

Collaboration Patterns in an Online Community of Practice in Oral Medicine

Göran FALKMAN ^{a,1}, Marie GUSTAFSSON ^a,
Olof TORGERSSON ^b and Mats JONTELL ^c

^a *School of Humanities and Informatics, University of Skövde,
P.O. Box 408, SE-541 28 Skövde, Sweden*

^b *Department of Computer Science and Engineering, Göteborg University*

^c *Institute of Odontology, Sahlgrenska Academy, Göteborg University*

Abstract. SOMWeb is an online collaboration system based on Semantic Web technologies, which is used for knowledge sharing and dissemination within an oral medicine community in Sweden. Based on a previous study of the use of SOMWeb, general patterns of interaction and communicative activities involved in community collaboration have been identified. The patterns for one such activity, distance consultation, are described and modeled using techniques from the Pragmatic Web. It is also shown how patterns could inform system design.

Keywords. Collaboration, Information management-dissemination, Knowledge-based systems, Modeling, Dentistry, Human Factors

1. Introduction

Evidence-based medicine (EBM) entails integrating the expertise of the individual clinician with the best medical evidence obtainable from different knowledge sources [1]. Central to EBM is the externalization of clinical practice knowledge of the individual clinician into diffused knowledge (e.g., protocols and clinical guidelines), together with the possibility to exploit explicit knowledge sources [2]. Although social communication is essential for both the externalization and exploitation of knowledge, interaction and communicative actions are often neglected in HIS design [3]. One way to promote the externalization process is to provide IT-support for the communities of practice (CoP) [4] that is formed by practitioners of a medical domain, taking advantage of the practitioners' passion for their profession, their ambition of learning how to do it better, and their mutual interest of advancing the level of knowledge within their domain.

A prerequisite of IT-supported externalization of clinical knowledge is the representation of knowledge in a computer-processable manner. Within the area of knowledge representation, there has been much focus on ontologies during the past ten years [5]. However, despite much effort, the adoption of ontologies within the medical domain has turned out to be more problematic and slower than many had hoped [6]. Open

¹ Corresponding Author: Göran Falkman, School of Humanities and Informatics, University of Skövde, P.O. Box 408, SE-541 28 Skövde, Sweden; E-mail: goran.falkman@his.se.

problems include how a group agrees on how a concept should be represented and how an ontology of the individual can be reconciled with an ontology of the community. The Pragmatic Web [7] [8] is a recent extension to the Semantic Web² in which these problems are addressed through the use of reusable patterns of meaning and knowledge flows, patterns in which emphasis is put on the context in which knowledge occurs [9].

SOMWeb is an online CoP for the Swedish Oral Medicine Network (SOMNet) [10]. SOMWeb is based on the Resource Description Framework (RDF) and the Web Ontology Language (OWL) of the Semantic Web, and uses ontologies for representing examination templates, values used in filling in templates, and for representing community data (information about users, meetings, cases, and news). In our previous research, we have studied the clinicians' use of SOMWeb, as the first step in the elicitation of contextual factors and communicative activities involved in knowledge sharing processes in oral medicine [11]. The study suggested improvements to SOMWeb based on taking contextual elements related to the users, their activity, and their environment into consideration. We have also studied the possibility of using ideas from the Pragmatic Web to identify pragmatic patterns within SOMNet [12]. It was shown how activities in SOMNet could be seen as instances of the community activation pattern in [13]. In this paper, we describe how the pattern for a general activity within SOMNet can be modeled and how a specific instance of this pattern, the pattern for distance consultation, can be put into use in SOMWeb.

2. Methods and Materials

2.1. Study Context

SOMNet functions as a community of practice within oral medicine in Sweden. As such, SOMNet promotes the collection of cases for subsequent analysis and harmonization within the field. Through regularly held teleconference meetings, SOMNet provides means for distance consultations and learning for a broader audience. In this, SOMNet is an important platform in the interaction between oral medicine and related medical specialties. As of November 2007, SOMNet has about 70 members in Sweden.

SOMWeb is an online CoP for communication and knowledge sharing and dissemination within SOMNet. Members can add cases, with associated pictures, that are discussed at SOMNet meetings. The activities supported by SOMWeb include browsing cases, meetings, and members of the system; looking at presentations of individual cases and meetings (past, current, or future); adding and administering the cases one owns; administering meetings; reading news; and using the discussion forum, with threads both associated with individual cases and topics that are more general.

2.2. Methods

Since 2004, researchers from computer science and interaction design have regularly observed the SOMNet teleconference meetings. An online questionnaire was also provided to the members of SOMNet. Users were polled for, e.g., perceived usefulness of the system for performing certain tasks and for reasons having/not having used certain functionality. A selection of SOMWeb users has also been interviewed.

