

# Criteria Catalogue for Collaborative Environments

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**Computer supported collaborative work supports the interaction and joint task solving between humans by setting a machine or computer in-between. Similarly, collaborative environments support decision-makings incorporating different points of view and a variety of competences. As such, the identification and selection of the underlying requirements involved in a collaboration is a challenging task. In order to facilitate this task, we performed a thorough literature review with the aim to discern such requirements. The result is a set of qualitative criteria that can be applied to generic computer supported collaboration environments.**

*Teamwork support, Collaboration Software, Criteria, Computer supported Collaborative Work, HCI*

## 1. INTRODUCTION AND RELATED WORK

Collaboration among stakeholders is an increasingly used practice for design, evaluation, and concept balancing. This practice enables decision-making processes with a rich environment allowing different points of view and a variety of competencies. Reflecting and integrating all the relevant ideas and expertise is crucially important. Further, collaboration can be defined as a joint activity in which individual participants share an obligation to coordinate in individual autonomy in the service of progress towards a common goal (Johnson et al. (2011)). This definition indicates that different working styles and different work phases exist in collaborations. However, with regards to computer supported team work additional attributes like the participants' location and the synchronicity of work performance needs to be considered. Commonly, software tools are used to support this working style. According to Mittleman et al. (2008), most of these collaboration tools are developed for the mass market and do not suffice the specific needs of a collaborating group. Hence, these needs must be satisfied by the use of customized tools. The design of such tools is highly challenging as important criteria might be missed out.

This works' objective is to establish and provide a set of qualitative criteria that apply to generic environments that can substantially and holistically advance the productivity of collaborations incorporating the interaction between humans and machines. The criteria catalogue presented here provides an overview

of the most important support features for collaboration systems and contains design recommendations to achieve the desired facilitation support. The catalogue is usable as a guideline for designers of specific collaboration environments.

An extensive literature review was performed covering the fields of Human Computer Interaction (HCI), Computer-supported collaborative work (CSCW), cognitive science and social science. From this wide range of collected publications, we identified criteria for collaborative work dedicated to specific technology (Borghoff and Schlichter (2000)) like table tops (Scott et al. (2003)) or mobile devices (Donker and Blumberg (2011)). We extracted criteria of collaboration support systems in information visualization (Tobiasz et al. (2009)), visual analytics (Brennan et al. (2006)), business processes (Mundbrod (2012)), virtual reality (Liu et al. (2012)) and design and engineering (French et al. (2014), Johnson et al. (2011), Briggs et al. (2010), and Briggs et al. (2003)). Also, existing work about single aspects of successful cooperation like awareness indication (Beaudouin-Lafon and Karsenty (1992), Dourish and Bellotti (1992)), as well as satisfaction and team effectiveness as investigated by (French and Kottke (2013), José et al. (2014), and Rousseau and Aubé (2010)) have been considered.

## 2. CRITERIA IDENTIFICATION

To identify an all-embracing criteria of collaboration support systems, we observed existing literature as

mentioned earlier and identified criteria intended to support collaborative work. In the first step, the criteria have been collected, sorted and grouped in conformity with the proposed instructions (e.g. highlighting, screen sharing, etc.). Then, analogous criteria have been detected and integrated into single criterion definitions while additional criteria are deduced from existing ones. Additionally, the results of this classification were validated through extensive interviews and questionnaires, and by monitoring and observing collaborative design sessions. The resulting catalogue of collaboration support criteria is presented below:

**Content support** refers to the active interaction and integration of the content by the actors, which is highly reliant on the underlying task. These following criteria are required in adapted form, which are derived from the task models: Content integration (Add, Associate, Modify, Delete), Move (Change structures and appearances), and Judge (Render an opinion to the made contribution).

**Information sharing** involves functionalities and technical modules, which are used to share information in order to establish the knowledge basis for all actors: Quickly retrieve context-relevant information (Ability to detect changes), Access to shared objects (Ability to access and edit shared artefact), Accentuating (Pointing, marking, annotate), Track others approach (Can improve coordination and skill transferability), Screen sharing (Ability to accentuate own or draw attention to others viewpoint), Individual and/or shared workspaces (Allows performing single tasks and keep track of overall goal).

**Coordination support** refers to the spectrum of tasks that are used to support the coordination of work packages and the coordination between actors: Jurisdiction (Assignment of tasks, roles, responsibilities, rights), Transformations (Transitions between personal and group work, between activities, and between tool and external work), Alert mechanisms (Notification of changes or of required user input), Awareness Support (Amplifies coordination and communication), Community Support (Online documentation and strength of the community), Team structure and size (Ability to create team structures and optimal team sizes), Changing work styles (Ability to change between single and group).

**Communication support** describes the support of advanced and unimpeded communication among actors to bridge spatial gaps [2]: Communication in group and or individual (For public and private conversations), Discussion tool (Rich and powerful communication channels), Encrypted Communication (Increases actors reliance in the technology).

**Compliance support** relates to rules or guidelines that should be fulfilled to conduct a well thought out decision making process: Avoid team debates

(If actor has to explain himself with low accordance the individuals satisfaction is reduced), Group process training (Supports the sense of cohesiveness and shared goal), Reflecting all individuals' notions/opinions (Feeling of left out arises frustration), Use guidelines and defined restrictions instead of strict rules (Guidelines for task performance, discussion, and decision making), Involving all actors (Actors without a task or role are not part of the work team), Team self-managing behaviours (Actors' ability to collaboratively assume responsibilities for directing their task accomplishment toward the achievement of the established team goals).

**Content management** refers to the action execution of dynamical content manipulation by actors and granting valid and reliable database entries: Action parameter (Synchronicity of action and identifiability of actors), Access Control (Allocation of access rights), Session Persistence (Degree to which contributions are ephemeral or permanent), Consistency and interactivity (Causality, concurrency, simultaneity, instantaneity).

**Usability** involves next to user satisfaction to the degree of efficiency and effectiveness of the technology, including the acceptability by users: Reliability (Same results are achievable with different actors), Reusability (Session/ results/ configurations can be recorded and reused), Transferability of skills (Degree of apprenticeship of a novel actor in order to gain insights and being able to conduct work practices on their own), Flexible actor arrangements (Configurable collaborative components scaling over different types and sizes of input devices), Guidance, Generalizable and ease of maintenance.

**User experience** describes the actors emotions and attitudes about using the technology: Natural interpersonal interaction (Urges collaborative interaction/communication), High user satisfaction and motivation (Amplifies active participation), Intuitive and simple technology (Easy to understand and easy to use), Reduced cognitive load of actors (Actors are able to focus on tasks), No all-embracing knowledge/expertise needed (Actors only learn own domain related techniques).

### 3. CONCLUSION AND FUTURE WORK

In this paper we presented a generic criteria catalogue for collaborative environments. The presented criteria catalogue will be used further on to identify software architecture modules of new systems and can serve as a guideline for evaluating existing collaboration systems.

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