

# Quality Assessment of Awareness Support in Agile Collaborative Tools

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**Abstract**—Computer Supported Cooperative Work (CSCW) is a research field focused on understanding characteristics of interdependent group work with the objective of designing adequate computer-based technology to support cooperative work processes. One of the key concepts of CSCW is the provision of relevant information to workers in a team, a concept named awareness. As the market and research community have already perceived the importance of providing fast and reliable information among team workers, it shares the interest of CSCW in awareness improvement. This addresses the following research question: What is the quality of awareness support in agile collaborative tools? To answer this question a survey was performed with 200 users which provided feedback scores for each given design element related to support of different awareness aspects. We used a Formal Technical Review (FTR) method specifically focused on awareness assessment, named Awareness Checklist. According to this method, there are 54 design elements that influence or contribute to awareness support. Those elements can be categorized in 14 design categories, which are directly related to six awareness types: Collaborations, Location, Context, Social, Workspace and Situation. We found that Microsoft Team Foundation Server, Jira and Trello offer more collaborative aware support, however about localization and context the DotProject tool obtained the highest score, as well in Social and the Situation too. The results offer the opportunity to assess the quality of awareness in any collaborative software used in small or bigger business projects and can be used to demonstrate certain aspects of the software which can be improved to achieve their user’s satisfaction. The same concept can also be used to outline the tools main advantages and disadvantages, acting as a quality reviewer that can help to choose which collaborative tools should be adopted according to categories strengths and weaknesses.

**Keywords**— CSCW; Computer Supported Cooperative Work; Awareness Support; Collaborative Applications.

## I. INTRODUCTION

Facing the growing complexity of business, the worldwide nature of markets has forced many companies to decentralize their organizational structures. With regard to organizations whose value are based on information technology, it is clear that they are under pressure to deliver products with better

quality at greater speed [1]. These companies spend considerable effort increasing the effectiveness of their production processes, augmenting their product quality, and reducing the time-to-market. They require optimally tailored working environments, which open new application domains for Computer Supported Cooperative Work (CSCW) [2]. CSCW has emerged as an identifiable research area focused on the role of the computer support in group work [3], it indicates a variety of technologies that enable teams of workers to cooperate electronically [4].

A CSCW system relates functional features with the social aspects of teamwork. Each functionality has an impact on the work behavior and efficiency of the whole group using the system. These functionalities also influence the behavior of individual group members. However, the psychological, social, and cultural processes active within groups of collaborators are the real keys to the acceptance and success of CSCW systems [2]. According to the CSCW characteristics, the applications tend to include, at least, communication as one of its functions, used by members of the organization [5].

In Software Engineering, CSCW tools are used in communication between the development team they enable greater collaboration in environment work [6]. To understand the quality of CSCW tools in context of Agile Software Engineering, this paper addresses the following research question: What is the quality of awareness support in agile collaborative tools? To answer this question, we evaluated the awareness support tools available in the market by user perspective. For this purpose, we used the evaluating of CSCW tools through the approach presented by Antunes *et al.* [7], [8]. Their awareness checklist proposal was adapted to be used with a broader profile or respondent. The statements used to evaluate the 54 design categories were translated to the respondents’ native language (Brazilian Portuguese) and the resulting radar graph has been adapted to display only positive results, as this eases comparison of the evaluated tools among themselves.

The survey was carried out with 200 IT professionals, each one of them selected a tool to evaluate, in total was evaluated 20 collaboration tools regarding their awareness categories.

The results outline some of the strengths and weaknesses that can be used to propose improvements or help users to choose which tool should be implanted, given an awareness category in concern. The lowest overall evaluated score category was location awareness with an average of 238.48 out of 600 points, while the highest was workspace awareness with an average of 374.62 out of 600 points.

As result of this research, we found that the tools: Microsoft Team Foundation Server and Atlassian/JIRA achieved a Good rating score in Collaboration Awareness Support. Yet about localization, the DotProject and Microsoft Sharepoint tools obtained good scores about localization, context, social and situation, as well Redmine that achieved good scores in social, situation, too, beyond workspace.

The results offer the opportunity to assess the quality of awareness in any collaborative software used in small or bigger business projects and can be used to demonstrate certain aspects of the software that can be improved to achieve their user’s satisfaction. The same concept can also be used to outline the tools main advantages and disadvantages, acting as a quality reviewer that can help to choose which collaborative tools should be adopted according to categories strengths and weaknesses.

This paper is structured as follow: in Section II describes the background about CSCW and the concepts of awareness checklist. The Section III lists the related work. The Section IV presents the survey. Section V discusses the results. The Section V presents the threat to validity and the Section VII summarizes the conclusion.

