



University of Castilla - La Mancha

Assesing the Understandability of Collaborative Systems Requirements Notations: an Empirical Study - Experimental Material

Technical Report # DIAB-11-06-1

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June 2011

As for single user systems, a proper specification of software requirements is a very important issue to achieve the quality of the collaborative systems. Nevertheless, many of these requirements are from a non-functional nature because are related to the user's need of being aware of other users, that is, the workspace awareness. In order to model these special kind of requirements, CSRML, an extension of i^* has been proposed. In this paper, we present a controlled experiment to assess the understandability of this notation compared to i^* . The specification of two different systems was used as experimental material and undergraduate students of Computer Science with an average of two years experience in Requirements Engineering were the experimental subjects.

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Introduction

In this Technical Report we show the materials given to the experiment's subjects. First, we gave the students a datasheet to fill with his/her personal data (pages 4 and 5) and we divided them into two groups (G1 and G2). This document also contained the questionnaires to be answered. Also, with this document, we gave a description of Workspace Awareness in order to facilitate the concept comprehension.

Just after giving this documentation, we gave the students, depending of his/her group belonging, the jigsaw domain modeled with i^* (pages 7 and 8) or CSRML (pages 11 and 12).

Once all the subjects finished filling the first questionnaire, we remove them the jigsaw model and gave them the conference domain one, once again modeled with i^* (pages 9 and 10) or CSRML (pages 13 and 14).

Student Data

Group:

1 2

D.N.I.¹: _____

Knowledge about Requirements Engineering:

None Less than a year Less than two years Two or more years

Experience with Goal-Oriented Requirement Engineering techniques (*i**, KAOS or similar):

Yes No

Average mark (approximate): ____

Age: ____

Gender: M F

Jigsaw Questionnaire

Answer the following (T) rue / (F) alse statemens:

1. The task “Designate experts coordinator” is a collaborative task ____
2. The task “Expose at team meeting” is a collaborative task ____
3. Two different roles are necessary to perform the task “Give permission to an expert for exposing” ____
4. Two different roles are necessary to perform the task “Attend experts meeting” ____
5. A “Student” actor can play the “Expert” role anytime ____
6. Only a “Expert” is needed to “Make experts report” ____
7. “Participant list with exposition order” is a implementation of “Be aware of expert group member” softgoal ____
8. “Experts report” is an implementation of “Make experts report” ____
9. “See the other users activity” is a softgoal related with awareness ____
10. “Designate experts coordinator” task is more important than “Expose at experts meeting “ task ____

WRITE DOWN DURATION TIME (HH: MM: SS) _____

¹ Student’s DNI will be kept anonymous

Conference Questionnaire

Answer the following (T) rue / (F)alse statemens:

1. The task “Paragraph review” is a collaborative task ____
2. The task “Communicate outcome of the review to authors” is a collaborative task ____
3. Two different roles are necessary to perform the task “Paragraph review” ____
4. Two different roles are necessary to perform the task “Communicate outcome of the review to authors” ____
5. A “CP” actor can play the “Reviewer” role anytime ____
6. Only a “Reviewer” is needed to “Paragraph review” ____
7. “Telepointers with reviewer’ name and color” is a implementation of “Be aware of other reviewer activity” softgoal ____
8. “Revision history of each paragraph” is an implementation of “Know who and when reviewed each paragraph” ____
9. “Review outcome” is a resource related with awareness ____
10. “Paragraph review” task is more important than “Communicate outcome of the review to authors” ____

WRITE DOWN DURATION TIME (HH: MM: SS) _____

Workspace Awareness

A collaborative system is a distributed software which allows several users to work together and carry out collaboration, communication and coordination tasks. To perform these tasks, the users have to be aware of other user's actions, usually by means of a set of awareness techniques.

Workspace Awareness (WA) is the up-to-the-moment understanding of another person's interaction within a shared workspace. Workspace awareness involves knowledge about *where* others are working, *what* they are doing *now*, and *what* they are going to do *next*.

The basic the elements is the set of questions "who, what, where, when, and how". That is, when we work with others in a physical shared space, we know who we are working with, what they are doing, where they are working, when various events happen, and how those events occur.

