Heuristic to Support the Sociability Evaluation in Virtual Communities of Practices

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Abstract. The Virtual Community of Practices (VCoPs) create collaborative spaces that promote cooperation and the construction of knowledge, because provide communication and interaction between individuals so that knowledge and experience are utilized in a coordinated manner. A significant aspect of VCoPs is sociability, because it is related to the manner that people interact in the environment. Therefore, the objective of this work is assist expert professionals in the planning and creation of VCoPs interfaces, from proposition of a heuristic evaluation of interfaces these communities in order to minimize the difficulties of users concerning the sociability. The proposed heuristic was applied in the evaluation some VCoPs aiming the construction of virtual communities that allow a higher quality interaction for participants, respecting the guidelines for good sociability.

Keywords: Heuristic · Virtual community of practices · Interface evaluation · Human-Computer interaction · Sociability

1 Introduction

The Virtual Community of Practices (VCoPs) are developed in order to allow the users to discussing about a subject and sharing experiences using the Web. The VCoPs inherent aspect is the sociability, that, according to [2] "is the human skill of establish networks, using units of individual or collective activities and makes circulate information representing the interests and opinions".

The VCoPs are also interactive systems and usually it is developed without planning and the final product does not achieve the basic user requirements such as usability and sociability. Many times, the users don't use a software because it is difficult to manipulate, has low levels of usability and does not provide appropriate sociability requirements.

This paper presents the proposition of a heuristic to support the sociability evaluation in VCoPs. The heuristic was created, mainly, based on [13], which proposed

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some guidelines to be used in order to achieve sociability in websites. Other researches such as [18] that presented the concepts of a CoP and their relations (community, members, competences, collaboration, decision-making and CoP resources) and the [6] research that organized the collaboration concepts in a model named Model 3C (communication, coordination and cooperation).

After the evaluations performed using the proposed heuristic, we proposed guidelines to be applied in the VCoPs in order to improve the sociability requirements such as: purpose, policies, knowledge, skills, behavior, communication and others. So, we intended to decrease the bad experiences of users, reducing the problems in the VCoPs.

This research was performed in five stages: (1) Definition of the parameters of analysis; (2) Select the evaluates according to the profile required; (3) Orientation to the evaluators as heuristic guidelines; (4) Application of heuristics in evaluating VCoPs, realized individually by each of the evaluators; and (5) Analysis of results.

2 Virtual Communities of Practices

The expression "Community of Practices" (CoP) provided by [9] is defined as a group of people that share knowledge about some subjects and aim to interacting regularly in order to improve the knowledge about this subject [22]. The community builds relationships that allow the easiest communication among their members and so, allows the all the members learn about a theme [20].

According to this concept, [6] write: "The Collaboration allows the improvement and complementation of the skills, knowledge and individual efforts".

A CoP is structured in three main components [22]:

- Domain: the knowledge that guides the community, that defines the identity and the main issues that the members should discuss about;
- Type of Community: the community of interests, the community of apprentices or goal oriented;
- Use strategy: The strategy used by users to perform their tasks.

The CoPs can be available in virtual environment such as Internet or Intranet. These CoPs are named Virtual Communities of Practices (VCoPs). This concept was defined by [16] as a group of people that share the same interests by the Internet.

A robust research in order to contribute the improvement of collaborative learning was realized by [18]. The concepts related to members, resources and knowledge were defined from the research on 12 CoPs of the Palette4 project [8]. Table 1 presents a summarize, made by [19] from research of [17, 18].

A CoP involves a series of elements (actors, resources, competence, activists, among others) and their inter-relationships, necessaries to achievement of objectives. On your work [18] presents the main elements and the semantic annotations to the learning process on CoP.

