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The Role Concept as a Basis for Designing Community Systems

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Abstract. This paper describes the sociological concept of roles as a basis for designing computer-supported community systems (CSCS). The goal is the systematic analysis of roles and role-development from a sociological point of view to enhance socio-technical community-systems. In system theory social structures are expectational structures and roles identify these expectations [22]. Roles explain how actors interact, collaborate and work together to cultivate knowledge exchange. The role concept in social science assumes that people interact with respect to their social roles and take certain roles as a basis for their social interaction and communication. Persons' activities and interaction is shaped by roles and vice versa. In contrast, the role concept of computer science focuses on the management of access rights and access control models, and should be clearly differentiated from the sociological understanding.

This paper presents the sociological perspective of the term "role" and explores it in more detail. Then, we present an explorative study of role-development in a web-based learning environment. We conclude by giving examples and making proposals for the technical support of roles. We pay special attention to role-taking, role-making, assigning roles, defining roles and changing roles.

Keywords: Communities, Community Systems, Roles, Sociology

1. Introduction

The experience gained in case studies and experiments with a prototype of the web-based collaborative learning environment KOLUMBUS [12] revealed that a successful usage required the possibility to be able to structure the communication process. This is the result of a detailed experiment and 10 case studies in the area of knowledge management [13]. They did show that the participants (of web-based collaborative learning processes) attempted to take different roles and tried to change their roles dynamically in being able to structure their communication. For instance, on one occasion they discussed rules and forms of annotations (e.g. the position to upload) and another occasion they contributed on content. They distinguished between organizational contributions and content. (Details of the explorative study are presented in section 3.) In addition, results of Strijbos' et al. experiment in 2003 [34] emphasised that roles appear to increase participants' awareness of interaction and efficiency through cohesion and responsibility[1]. This applies to small groups as well as social systems in general.

We presume that this also concerns computer-supported cooperative work and groupware as well as computer-supported community systems (CSCS). Further evidence can be

[1] Their study involved 57 persons, separated in ten groups. Five groups "were instructed to use roles" and the other five were "instructed to rely on their intuition and previous experiences" [34].

found in the literature (e.g. [11], [42]), which refers to a multitude of different views on roles. If we support role-development in social systems, which use computer-mediated communication, we also have to design the technical system. Often technical systems do not permit role-development, e.g. role-taking and role-changing. The establishment of social systems depends on the construction of social processes (communication processes), which are based on behavioral expectations and the differentiation between roles. In particular, the participants should be supported in selecting different types of roles, role-taking, role-assignment and role-changes. However, in the literature, roles are usually considered as having a secondary importance. Therefore, a systematic analysis is missing, which could help to find a differentiation of roles and present possibilities to support role-development and role-taking. The paper's aim is to present a systematic approach of the analysis of roles and supporting community systems. Furthermore, it is not made clear as to how the term "role" is used, in both, sociological theory and computer science. However when supporting socio-technical systems like web-based communities it is indispensable to understand the differences.

In computer science the term "role" is used in different areas, such as computer-supported collaborative learning (CSCL, e.g. [23]) or in the context of workflow-management systems (WMS). The understanding is related to roles, which are usually characterized by a set of access rights. Users in technical environments have certain opportunities of doing something if they are authorized to use them. This authorization determines the kind of access to data or the selection of functions, which can be activated (e.g. [30]) – such as deleting a persons file or creating a new folder. This WMS-oriented type of technical support for roles is not sufficient in the context of knowledge management systems, web-based learning environments and community systems. For instance, users have no opportunity of indicating role-change (colloquially: *putting on another hat*). This can be observed in face-to-face situations (with verbal and nonverbal behavior), but is missing in virtual settings. In face-to-face workshops, person A answers as a participant. A few minutes later she can stand up and give instructions as a facilitator to structure the discussion. Our explorative study also shows existing role differentiation in the logged dialogues in a learning environment, and we think supporting role-development more actively may result in a more effective social interaction, communication and knowledge transfer.