Table 1: Elements of workspace awareness related to the present

Category	Element	Specific questions
Who	Presence	Is anyone in the workspace?
	Identity	Who is participating? Who is that?
	Authorship	Who is doing that?
What	Action	What are they doing?
	Intention	What goal is that action part of?
	Artifact	What object are they working on?
Where	Location	Where are they working?
	Gaze	Where are they looking?
	View	Where can they see?
	Reach	Where can they reach?

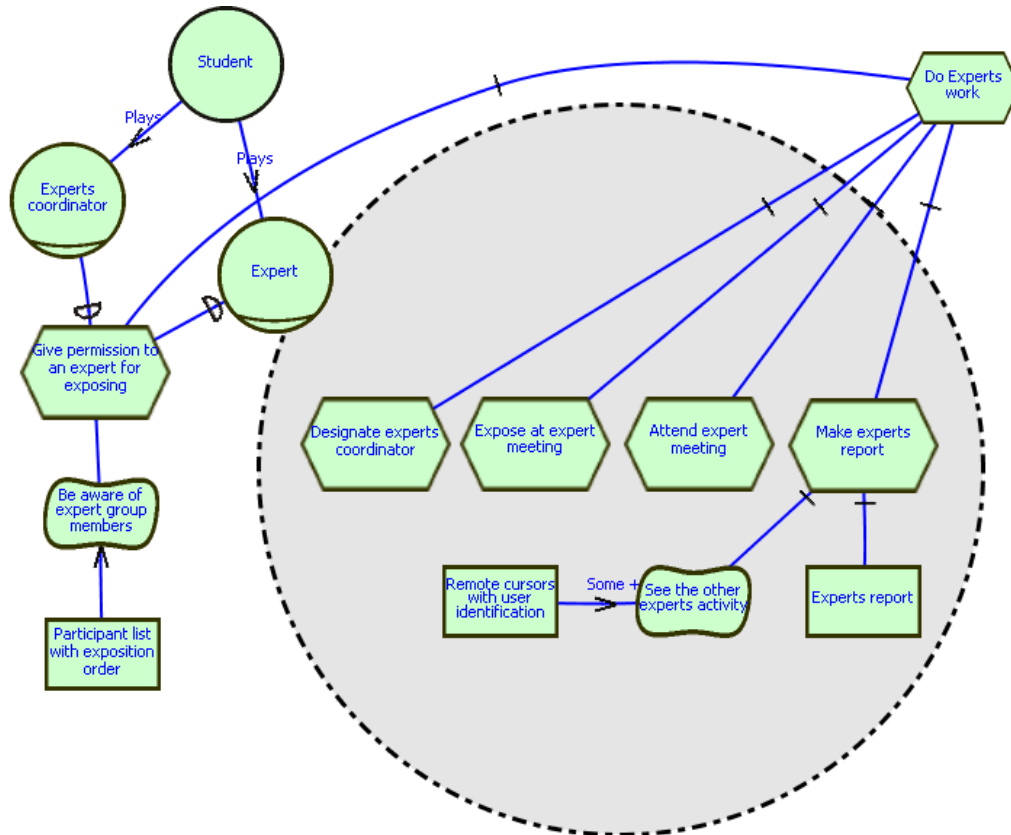
Table 2: Elements of workspace awareness relating to the past

Category	Element	Specific questions
How	Action history	How did that operation happen?
	Artifact history	How did this artifact come to be in this state?
When	Event history	When did that event happen?
Who	Presence history	Who was here, and when?
Where	Location history	Where has a person been?
What	Action history	What has a person been doing?