These concepts (Table 1) also are inherent to VCoPs, since that virtual communities demand similar characteristics to a real environment with relation to interaction. Thus, can be notice that a VCoP also presents the following concepts: has a motivation;

Table 1. Main CoP concepts. [20]

CoP – Main concepts		Authors
Community	Motivation, Domain, Practice	Wenger (2010)
	Area; Purpose; Structure Composition	Tifous et al. (2007)
	Cultural Diversity	Langelier (2005)
Members	Personal Characteristics; Type of involvement; Role in the CoP, Peripheral Role	Miller (1995), Tifous et al. (2007)
Competence	Type of Competence	Tifous et al. (2007)
Collaboration	Collaboration objective; Collaboration Activities; Roles; Geographic Dimension; Temporal Dimension; Collaboration Resources; Media; Type of interaction	Vidou et al. (2006)
	Engagement; Coordination	Deaudelin et al. (2003), Weiseth et al. (2006)
Decision-Making	Resources for Decision-Making; Results; Actors involved; Strategies	Tifous et al. (2007)
CoP Resources	Interactions registration; Tools CoP	

presents a domain that characterizes; has cultural diversity among its members; presents the differentiation of roles among its members; gathers different competences, needs that its members to communicate, cooperate and coordinate the group activities; among others.

3 Interaction Design on VCoPs: Collaboration and Sociability

The CoPs are collaboration environment aimed to provide the cooperation and the knowledge building due to the reason that allows the interaction among members in order to share their knowledge and experience in a coordinated way.

Due to the CoPs features, it can be related with collaborative system because both aim to meet users in order to discuss about a subject and collaborate with others to achieve a common objective. These tools allow the participants to interact among them to contribute in the collective knowledge improvement [15].

The 3C collaboration model is a model to support the collaborative tools design. The model is based on the definition that to collaborate, the participants need communication, coordination and cooperation.

According to [7] to collaborate, the people establish communication among them and during this communication, tasks are created. The tasks are created and managed by the CoPs manager. The manager organizes the group to ensure that the tasks to be performed in cooperation and in the correct order and time. The perception is essential to provide the collaboration about the subject discussed in the environment to the members.

Considering the increase of the number of VCoPs users, the developers needs to concern not only in the usability, but also in the sociability features [5]. According to [14] the sociability is the join of people in order to generate purposes and practices where the participants share the same idea and has several relations (harmonic or conflicting) allowing them always acquiring knowledge and competencies of others about the subject.

Each VCoPs user has previous knowledge about a discussed subject and due to this reason the information are distributed quickly and directly. Thus, case a problem occurs, the same problem can be solved faster [14].

Preece [13] quotes three components that support a high level of sociability: (I) Pupose: the subject shared by the community members, an interest, an information, service or support that provide a reason to a user to subscribe in a VCoPs. (II) Participants: Users that work in different tasks in the community such as manager, moderator, simple users; and (III) Policies: languages, protocols that guide the interaction among the users. Forms policies, register policies and codes of conduct can be necessary. Therefore, to promote a high quality level of sociability the VCoPs should provide a purpose and the users should be engaged in a common subject supported by policies and practices in the social interaction.

4 Heuristic for Sociability Evaluation in VCoPs

Barbosa and Silva [3] describe that the main goal of the evaluation is to enable the delivery of the product with best quality guaranteed, to fix problems and to increase the users' productivity and their satisfaction towards the product. In the long run, the evaluation may not only decrease training and support costs, but also increase the user satisfaction and minimize planning of future versions of the system, as the evaluation may call the attention of the team concerning parts that may be further explored or improved.

In order to perform the interface evaluations in the literature, mainly three methods are discussed: investigation method, inspection method and observation method. The inspection method was adopted for this paper. In this method, the evaluator examines a solution of IHC, trying to predict possible consequences of certain decisions of design upon experiences of use. Furthermore, the evaluator deals with experiences of potential use, and not actual use. There are three types of inspection evaluation: heuristic, cognitive course and inspection semiotic. In this research is proposed a heuristic to inspect VCoPs, in order to seek sociability problems involved in VCoPs.

Barbosa and Silva [3] report that heuristics for evaluation may guide the evaluators to inspect the interface, aiming to find problems that hinder its use. The heuristic is a fast and low cost alternative as opposed to empirical methods. Nielsen [12] recommended that the evaluation should involve three to five evaluators. Table 2 presents activities involved in the heuristic evaluation [3]:

Taking into account the preparation activity, the evaluators organize the screens of the system being reviewed and the heuristics list or guidelines that should be taken into consideration. The solution evaluated may be the own working system, executable prototypes or not executable. Moreover, it is recommended that the evaluator scroll the

Table 2. Heuristic Evaluation [3]

Activity	Tasks
Preparation	*All the evaluators:* to learn about the current situation: users, domain, among others. To select the parts of the interface that should be evaluated.
Collection and data interpretation	*Each evaluator, individually:* to inspect the interface to identify heuristics violations; to list problems found by the inspection, indicating location, severity, justification and recommendations for the solution.
Consolidation and Result Report	*All the evaluators:* to revise problems found, judging its relevance, severity, justification and recommendations for the solution; to generate a consolidated report.

whole interface at least two times before starting the analysis, in order to be acquainted with its ergonomic, iconographies and operational features [1].