## II. BACKGROUND

### A. CSCW Awareness

Computer Supported Cooperative Work (CSCW) is the study of how people use technology with relation to hardware and software, to work together in shared time and space. CSCW began as an effort by technologists to learn from anyone whom could help better understand group activity and how one could use technology to support people in their work. It includes areas of research like economy, psychology, anthropology, organizational theory and education [9].

One of the main purposes of CSCW is the provision of information to each worker on the presence and the activities of other group members. This information is called group awareness and has been a central topic of research because it satisfies the need of collaborators to watch each other’s activities and coordinate accordingly their own work [10]. Studies have found awareness to be an important component of a collaborative system [9], [11]. Users’ mobility increases the need for awareness since the collaboration environments typically change very often in this case [8]. Awareness support is a challenge for synchronous CSCW, where interactive responsiveness is the foremost goal. This implies that awareness information must be provided at a properly fast pace to convey the status of cooperative work without outstripping the collaborators’ ability to perceive it [4].

According to [12] [13] [14] [15] [16], there are six main awareness elements, which in Antunes et al. [8] base its model, called Conceptual view of awareness support, shown in Figure 1 and further described.

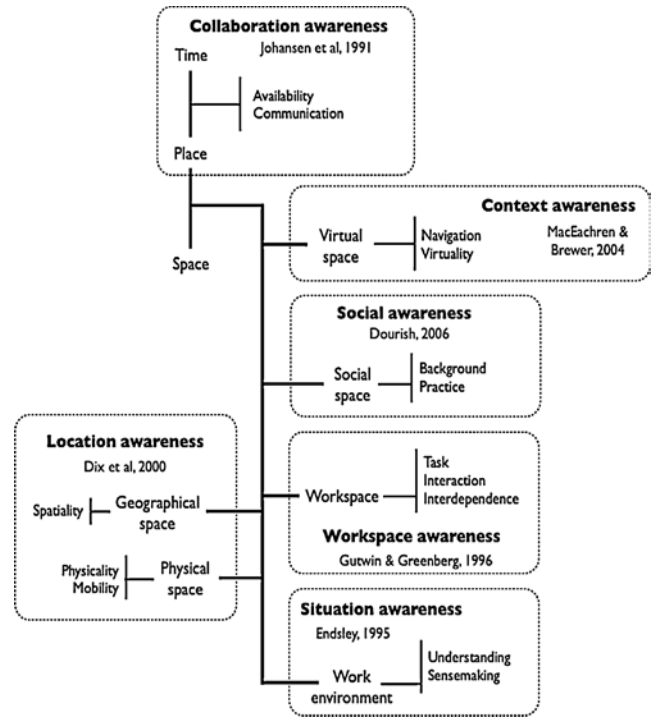


Fig 1 Conceptual view of awareness support [8]

**Collaboration Awareness:** Based upon the work of DeSanctis and Gallupe [17] on the support to remote and local groups, the time/place map proposed by Johansen et al.[12] is the most prevalent subject related to collaborative applications. It considers group availability (whether people are working in the same location or remotely) and the communication mode (whether the information exchange is synchronous or asynchronous). Also, still related with communication modes, we should also consider that network operations affect collaboration awareness, as perceiving network connectivity (connected/disconnected), message delivery (which affects the flows of communication and collaboration) and message delays have been considered important design features for collaboration support [18].

**Location Awareness:** In this context, location can be understood as geographical relationships among collaborators such as location, distance, orientation and range of attention [19]. Dix et al. [13] characterized location as either being Cartesian or topological. Especially regarding mobility, location awareness can contribute to improve the usability and usefulness of mobile applications [20] and it has been categorized in wandering, visiting and traveling [21]. Weather conditions and local temperature information are also related. Hazas et al. [22] discuss location awareness as the means to determine physical location using various types of sensing technology such as GPS and RFID. Hazas et al.[22] also make the distinction between physical and semantic locations such as rooms, floors and buildings.

**Context Awareness:** Rodden [3] developed the notion of virtual space as a collection of computer-supported interactive spaces. Many collaborative applications offer various types of virtual spaces, including virtual meeting rooms, media spaces and collaborative virtual environments [8]. In this case, concepts such as virtual topology, navigation and viewports are very important to allow a group of collaborators maintaining a sense of what is happening in the virtual space.

**Social Awareness:** Dourish [23] proposed social spaces as adequate to understand broader issues related to social practice and context. Dourish [24] also proposed the notion of embodied interaction to account for the embedded relationships between social and the other spaces. It combines geographical, physical and virtual affordances with social interaction, cultural meaning, experience and knowledge [8].