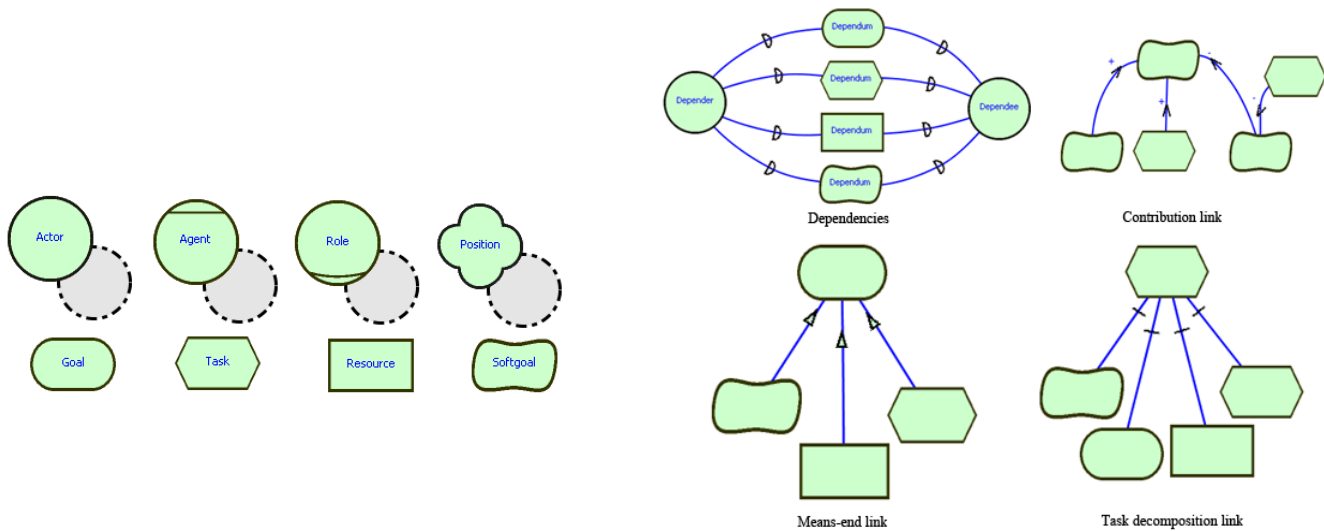
Tables 1 and 2 show these elements and list the questions that each element can answer. Table 1 contains those elements that relate to the present, and Table 2 contains those that relate to the past. The elements are all commonsense things that deal with interactions between a person and the environment.

Group 1 – Jigsaw

The following *i** diagram describes a jigsaw learning activity, a cooperative-learning technique in which students individually do some research in a proposed problem and then they teach each other what they have learned by sharing each individual view of the problem.



*i** elements²:



² At back page detailed information about the *i** elements can be found

*i** language

The *i** Framework distinguishes between two kinds of elements: objects and relationships. The objects considered in *i** are:

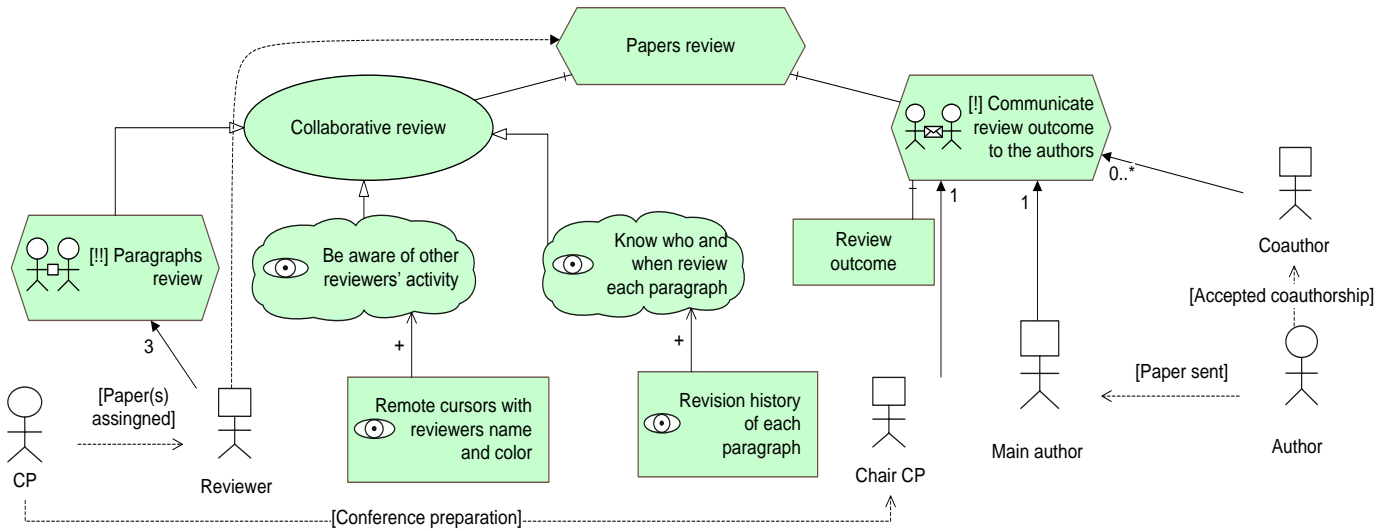
- An *actor* is a person or a system that has a relationship to the system to be developed. *i** identifies three kinds of actors:
 - *Agent* is an actor who has a concrete physical representation, e.g. a person or a system.
 - *Role* defines the behaviour of an actor within a specific context. An actor can have several roles, and a role can be assigned to multiple actors..
 - *Position* is a set of roles that can be typically played by one agent. An agent can play several positions.
- *Goal*: A goal answers “why?” questions. It describes a certain state in the world that an actor would like to achieve. However, a goal does not prescribe how it should be achieved.
- *Task*: A task specifies a particular way of doing something. Typically a task consists of a number of steps (or sub-tasks) that an actor must perform to execute it.
- *Resource*: A resource is a (physical or informational) entity that the actor needs to achieve a goal or perform a task. The main concern about a resource is whether it is available and from whom.
- *Softgoal*: A softgoal is a condition in the world that the actor would like to achieve, but unlike the concept of (hard) goal, the condition to achieve it is not sharply defined. A softgoal is typically a quality attribute that constrains other elements such as a goal, a task, or a resource. A softgoal is considered to be fulfilled if there is sufficient positive evidence for its fulfilment and little evidence against it.