Next, the evaluators start to the collection step and data interpretation. Each evaluator should inspect each selected screen aiming to determine whether the guidelines were respected or violated. Each violation is perceived as an IHC problem. Therefore, evaluators should note every problem, location, severity and violated guidelines.

Finally, the evaluators convene a meeting to consolidate the results. Each evaluator shares a problem list. Next, the evaluators perform a new evaluation, which each evaluator is able to assign a new severity degree for each problem. The evaluators talk and find an agreement on the final severity degree of each problem and decide what problems and suggestions should be part of the final consolidated report.

4.1 Proposal Heuristic – SVCoP

In this section, the sociability evaluation heuristic of VCoPs, named SVCoP (Sociability in Virtual Communities of Practice), is presented. SVCoP was organized, in its first level, according to the structure of [18], which defines that CoP is characterized by the following aspects: "Community", "Members", "Competence", "Collaboration", "Decision Making" and "CoP Resources". As the aspect "CoP resources" is connected to all other concepts to support them. In addition, "CoP Resources" was also eliminated from the first level of the model, but it appears in the details section of the heuristic evaluation. Figure 1 shows the structure of the heuristic proposal.

The heuristic is structured as follows:

- "Community" refers to the domain, objective, composition and cultural diversity of CoP. In addition, "Community" is aligned to the concepts of [13], "purpose" is a reason why a member would belong to VCoP and "policies" are records and codes that guide interpersonal interactions in VCoP.
- "Members" are people from CoP with your given roles and personal features, referring to the features of people from VCoP, to their different roles and positions.

Fig. 1. Heuristic Structure

- "Competency" is defined as a set of resources provided to be acquired by [18]. The resources to acquire the expected competency are "knowledge", which refers to acquiring theoretical information of a determined subject, "skills", which is the capacity of an actor to perform tasks in practice and "behavior", which is summarized by the way in which actor behaves in a group or in a particular situation.
- "Collaboration" groups concepts of "communication", "coordination", "cooperation" and "perception" as cited by [6] in Collaboration Model 3C, in the second level. This model is based on the premise of in order to have collaboration, not only communication junction, but also coordination, cooperation and perception is required.
- "Decision Making" refers to available resources for such, to the individuals involved and to the strategies utilized in the process.

From the aforementioned concepts, a set of questions has been elaborated. The questions (for each axis) comprise the proposed heuristic requisites, and are detailed in [10].

In the "Community" axis, the following items have been analyzed: Purposes and Policies. In addition, seven questions were developed aiming to analyze the community purpose, among them: Is the purpose of community in accordance with its given name? Does the community clearly transmit its intentions to its users?

To analyze the Policies, eleven questions were developed, among them: Does the community present policies of use for all developed activities (registration, publication, commercial transactions, copyrights, among others)?; Is the reliance of the community encouraged by a policy or by a procedure?; Are there any form of complaining in case the community is incorrectly utilized?

In the "Members" axis, eight questions have been elaborated, among them: Is the registration required when a person intends to either become a member of the

community or leave the community?; Are anonymous users and visitants allowed?; Can a member assume a given role in VCoP (facilitator, participant, coordinator, among others)?

In the following axis, "Competence", the following items have been analyzed: "Knowledge", "Skills" and "Behavior". Five questions have been developed concerning "Knowledge", among them: Can VCoP members acquire required information on the VCoP operation?; Is information on subjects discussed in VCoP clearly transmitted?; Is the user-to-user knowledge clearly transmitted?

The "Skills" are analyzed from three questions: Is the responsibility of each member to perform tasks presented in VCoP?; Can members learn and transfer their knowledge in VCoP?; Do members assume responsibilities, risks, and consequences of their actions and, as a result, are recognized?

Finally, the "Behavior" is analysed from three questions: Does VCoP allow the evaluation of its members' satisfaction?; Does VCoP register the actions of each member aiming to be able to analyze their involvement?; Are there many ways employed in VCoP to motivate their participants?