**Workspace Awareness:** Snowdon and Munro [25] describes a workspace as a container of places with ongoing activities. It's possible to distinguish two different aspects of workspaces: (1) workspaces may organize activities according to logical sets (i.e. a group editor, as it serves to organize activities like writing and revising, while maintaining a coherent view of the whole [26]); (2) workspaces also introduce geography as an important context for working activities[8]. Most workspaces have a main purpose of organize tasks, which are characterized by who, what, when and how they are accomplished. Feedthrough is necessary to bring information about the other's actions and backchannel feedback conveys unintentional information indicating that the listeners are following the speaker [27].

**Situation Awareness:** Jensen [28] combined situation awareness with sense making, a theory developed by Weick [29], [30] to understand the relationships between environmental changes and organizational responses. Sense making is defined as the capability to create order and make retrospective sense of what occurs through the articulation of several cognitive functions like perception, interpretation and anticipation of events [8]. Cecez-Kecmanovic [31] highlighted that sense making emerges from individual, coordinated and collaborative efforts.

### B. Conceptual view of Awareness Checklist Method

According to awareness checklist method, 54 design elements influence or contribute to awareness support. Those elements can be categorized in 14 design categories, as shown in Table I.

TABLE I. MAIN DESIGN ELEMENTS INFLUENCING AWARENESS [8]

#	Design Category	Design Elements
1	Accessibility	Same place, different place, any place, co-located, virtually co-located, remote
2	Communication	Synchronous, asynchronous, network connectivity, message delivery, network management
3	Spatiality	Cartesian locations, topological locations, distances, orientation, focus/nimbus

4	Mobility	Wandering, visiting, traveling, fixed, mobile, autonomous, independent, embedded, pervasive
5	Physicality	Physical constraints, physical places, physical topology, physical attributes
6	Navigation	Viewports, links, radar views, teleports
7	Virtuality	Private, group, public, data access privileges, concurrency control, floor control, version control, virtual constraints, virtual places, virtual topology, virtual attributes
8	Membership	Participants, roles, activities, privileges, group history
9	Attention	Eye-gaze orientation, body orientation, voice filtering, portholes/peepholes
10	Task	Who, what, where, when, how, task history
11	Interaction	Feedback, feedthrough, backchannel feedback
12	Interdependence	Parallel activities, coordinated activities, mutually adjusted activities, loosely coupled, tightly coupled
13	Internalization	Events, actions, resources, critical elements, meaning, future scenarios
14	Externalization	Individual cognition, distributed cognition, team cognition

Antunes et al.[8] relate the Design Categories with the Awareness Types by requesting experts in collaborative technology to define the relationships between the 54 design elements and the six types of awareness shown in Table II.

TABLE II. MAIN RELATIONSHIPS BETWEEN DESIGN AND AWARENESS ELEMENTS [8]

#	Awareness type	Related design categories
1	Collaboration awareness	Availability, Communication
2	Location awareness	Spatiality, Mobility, physicality
3	Context awareness	Navigation, virtuality
4	Social awareness	Practice, Background
5	Workspace awareness	Task, Interaction, Interdependence
6	Situation awareness	Understanding, Sense making

Different from the simple relations implied by Table 2, the researchers then considered these relations more complex, so they decided to scale each of the 54 design features according to their awareness categories influences. The resulting correlations matrix is shown in Table 3.

TABLE III. NORMALIZED CORRELATIONS TABLE [8]

Collaboration	Location	Context	Social	Workspace	Situation
32.5	6.4		4	4.5	
8.1	1.8		1.3	1	
8.1		0.8	0.8	0.7	
8.1		1.1	0.8	0.7	
8.1					
	5.7	0.6	0.7		
	5.7	0.7			0.9
	5.7	1.1	1.1		
	5.7	0.6	0.7		
	5.7	1.1	1.2		
	9.2	1.1	2.2	1.1	2
1.6	9.2	1.2			1.3

2.4	9.5	1.4			
	7.1	1.7			2.3
	7.1	1.5			
	7.1	1.6			
	7.1	1.6			0.9
		5.3	2.2	1.4	
	1.1	5.3	2	1.4	
	1.6	5.3	1.3	2.6	1.7
	1.2	5.3	1	2.5	1.7
0.8		4.2	1.5	3.1	
		4.2	1.2	2.9	
		4.2		0.7	
	1.1	4.2		0.9	
		4.2		1.5	
3.2		4.2	13.4	1.7	2.6
2.8		3.4	13.4	2.2	3.4
		4.2	13.4	1.7	2.6
		2.4	13.4	1.4	1.9
1.1		1.2		3.7	0.9
0.8		1.5		3.7	1.4
0.9	2	1.1		3.7	1.4
1.1		1.2		3.7	1.4
		0.9		3.7	1.6
1.2		0.6	0.6	3.7	0.9
1		0.5	1.5	4.5	1.2
1		0.5	1.6	4.5	1.5
		0.7		4.5	0.9
		1.1	5.4		

In short, each given design element score is multiplied by its correlation scale. Blanks count as zero, nulling the element. Each awareness category is the sum of all its related design features, with different scales as shown in Figure 2. The final awareness score can be strategically shown as a radar graph with results from zero to 600 points, as demonstrated in Figure 2.