The previous objects are related between them through this set of relationships:

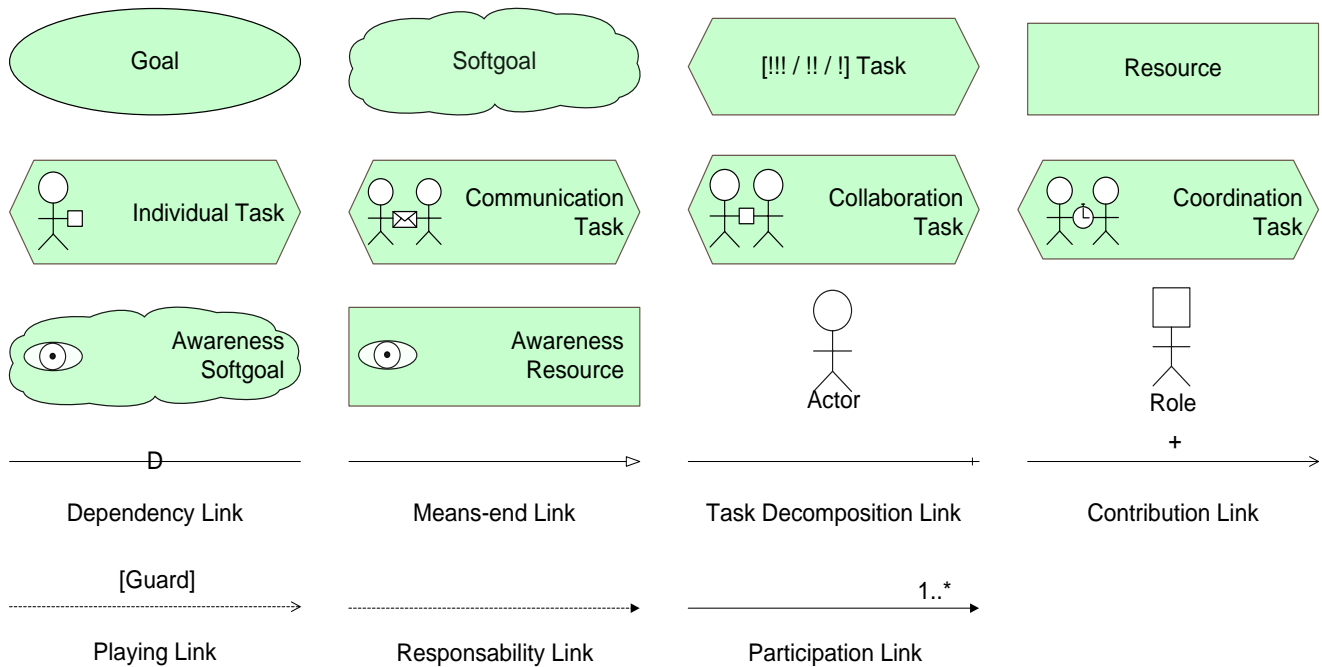
- *Dependency*: A dependency in *i** documents a relationship between a depender and a dependee for a dependum. The depender and the dependee are actors. The depender depends on the dependee for achieving a goal, performing a task, or using a resource. The dependum is the object which the dependee must deliver and which the depender depends on. It can be a goal, a task, a resource, or a softgoal. If the dependee fails to deliver the required dependum, the depender’s ability to achieve its own goals is affected. In other words, it becomes difficult or impossible for the depender to achieve a goal, perform a task, or use a resource. Based on the type of dependum, *i** distinguishes four types of dependencies: (i) *Goal dependency* determines that the depender assumes that the dependee achieves the goal, but does not prescribe how it should achieve the goal; (ii) *Task dependency* defines that the dependee must perform the assigned task to achieve a goal; (iii) *Resource dependency*: expresses that the depender depends on the availability of a physical or informational resource that is provided by the dependee; (iv) *Softgoal dependency* expresses that the depender depends on the dependee to perform a task that leads to the achievement of a softgoal. The criteria to determine how to achieve the softgoal are not clearly defined. Typically, the dependee offers several alternatives for achieving the softgoal, and the judgement of whether the softgoal is achieved or not is up to the depender.
- *Means-end link*: A means-end link documents which softgoals, tasks, and/or resources contribute to achieving a goal. A means-end link also facilitates the documentation and evaluation of alternative ways to satisfy a goal, i.e., different decompositions of goal into subgoals, tasks, and resources.
- *Task decomposition link*: A task decomposition link documents the essential elements of a task. A task decomposition link relates the task to its components, which can be any combination of sub-goals, sub-tasks, resources, or softgoals. The decomposition of a task can thus comprise sub-tasks that must be performed, sub-goals that must be achieved, resources that are needed, and softgoals that typically define quality goals for the task.
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Group 1 – Conference