In the next axis, "Collaboration", questions have been elaborated to analyze the following terms: Communication, Coordination, Cooperation and Perception. Seven questions have been developed in order to analyze the communication, among them: Are there several ways to communicate in the community? For instance: by written (text), by speech (audio), by pictorial (images and animations) and by gestures (video and avatar); Are there a way to read and send messages promptly (after the formulation of the message as a whole by the sender) (asynchronous communication)?; Can I express myself in the way I expect? For Instance: the type of speaking (whisper, speech, question, yell, answer, acceptance, disagreement), the type of speech (direct or indirect), and the type of emotion (happy, normal, angry).

The analysis of the "Coordination" was performed through six questions, among them: Does the community encourage empathy, confidence and cooperation?; Generally, is the community a nice place, where people are able to do what they want?; Does the community offer the availability status of the users (available, busy, away, among others)?

In order to analyze the "Cooperation", four questions were developed, among them: Are there any activities in which members depend on each other in VCoP when performing any tasks?; Are there group activities?; Does the community show any types of records to store posts that have been already published?

"Perception" was analyzed from five questions, among them: Can people see other members online in the community?; Can people see what the other members are doing in the community?; Does the community present the role of the users to other members (facilitator, participant, coordinator, among them)?

Finally, in the axis "Decision making", have been developed three questions: Does the community promote assistance for decision-making? (E.g.: Consensus - all the members decide, Majority – the majority opinion wins, Minority – a subcommittee decides, among others); Is there any specialist holding specific knowledge for decision making regarding a determined task?; Is there an authority (moderator/leader) for decision making in VCoP?

From the developed heuristic, the validation was applied, followed by the methodology described in the next section.

4.2 Heuristics Application Methodology

To perform the evaluation was created an online form containing 61 questions corresponding to heuristic guidelines. From these questions, the evaluators were able identify if the guidelines were respected or violated in VCoPs.

The form was distributed to five expert professionals that evaluated seven communities of practice. For the purpose of provide greater familiarity with VCoPs, the evaluators were able choose which would be evaluated.

To assist the evaluation process, some parameters were established to the verification of 61 questions that constitute the heuristic. The parameters vary from 0 to 2 as follows: (0) No – when there is not occurrence. The aspect is not identified in VCoP; (1) Partially - partial occurrence. The aspect is identified not satisfactorily in VCoP; (2) Yes - when the occurrence is complete. The aspect is satisfactorily in VCoP.

For instance, the area "policies" to the question that checks if "Use policies are presented?" are proposed the following options: (0) No - use policies do not presented in VCoP; (1) Partially - use policies are presented only the moment of member registration in VCOP; (2) Yes - use policies are remembered at several moments during use of VCoP.

Therefore, for each question were presented three alternatives to analyze the occurrence of sociability guidelines in VCoPs.

In order to evaluate the proposed heuristic, concerning to completeness, strengths and weaknesses, was created another online form with eight questions to be answered by the evaluators at the end of the evaluation of VCoPs. With this questionnaire, evaluators could contribute with suggestions for improvements to the proposed heuristic.

4.3 Results and Discussion

From the tests conducted through the SVCoP, we could identify the aspects of sociability which are well explored in VCoPs and aspects that present themselves poorer. Some of the issues involving the various analyzed axes (Community, Member, Competence, Collaboration, Decision Making) are highlighted in Table 3.

The best evaluated aspects are related to Community axes (Purpose and Policy), Members and Competence (knowledge, skills and behavior). It was observed that the purpose of the evaluated communities is presented very clearly and prominently, motivating its participants for their use. The policies are widely disseminated and there is a strict control for security of confidential information, bringing confidence and encouraging participants along the interaction activities. Regarding the Members, it was observed that the VCoPs well delimit the roles of each member in the community, but mostly also allow access to anonymous users. On competence, it was found that the VCoPs have several ways of sharing information contributing to the construction of knowledge.