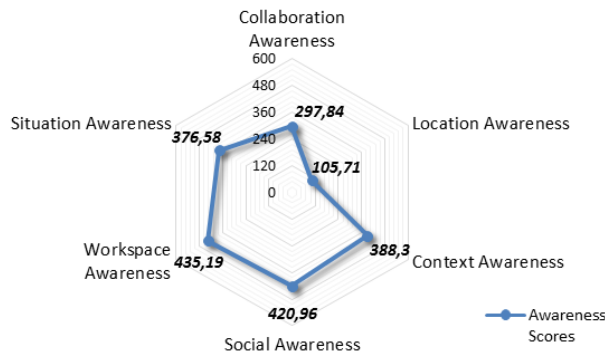


Fig 2 Awareness report score graph [8]

The awareness checklist allows quickly obtaining hints on the quality of awareness support supplied by an application by simply inquiring about how effectively some key design elements have been supported [8]. The relationship between design categories and type of awareness is the main foundation to motivate the survey on reviews of design attributes, to further address awareness deficiencies in agile software tools in order to propose improvements and remark the main qualities that users perceive as a differential factor.

### C. Awareness Checklist

Evaluation of the quality of awareness support can be traced back to Formal Technical Reviews (FTR) [32], widely adopted in software engineering [33]. Holzinger [34] remarks that participation of users is not always possible or available at the time of evaluation. For that purpose, Antunes, Sapateiro and Pino [35] [19] proposes a FTR method specifically focused on awareness assessment, named Awareness Checklist. According to Antunes et al. [7], Quality Assurance (QA) is essential to ensure the quality of collaborative systems development. Collaborative systems are difficult to assess due to the complexity, cost and time involved [36], and most of them tend to be informal. The Awareness Checklist is based on the concepts of CSCW Awareness, its types and a method in which the users provide feedback scores for each design category related to awareness support.

### III. RELATED WORK

Antunes et al. [8] relates the uses their latest proposal of Design elements, Design categories, Awareness types relationships, and further QA assessment using a FTR approach in order to evaluate the quality of awareness support. Besides offer the proposal they show an example of use which they evaluated two collaborative applications: MobileMap and COIN. The first is using by firefighters and the second is using by inspector to review physical infrastructures in construction sites. To evaluate the MobileMap two developers used the checklist which found problems in the system with virtual space awareness. Yet the COIN was evaluated by two developers too and was found that there are problems in physical, virtual space awareness and situation. Like Antunes et al. the present also use the proposal checklist to evaluate the quality of systems. However, different of authors this research looked understand the view of users of several collaborative systems.

Neale et al. [38] also evaluated a distributed CSCW system, in their research they present the challenges of CSCW evaluating which it is show the review of approaches and methods of evaluations. They point the difficult of evaluation about logistic, a greater number of variables and focus on validating the reengineering of group work based on CSCW concepts. They propose a framework to evaluate CSCW applications, the framework is composed by three main components: coordination, communication and work coupling. To demonstrate the use of the framework, the authors performed the evaluation of scholar system used by two classrooms of middle school. They analyzed the use of system by students and classified the behave of users during group tasks using the system, over a 2 years period and according of model propose by themselves. Unlike the authors, this paper also analyzed collaborative systems, but different of them we looked the view of users regarding the systems used in software development. The checklist used in this research allows evaluating the collaborative systems in several dimensions.

Araújo et al. [39] developed a conceptual framework to evaluation CSCW tools. In their work, they identified four dimensions for groupware evaluation: group context, usability,

collaboration and cultural impact. They did a case study with two collaborative environments used by master and doctoral students. The first study was performed in COPLE (Cooperative Project- Based Learning Environment), an educational groupware. The second study did in a workflow system, the PIEnvironment. The authors did questionnaires with users of systems to measure the dimensions of framework. As the Araújo et al. we also used questionnaires to identify dimensions of CSCW tools, but different dimensions.

Churchill et al. [40] developed the TeamScope tool to be used by student engineering in six universities around the world. The students used the TeamScope to do group work with people that never met face-to-face. The authors compare the TeamScope with other awareness tools and evaluated it through system logs, questionnaire, interviews and observations of teams. Thus, they analyzed strengths and weaknesses of tool with the intention of improving the TeamScope. Like Churchill et al., this paper also evaluated tools according the users. Different of them, we evaluated eleven collaborative tools used by developers and managers of software. Nevertheless, we did not analyze the use of these tools logs neither interviews nor observation. In addition, we used the model checklist to do questionnaire that was possible compare the strengths and weaknesses of tools.