² <http://www.w3.org/2001/sw/>

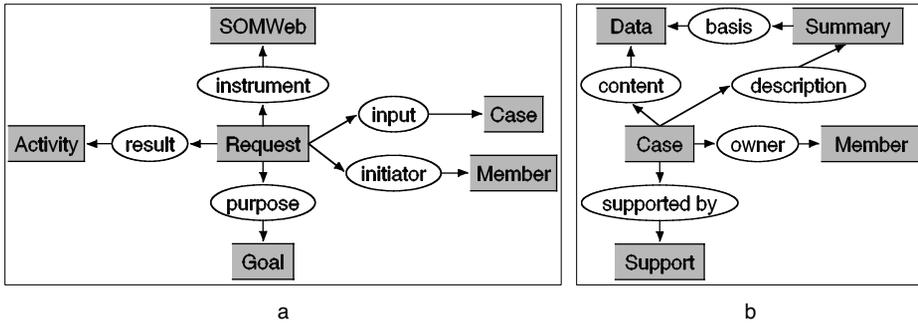


Figure 1. The activity request pattern (a) and case pattern (b).

3. Results

3.1. Collaboration Patterns in SOMWeb

Based on the study of the collaboration within SOMNET and the use of SOMWeb, we have identified a number of *collaboration patterns* that are involved in the SOMWeb activities that are the result of a user requesting some input on a specific case.

In general, such an activity is initiated by a member using the SOMWeb portal to issue a request, with the purpose of fulfilling some goal and with a specific case as the starting point. Figure 1 (a) depicts this *activity request pattern* using a conceptual graph notation [14]. Our study of the use of SOMWeb informs us that the goal of a member is seeking consultation on a case, wanting to share information about a case, or creating a discussion about a case.³ The case in question is part of the community resources, in that it has previously been added to the SOMWeb database. Every case has a member as its owner. The contents of a case consist of data, which in this case means examination data and photos, and a description of the case is provided in the form of a summary that is constructed using the template-based natural language generation component of SOMWeb. The case may also be supported by other resources, e.g., similar cases or various types of evidence. This general *case pattern* is depicted in Figure 1 (b).

The result of an activity request is an instance of the *activity pattern* (Figure 2). As

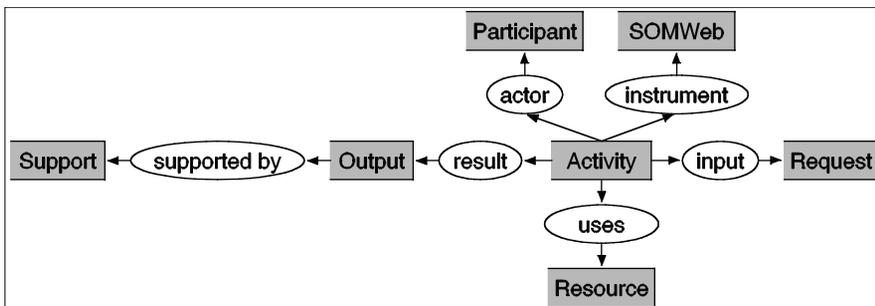


Figure 2. The activity pattern describes the implementation of an activity request.

³ For the reason of brevity, we will not give an explicit presentation of the conceptual graph type hierarchy used in the presented patterns, e.g., formally defining 'creating a discussion' to be a subclass of 'goal'.

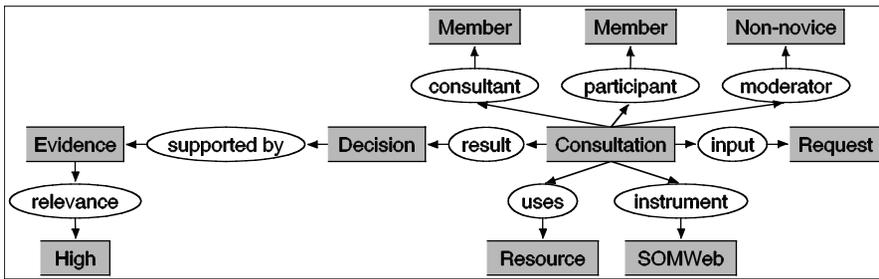


Figure 3. The consultation pattern is a specialization of the activity pattern.

was noted earlier, the resulting activity is case consultation, case sharing, or case discussion. Common to all three types of activities are that they take an activity request as input (including the purpose, initiator, and input case of the request), some action is performed by the participants of the activity, during which resources of the community (members and stored cases) are used, and that they result in some output, which is supported by some kind of support. In all this, SOMWeb is instrumental.

A specialization of the activity pattern is the *consultation pattern*, as depicted in Figure 3. The consultation pattern stipulates three types of participants: one moderator of the consultation, which must not be a novice user, one consultant, and any number of other participants, all of which are members of the community. The output of a consultation activity is a decision. In practice, there are three types of decisions: establishing a diagnosis, deciding on a treatment plan, and general advice on how to proceed with a case (including deciding on a follow-up meeting). The pattern also requires that the decision should be supported by evidence of high relevancy (and quality).