The following CSRML diagram describes a conference review system with collaborative aspects. In particular, it is the part of the system related to a process review performed in a collaborative way among various reviewers.



CSRML elements³:



³ At back page detailed information about the CSRML elements can be found

CSRML language

The CSRML elements are:

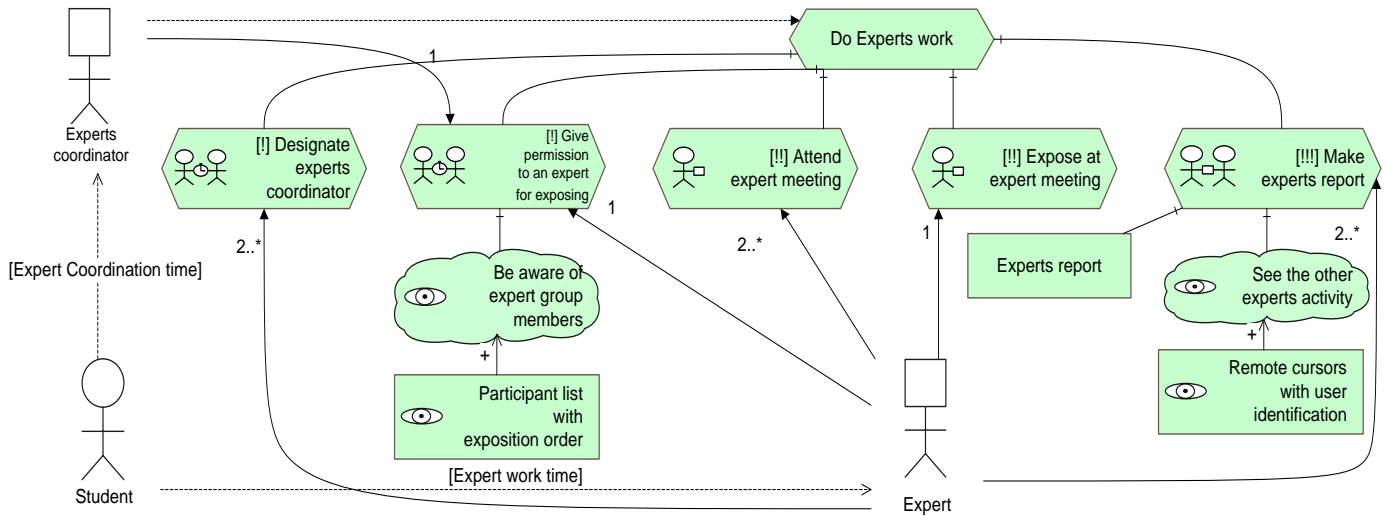
- **Role:** A role is a designator for a set of related tasks to be carried out. The difference between *i** and CSRML is that an actor playing a role can participate in individual or collaborative tasks (through participation links) and can be the responsible for the accomplishment of a goal (through responsibility links). In addition, the graphical notation is also different from the *i** role (the concept of role/actor boundary is not used in CSRML).
- **Actor:** An actor is a user, program, or entity with certain acquired capabilities (skills, category, and so forth) that can play a role in executing (using devices) or being responsible for actions. An actor has to play a role (specified by means of a playing link) in order to participate in the system.
- **Goal:** A goal answers “why?” questions. It describes a certain state in the world that an actor would like to achieve. However, a goal does not prescribe how it should be achieved.
- **Task:** A task specifies a particular way of doing something. Typically a task consists of a number of steps (or sub-tasks) that an actor must perform to execute it. The notation to define the importance of a task is: one, two or three exclamation signs, depending on the importance of the task. Two kinds of CSRML tasks have been identified:
 - **Abstract task:** This kind of task consists in an abstraction of a set of concrete tasks and, possibly, other elements. We are not able to assign participation links directly to this kind of tasks.
 - **Concrete task:** These are the tasks the participants are involved to. The abstract tasks are refined in these ones. Participants will be assigned to the task through participation links. There are four types of these tasks:
 - **Individual task** is a task that an actor can perform without any kind of interaction with other actors.
 - **Collaboration / Communication / Coordination task** two or more actors are involved in order to perform any kind of collaboration / communication / coordination among them.
- **Resource:** A resource is a (physical or informational) entity that the actor needs to achieve a goal or perform a task. The main concern about a resource is whether it is available and from whom.
- **Awareness resource:** This special kind of resource corresponds to an implementation or a design solution to accomplish an awareness softgoal.
- **Softgoal:** A softgoal is a condition in the world that the actor would like to achieve, but unlike the concept of (hard) goal, the condition to achieve it is not sharply defined. A softgoal is typically a quality attribute that constrains other element such as a goal, a task, or a resource. A softgoal is considered to be fulfilled if there is sufficient positive evidence for its fulfilment and little evidence against it.
- **Awareness softgoal:** CSRML refines the *i** concept of softgoal into a new specialization: awareness softgoal, that represents a special need of perception of other user’s presence / actions, without which the task the user wants to perform would be affected negatively or even could not be done.

The previous objects are related between them through this set of relationships:

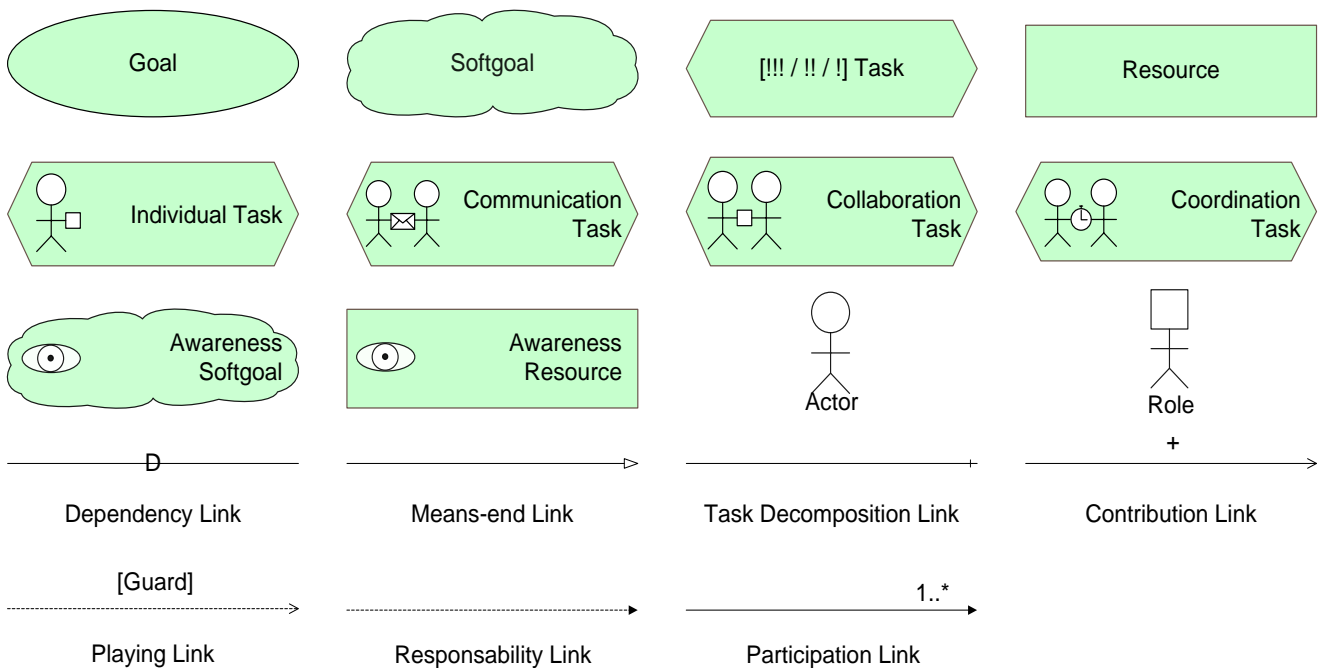
- **Dependency:** A dependency in *i** documents a relationship between a depender and a dependee for a dependum. The depender and the dependee are actors. The depender depends on the dependee for achieving a goal, performing a task, or using a resource. The dependum is the object which the dependee must deliver and which the depender depends on. It can be a goal, a task, a resource, or a softgoal. If the dependee fails to deliver the required dependum, the depender’s ability to achieve its own goals is affected. In other words, it becomes difficult or impossible for the depender to achieve a goal, perform a task, or use a resource. Based on the type of dependum, *i** distinguishes four types of dependencies: (i) **Goal dependency** determines that the depender assumes that the dependee achieves the goal, but does not prescribe how it should achieve the goal; (ii) **Task dependency** defines that the dependee must perform the assigned task to achieve a goal; (iii) **Resource dependency:** expresses that the depender depends on the availability of a physical or informational resource that is provided by the dependee; (iv) **Softgoal dependency** expresses that the depender depends on the dependee to perform a task that leads to the achievement of a softgoal. The criteria to determine how to achieve the softgoal are not clearly defined. Typically, the dependee offers several alternatives for achieving the softgoal, and the judgement of whether the softgoal is achieved or not is up to the depender.
- **Means-end link:** A means-end link documents which softgoals, tasks, and/or resources contribute to achieving a goal. A means-end link also facilitates the documentation and evaluation of alternative ways to satisfy a goal, i.e., different decompositions of goal into subgoals, tasks, and resources.
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Group 2 – Jigsaw

The following CSRML diagram describes a jigsaw learning activity, a cooperative-learning technique in which students individually do some research in a proposed problem and then they teach each other what they have learned by sharing each individual view of the problem.