#### IV. SURVEY

Using a FTR method to evaluate the quality of awareness and tools to assess, a survey was conducted to gather scores for each individual awareness category. Surveys can gather insights about people’s attitudes, perceptions, intents, habits, awareness, experiences, and characteristics, both at significant moments in time and over time [37].

##### A. Population and Sample

To evaluate the quality of awareness of agile collaborative tools, respondents needs to use or at least have certain knowledge about collaborative tools. For the purposes, the set of respondents was composed by Brazilian companies’ owners and employees. We gathered a sample of 200 valid assessments for data analysis using an online survey tool named Survey Monkey<sup>1</sup>, which was used to transcribe the respondents’ physical surveys and to gather more respondents using e-mail invitation. 56% of respondents have more than 5 years of professional experience and more of 47% work as analyst, as show in the Figure 3 and Figure 4.



Fig 3 Respondents time of professional experience

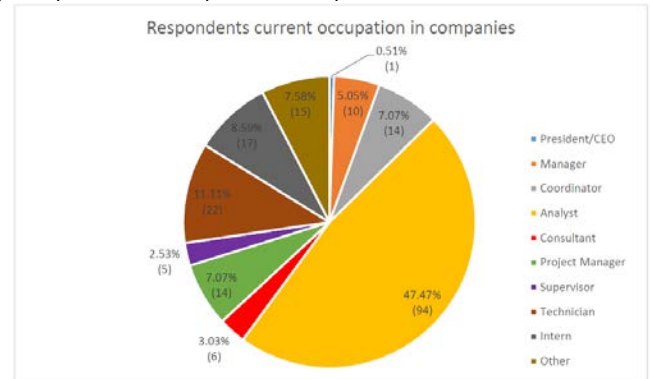


Fig 4 Respondents current occupation in companies

##### B. Adapted Awareness Checklist

The survey applied was adapted from the Awareness checklist proposal of Antunes et al. [8], with each of the 54 statements of design elements translated to the respondents’ native language (Brazilian Portuguese) and switching the score scale to a Likert form, with ratings as it follows:

- Strongly Agree: +3.0 points;
- Agree: +1.5 points;
- Neutral: 0 points;
- Disagree: -1.5 points;
- Strongly disagree: -3.0 points.

The questionnaire is available on the link: <https://doi.org/10.5281/zenodo.1325074>.

##### C. Selected the tools evaluated

The tools selected for evaluation were defined considering the data from the State of Agile 2017<sup>2</sup>. The selected tools used in the experiment were:

- Microsoft Project;
- Atlassian/JIRA;
- Microsoft TFS;
- Microsoft Sharepoint;

<sup>1</sup> <https://www.surveymonkey.com/>

<sup>2</sup> <http://stateofagile.versionone.com/>

- Trello;
- ThoughtWorks Mingle;
- Mantis;
- Bugzilla;
- Primavera;
- DotProject;
- Redmine;
- IBM RTC.

To answer the questionnaire, the respondents chose a tool which they have more knowledge about. As shown in Figure 5, the most selected tool for evaluation was Microsoft Project, with 22% of respondents, followed closely by Microsoft Team Foundation Foundation, with 21.5% of respondents.

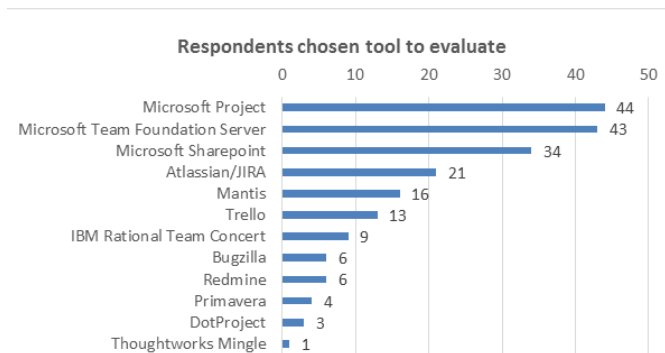


Fig 5 Respondents chosen tool to evaluate

Considering that the best score possible in each awareness category is 300.00 points and the worst is -300.00 points, the scores were further increased with 300 points in order to display only positive scores for a better visualization, therefore the adjusted report has a 0 to 600 points scale.

#### D. Results

Figure 6 presents the radar view of the results of each tool awareness categories support.