Table 3. Some questions of heuristics - SVCoP

Heuristic - SVCoP	VCoP 1	VCoP 2	VCoP 3	VCoP 4	VCoP 5	VCoP 6	VCoP 7
Does the community clearly transmit its intentions to its users?	2	1	2	2	2	2	2
Is the reliance of the community encouraged by a policy or by a procedure?	1	0	2	1	0	0	0
Are anonymous users and visitants allowed?	0	2	1	0	2	2	2
Can a member assume a given role in VCoP?	2	2	1	2	2	2	2
Can members learn and transfer their knowledge in VCoP?	1	2	2	2	2	2	2
Does VCoP allow the evaluation of its members' satisfaction?	1	0	2	0	0	2	0
Does VCoP register the actions of each member aiming to be able to analyze their involvement?	1	1	2	2	2	2	2
Are there several ways to communicate in the community? For instance: by written, by speech, by pictorial and by gestures.	2	1	2	1	0	0	0
Does the community encourage empathy, confidence and cooperation?	2	2	2	2	2	2	2
Does the community offer the availability status of the users?	2	0	0	0	2	2	2
Are there group activities?	2	2	1	1	2	2	2
Does the community show any types of records to store posts that have been already published?	2	2	2	0	0	0	0
Does the community promote assistance for decision-making?	2	0	0	2	0	0	0
Is there an authority for decision making in VCoP?	2	2	2	0	0	0	0

The aspects that have shown a lower incidence were related to the Collaboration and Decision Making. The VCoPs demonstrated weakness with regard to communication, regarding the accessibility and forms of communication. Coordination in VCoPs is not explicit, usually because they have a more informal organization. Perception already demonstrated great deficiency in his assessment, appearing as one of the worst aspects evaluated. The lack of visibility regarding the actions of participants

and roles performed are the main difficulties pointed out. The assessment indicated that the VCoPs, mostly do not have tools for Decision Making as voting arrangements, polls, among others. Two out of seven communities have a specialist for decision making. This limitation, in the view of some evaluators, makes less democratic VCoPs.

After evaluating the VCoPs, some questions about the facilities and difficulties encountered during the evaluation process were answered by the evaluators. A summary of the opinion of the evaluators is described in the following:

- All evaluators responded that: (i) the heuristic is complete with respect to the sociability aspects evaluated, however, found a very extensive evaluation, consequently tiring, (ii) the main difficulties are related to the lack of familiarity with the VCoPs, prejudicing the identifying some aspects.
- Three evaluators observed that the heuristic could include an alternative to contemplate exceptions, such as: "It is not possible to evaluate".
- Two evaluators reported that: (i) it is necessary explain the aspects that appear in the questionnaire (community members, competence, among others) to facilitate the evaluation; (ii) some questions are repetitive, then, they suggest remove it.
- One reviewer suggested adding a question to identify if the VCoP disseminates knowledge beyond its members (eg. Open videoconferences).

In general, the evaluators demonstrated satisfaction with the proposed heuristic. One very positive aspect is associated with completeness of the aspects of sociability; however, the extension was criticized by most evaluators. These suggestions have contributed to the refinement and improvement of the heuristic.

5 Conclusion

This paper proposes a heuristic model to support the designers to create VCoPs with interfaces according to sociability features.

The heuristic, called SVCoP, presents its guidelines organized by aspects which are considered intrinsic to VCoPs: Community (Purpose and Policies), Members, Competence (Knowledge, Skills and Behavior), Collaboration (communication, Coordination, Cooperation and Perception) and Decision Making. Then, were developed 61 questions to cover all aspects and their interrelationships. The questions were applied for five evaluators at the end of the reviews suggested improvements to heuristic SVCoP.

Some perceptions about Sociability were possible with the reviews, among them: Most communities makes clear the group's intent and provide information for the environment to reaffirm your purpose; Policies are present only in the registration of one member and are not remembered along the interactions in VCoPs; The VCoPs offer some forms of communication (discussion forums, chat, email), but they do not stimulate the participants to develop their own communication styles.

A relevant aspect observed is that most VCoPs not present activities that can be developed cooperatively. Another important aspect that proved absent in VCoPs is the treatment of copyright issues and protection of confidential information.

As partial result, it was identified that the instrument proposed enabled to evaluate diverse sociability aspects in VCoPs. From the suggestions of the evaluators about the model of heuristic, were made some changes, such as, the inclusion of an alternative "Can not evaluate", and the refinement of some issues, including its change, inclusion and exclusion. Included is also links with explanation of key words of the questionnaire, such as, cooperation and perception.

As future work, it is intended to perform further assessments in order to refine and improve the heuristic. In addition, it is intended apply the heuristic to other types of collaborative environments.

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