3.1.1. Patterns in Use

We describe the use of the collaboration patterns using the following plausible scenario, thereby also giving some hints on how the patterns could inform system design.

Consider a member, M, an expert in certain lesions of the oral mucosa that has added cases to SOMWeb several times before. When M wishes to add a new case for consultation to the system, M is presented with an input form, which is generated from an OWL description of the content of a case. Since the case will be the basis for a decision regarding diagnosis or treatment, the system could adopt a relatively strict policy regarding M entering fundamental case data. After completion of the form, the system could initiate a matching process to look for previous cases added by M on the same or similar subjects, and for identifying members within the same area of expertise. These cases and members become parts of the case's supporting resources.

When the case is added to the system, M has the option of assigning it to one of the upcoming teleconference meetings. However, the consultation pattern states that there should be a moderator of the consultation, and, by default, this will be the chairperson of the proposed meeting. The designated chairperson is automatically notified by email of M's consultation request. The chairperson could then decide not to schedule the consultation on the proposed meeting, e.g., because very few of the members that ought to be interested in this case can attend the meeting. When the consultation finally has been assigned to a meeting, invitations could be sent out to interested parties. Before the meeting takes place, a discussion thread can also automatically be set up in one of the discussion forums provided by SOMWeb, with the consultant as the moderator.

During the meeting, the system can use the consultation pattern to help guiding the chairperson/moderator through the discussions, towards a decision that fulfills the goal of M's request. The system could also act as an advisor during the consultation activity, by providing reminders to the supporting cases and cuing participants that have been identified to be especially relevant for the case to address the meeting.

At the end of the meeting, the system could secure that a decision is being made and that the outcome is recorded and communicated to the community. This also entails the search for relevant external medical evidence and the assessment of its quality.

4. Discussion

Patterns supporting interaction and communicative actions in clinical knowledge processes can be one part of promoting EBM. Patterns put emphasis on the caregivers' interests and needs and on the contexts and processes in which different evidence occurs, thereby giving the clinicians the experience that EBM services are beneficial. Thus, pattern-based services have the potential of being integrated into clinical practice and therefore offer good possibilities for long-term use and increased patient benefit. In addition, general reusable patterns of clinical knowledge and decision-making could be turned into improved health care strategies, which over time provide new evidence, adding to the foundation of EBM.

In [13], generic collaboration patterns are used to describe community memory activation. In terms of our consultation pattern, the *goal pattern* would be to establish either a diagnosis or a treatment plan, supported by the best medical evidence available; *communication patterns* would include getting approval of the submitted case from the designated chairperson; *task patterns* would include recording the outcome of the meeting; an *information pattern* would be how to search for relevant medical evidence and assess its quality; and a *meta-pattern* would describe what to do if no relevant evidence supporting the decision can be found.

While we find the approach of [13] to be a good starting point, it does not directly address the questions of the origin of patterns and on what level of abstraction patterns should be defined. One way forward could be to connect the elements of community collaboration with an ontology over organizational elements. For example, in identifying and describing the goal patterns, the normative structure of the relationships that exist among members of an organization (e.g., values, norms, and role expectations) [2] could be useful. Further, the behavioral structure of an organization can be described in terms of activities and interactions between members, and, thus, could be used for identifying relevant communication patterns. Finally, in identifying and describing communication and information patterns, the technologies (material resources as well as technical knowledge and skills of members) available are a factor to consider.

A SOMNet meeting is an example of a multidisciplinary medical team meeting (MDTM), where the team members meet to review patient cases, establish a diagnosis, and decide on the most appropriate treatment plan for the patient [15]. The processes associated with a MDTM system are: (1) pre-meeting activities; (2) case presentation; (3) case discussion, including negotiation and reinterpretation of findings; (4) deciding on the diagnosis and treatment; (5) recording of the outcome; and (6) post-meeting activities. The same processes can be discerned in a SOMNet meeting. The processes 2–5 of a MDTM could serve as the appropriate level of abstraction (or granularity) for identifying and defining sub-patterns within the consultation part of the consultation pattern.

5. Conclusions

We have described how a pattern for a general collaboration activity within a CoP in oral medicine can be modeled, and how a specific instance of this pattern, the pattern for distance consultation, could be put into use in SOMWeb, an existing online CoP. The case study indicates that research on collaboration patterns within the Pragmatic Web can be useful in this, but that it would benefit from the addition of research on organizational ontology and multidisciplinary medical team meetings.

The long-term objectives of our research are to identify, represent, and make use of recurring patterns of interaction and communicative actions in clinical knowledge processes within oral medicine, patterns that could inform the design of online CoP. In the short term, we intend to continue studying the use of the SOMWeb system. As for patterns, the next step is to refine the consultation pattern and formalize the conceptual graph representation of patterns by extending the SOMWeb ontologies.

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