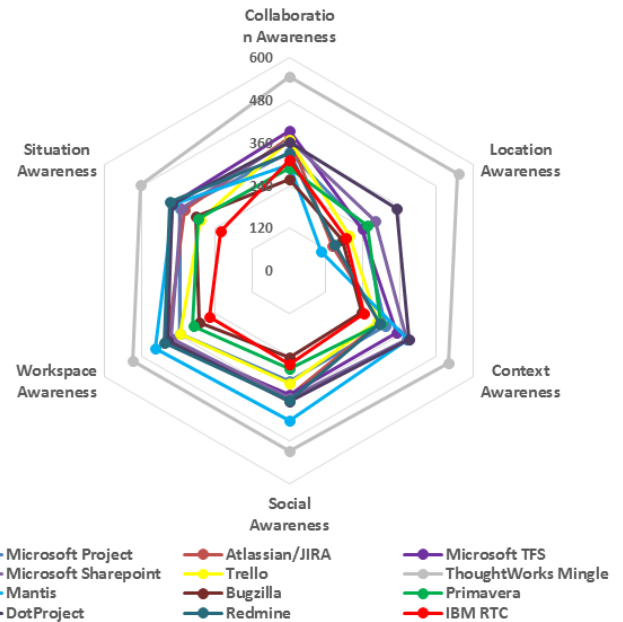


Fig 6 Awareness Report General Results

Table IV presents the detailed scores for each tool awareness categories support.

TABLE IV. FINAL TOOL SCORES FOR EACH AWARENESS CATEGORY WITH NUMBER OF RESPONDENTS

Tool	Respondents	Collaboration	Location	Context	Social	Workspace	Situation
Microsoft Project	44	334.93	239.27	311.75	311.93	355.46	352.98
Microsoft TFS	43	394.02	238.23	351.55	350.55	401.98	378.42
Microsoft Sharepoint	34	368.17	280.9	384.37	360.35	382.5	350.49
JIRA	21	376.03	142.48	293.78	351.73	392.96	341.43
Mantis	16	297.84	105.71	388.3	420.96	435.19	376.58
Trello	13	370.06	194.54	288.56	318.24	353.4	286.62
IBM RTC	9	310.97	183.99	241.97	262.69	257.89	223.64
Bugzilla	6	256.6	174	235.98	245.05	293.53	302.52
Redmine	6	330.35	149.9	296.12	366.75	407	385.9
Primavera	4	288.83	253.13	299.41	275.82	312.18	295.02
DotProject	3	362.1	349.5	389.3	368.7	393.2	378.55
Mingle	1	545.4	550.2	520.2	508.95	510.15	483.75

Table V presents a rating and feedback based on the achieved score range.

TABLE V. GENERIC FEEDBACK BASED ON THE ACHIEVED SCORE RANGE

Score range	Rating	Feedback
Under 120 points	Poor	Critical issues in the awareness category support.
From 120 to 240 points	Fair	Several points of improvement in the awareness category support.
From 240 to 360 points	Average	Average awareness category support.
From 360 to 480 points	Good	Adequate awareness category support.
Over 480 points	Excellent	Optimal awareness category support.

### E. Awareness Categories Rankings

The purpose to present the agile tools results on each awareness category separate is to rank the tools according their awareness support on each aspect. Although Mingle ranked far higher than others did, its results were discarded, since it was assessed by only one person. Therefore, Mingle general awareness results were not included in the rankings. It is important to note that the goal is not to encouraging developers to incorporate unnecessary features to an application, but rather to encourage reflection about which awareness elements would be valuable in a particular scenario [8].

Figure 7 shows the ordered rank of collaboration awareness support. Five tools achieved a Good rating score while six achieved Average scores.

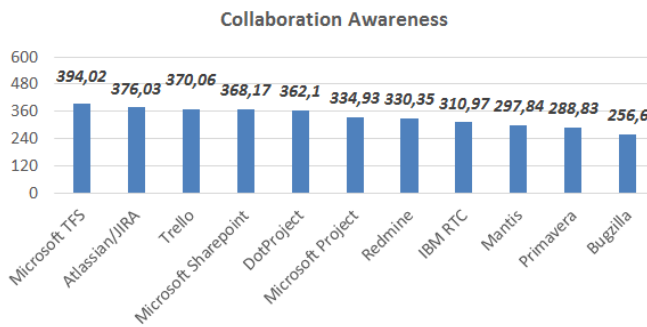


Fig 7 Collaboration Awareness Support Ranking

Figure 8 shows the ordered rank of location awareness support. Three tools achieved a Good score rating while eight tools achieved Fair scores. Mantis achieved a Poor rating score with 105.71 points. Location awareness was the lowest overall evaluated awareness category. It is possible to assume that this category achieves lower scores due to some specific design elements such as spatiality, mobility and physicality design categories.

