SOMWeb ontology. This may also be gleaned from that five members have contributed 50% of the cases. One may also observe that certain people more quickly take on a curator role, and maybe such a role should be provided in addition to the administrator role. In our interviews, for example, it became apparent that the respondents have rather varying sensitivities to detail. These differences must be handled in the tool as well, though perhaps they should be seen as a possibility rather than an issue, in that certain people will be more apt to perform clean up activities. White and Lutters [4] discuss the difficulties in getting heterogeneous groups to agree on a view of a subject and the level of granularity that should be used. This may be the case in SOMNet as well, and it will then have to be decided whether several conceptualizations shall be seen as valid or whether there should be a group process to decide upon one conceptualization.

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References

1. Falkman, G., Gustafsson, M., Jontell, M., Torgersson, O.: SOMWeb: A Semantic Web-based system for supporting collaboration of distributed medical communities of practice. *J Med Internet Res* **10**(3) (2008) e25
2. Nonnecke, B., Preece, J.: Lurker demographics: Counting the silent. *CHI Letters* **2**(1) (2000) 73–80
3. Siorpaes, K., Hepp, M.: Games with a purpose for the Semantic Web. *IEEE Intelligent Systems* **23**(3) (2008) 50–60
4. White, K.F., Lutters, W.G.: Structuring cross-organizational knowledge sharing. In: *Proc. GROUP '07*. (2007) 187–196