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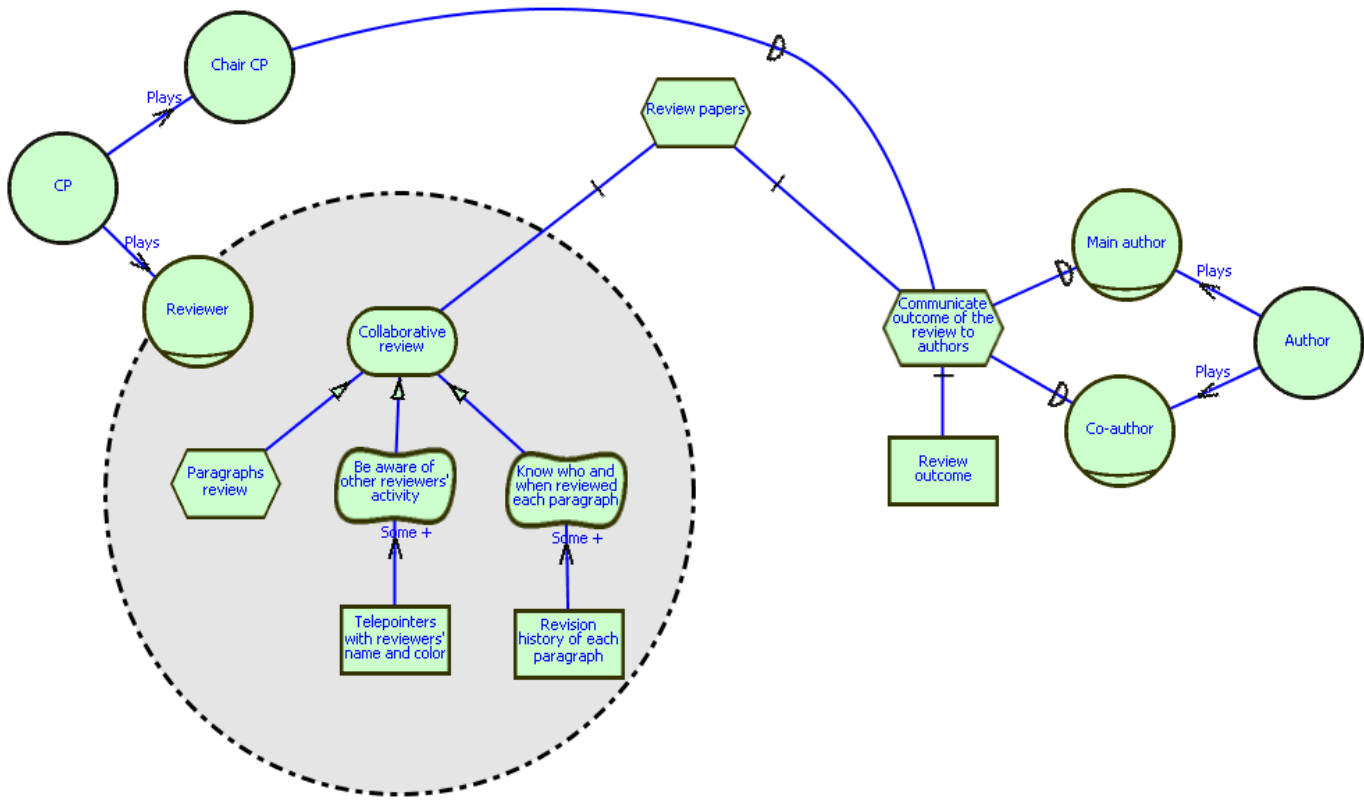
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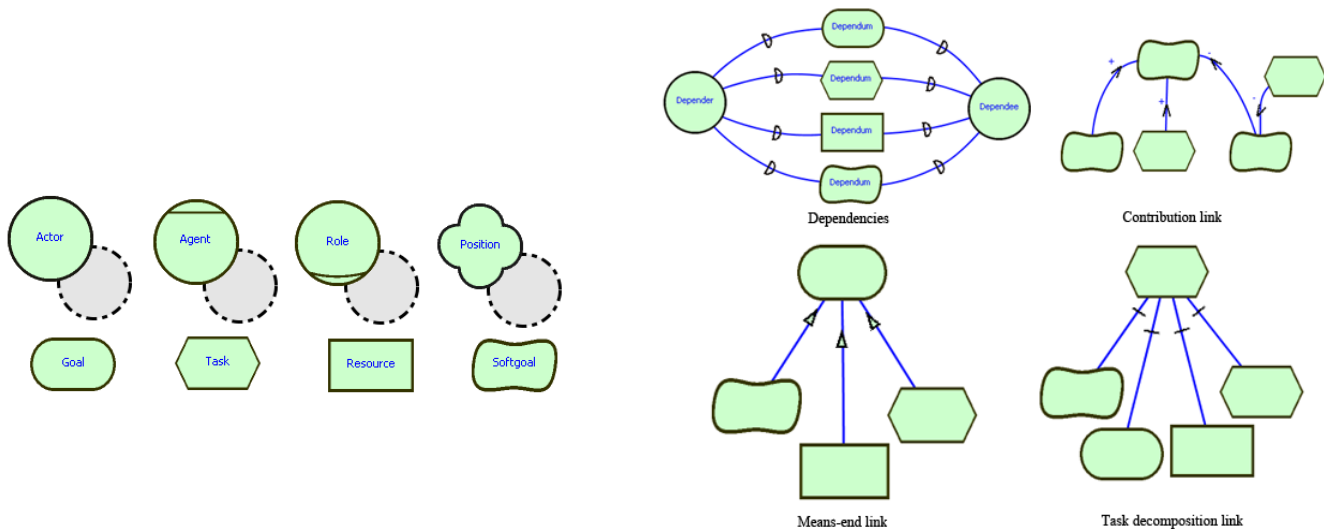
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