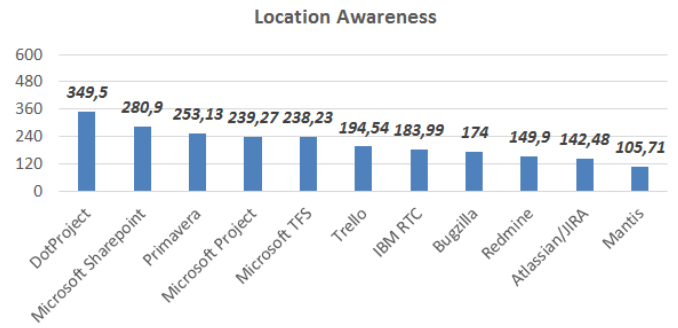


Fig 8 Location Awareness Support Ranking

Figure 9 shows the ordered rank of location awareness support. Three tools achieved a Good score rating while eight tools achieved Fair scores. The context awareness report did not present any major deviation.

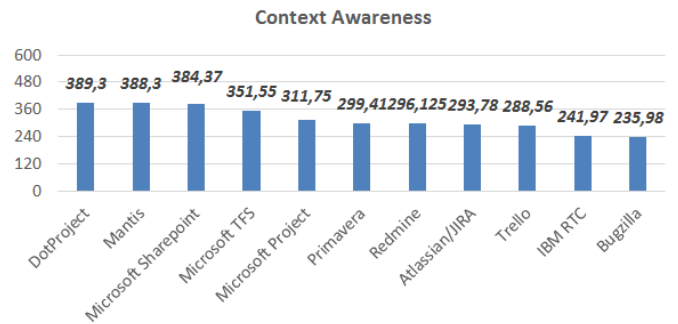


Fig 9 Context Awareness Support Ranking

Figure 10 shows the ordered rank of social awareness support. Four tools achieved a Good score rating while seven tools achieved Average scores. The context awareness report did not present any major deviation.

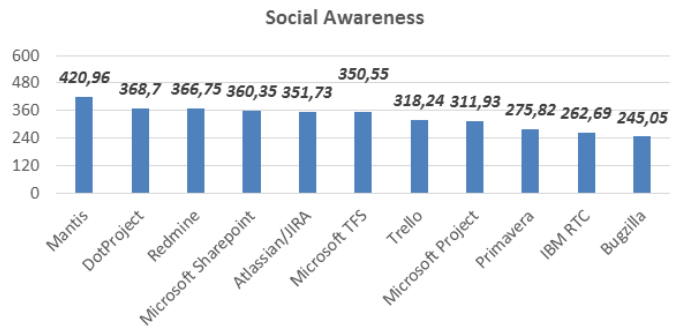


Fig 10 Social Awareness Support Ranking

Figure 11 shows the ordered rank of workspace awareness support. Six tools achieved a Good score rating while five tools achieved Average scores. Workspace awareness was the highest overall evaluated awareness category, probably because information regarding the artifacts of a project is the most used function of collaborative software.

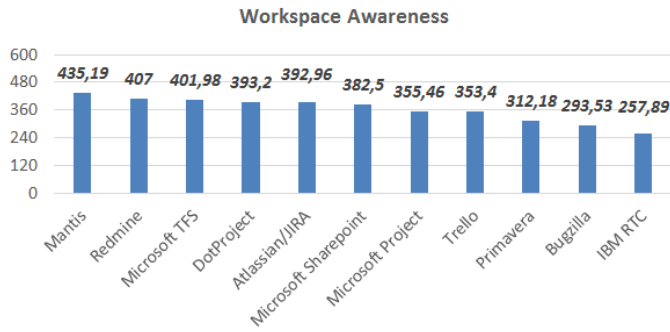


Fig 11 Workspace Awareness Support Ranking

Figure 12 shows the ordered rank of situation awareness support. Four tools achieved a Good score rating while six tools achieved Average scores. IBM Rational Team Concert achieved a Fair score rating.

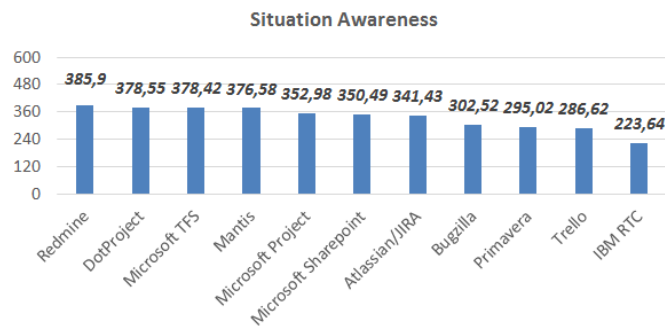


Fig 12 Situation Awareness Support Ranking

## V. DISCUSSION

By means of the results obtained in this research, Microsoft Sharepoint, Team Foundation Server and Project corresponded to 25% of the assessed tools and combining those results in 121 of the 200 assessments of the survey, which is an expressive 60.5% of the gathered sample.

Apart from Atlassian/JIRA, (which is proprietary, but free for use by official non-profit organizations, charities, and open-source projects, but not governmental, academic or religious organizations), there are roughly 50-50% of Open source and Proprietary tools, which shows that there are free viable and available alternatives for agile collaborative software.

In our research any tool evaluated obtained score range under 120 points. So, any tool is critical in awareness category support. But there are tools evaluated as fair rating score, in other words, tools that need improvement in some feature. The localization was the feature that more obtained low score by tools (below 240 points), only Microsoft Sharepoint, Primavera and DotProject received points above 240. Besides localization, the Bugzilla needs to improve in context, like IBM Rational Team Concert needs improve in situation.

To understand the main aspects of the selected tools according to the Time Space Matrix, we have classified the tools according to the diagram proposal of Rodden [3], as shown in Figure 13.

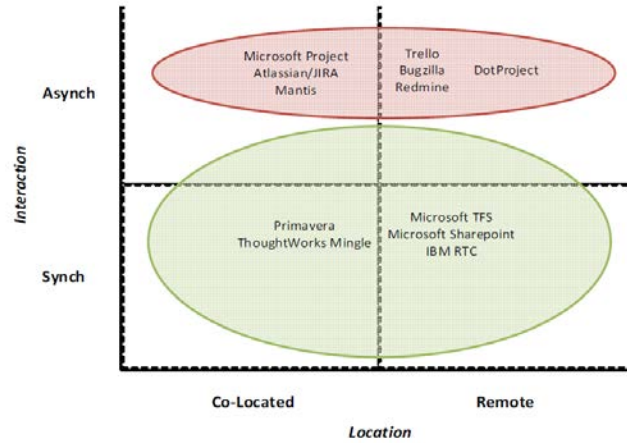


Fig 13 - Selected tools according the time space matrix classification

As demonstrated by the diagram, the tools are divided only by those which provides synchronous support (most by offering instant chat or virtual communications rooms and groups) and those which do not (being only capable of sharing information asynchronously). The location becomes irrelevant as most tools that operates in distinct locations (with communication provided by network, especially the internet) can also operate in the same location using two different network connected devices. Five tools offer synchronous and asynchronous features and the other seven only offers asynchronous support. Awareness support is a great challenge for synchronous CSCW, where interactive responsiveness is the foremost goal [4].

## VI. THREAT TO VALIDITY

One of threat to the validity of this research is about the capability of the respondents to evaluate the collaborative tools. A tool implemented for a given functionality can be used for another. As our sample was not entirely composed of CSCW experts, this was the main reason to adapt the answers to a relative (Likert scale) perspective, as they are not fit to declare that a tool has or not a design implementation, only to assess if they know if it has it or not and how well implemented it is in their opinion. Thus, the in this study the number of respondents per tool wasn't the same to each, for instance, the MS Project had 44 respondents and Mingle only one. The more respondents the tool has it's better to understand it. The occupation of the respondents can influence their responses, since each work can use the tool differently, but also, it's possible to analyze the tools from various points of views. In this research we believe that more users are needed to evaluate the tools in other locations to compare ours results.

## VII. CONCLUSION AND FUTURE WORK

In this paper, we adapted the Awareness checklist designed originally to be used by CSCW experts and applied it to non-experts. Changing the perspective of the evaluation to a subjective analysis instead of an objective one provided a different and novel approach and therefore can be considered a contribution.



The results show that it is possible to assess the agile software tools in order to improve certain aspects of the product and to achieve their customers' satisfaction. On the customer side, the same concept has been successfully applied to outline the tools main advantages and disadvantages, acting as a quality reviewer that can be used to choose which collaborative tool should be adopted according to their awareness categories strengths and weaknesses. New patterns can be easier identified using the adjusted awareness report graph.

Regarding the awareness reports scores, most assessed tools achieved relative low scores for location awareness when compared to other awareness categories. This can be interpreted as a deficiency in the criteria used to evaluate the category or a general deficiency in location awareness, which may be plausible given that most of the assessed tools have an initial release of 10+ years, which is before of the mobile technologies uprising that made a significant impact on most of the evaluated location awareness aspects (such as GPS orientation on devices with internet access). On the other hand, even the newer tools got low scores for this category.

A future proposal of this research can be the implementation of the used survey as a collaboration tool itself, by allowing reviewing the quality of awareness in any desired software tool and sharing collective results over the internet. As more users input their assessments and share their tool usage experiences, the more relevant the scores can be seen, perhaps even resulting in a viable commercial solution used to help users better choose their market options to improve their business goals.

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