Furthermore, it would be useful, if contributions, which are entered into a technical system, were labelled differently in accordance with their communicative purposes in relationship to the role of the contributor. For example, for retrospection on a web-based discussion it could be helpful to differentiate between content and organisational contributions and to allow the users to extract exclusively the content parts. So far, approaches which are inspired by a sociological understanding of roles to achieve an elaborated support for handling roles in computer-supported cooperative learning systems are hard to find. WMS, for example, are limited to predefined roles and to the assignment of tasks to a selected range of possible roles. In computer-supported virtual communities, it is not sufficient to offer pre-defined roles which are temporarily taken during a session and which can not be flexibly changed. Thus, the CSCL literature often suggests arranging certain roles with specific tasks, for example facilitator, expert and tutor (see [9], [2]). However, these suggestions neglect the possibility for dynamically creating new roles and flexible redefinitions.

From our point of view, one reason for this neglect is that the handling of social roles usually takes place implicitly for the whole group, although it is individuals that are consciously reflecting this. During the social interaction, roles are developed, assigned, or taken over, usually without a conscious decision. Exceptions are team-building processes in business enterprises where tasks and roles are assigned explicitly to persons. In terms of sociological theory, structuring is a process based on social interaction [6] which reduces complexity [22]. This is an essential part of our "life" and also an indispensable require-

ment for social structuring in web-based communities, to enable them to develop. Roles are a special kind of structure – which emerges by the observations of observable interactions and behaviour, which can be understood as patterns – which can be referred to in social interaction processes. This support of forming social processes facilitates work and communication and makes them more efficient. The roles which are gradually developed can be referred to explicitly by giving them names. For example, business enterprises employ this phenomenon and specify positions and roles (e.g. organizational structure, with formal organization charts). However, the aspect of dynamical change of role-development is often neglected (e.g. adaptation of task functions to an established role and the creation of new roles).

We start with the presentation of theoretical considerations which reflect the sociological term of role in respect to communities (section 2). Thus, providing the theoretical background for section 3 where we describe selected aspects of an explorative study. The study will present examples to show that participants in computer-mediated community systems attempted to structure their social interaction, and communication processes based on role-mechanisms like role-taking and role-assignment. The exploration shows the relevance of the term role in socio-technical environments and reveals some deficits. We found examples where it is hardly comprehensible to other participants, who plays which roles at any given time and who changes their role. The study will not and can not derive the definite set of features of role-design and role-development for technical systems. However, these examples point out the necessity for technical support of role-assignment and role-taking in web-based learning environments. Finally theoretical analysis of role-mechanisms provides a structure to present some simple technical options to support social role-development in computer-supported community systems. This is systematically explored in section 4.

2. Communities, Roles and Role-Mechanisms

Sociological theories distinguish between societies (organizations and groups) and communities: the distinction reflects the difference between a formal systemic integration and an informal social integration of people into social systems. The first term is based on functional differentiation which includes the development of organizations and groups, assignment of duties and delegation of functions. The second term emphasizes social relations to neighbours, friends and kin relationship. We understand the concept of a social community as social relations and social networks, in which rules and conventions, as well as concrete membership develop dynamically. They are different from formally organised social systems (organisational systems based on mainly formal roles) or from well established small groups. Their participants are informally or loosely coupled and not formally bound e.g. by a work contract (e.g. project-groups give specific tasks to their participants). Although role development is more dynamical in communities, role development is also observable in groups and organisations. If for example a small group starts using a web-based communication platform, they have already established a role structure and they are heavily influenced by knowledge and expectations they already have about each other. These characteristics are related to their size and the opportunities provided for face-to-face communication. In contrast, communities, especially web-based communities, can be very large. Memberships can vary and they exist in non-virtual as well as in virtual communities. Memberships are investigated by research using both aspects. Under these conditions of new information technologies there are many different types of communities on the web, e.g. *discussion forums about a certain topic*, *news forums*, SLASHDOT.ORG or EBAY. These type of communities are characterized by attributes such as *online*, *virtual* or *computer-supported communities.*

2.1. The term "Community"

Tönnies work on community (German: Gemeinschaft) and society was first published at the beginning of the 19th century (first edition 1887 [35]). As examples of communities families were used. Following Tönnies, communities are characterized by traditional behavior patterns (community of the blood: Kinship; Community of the place: Neighbourhood; Community of the spirit: Friendship). In 1979, Barry Wellman began a new discussion about communities [38], and later he extended his work to virtual communities. His works emphasise six aspects in analysing virtual communities: "density, boundedness, range, exclusivity, social control and strength of relationship" ([39], pp. 185). Another approach is called communities-of-practice: in the beginning of the 1990's, the term community was related to Communities of Practice by Lave & Wenger [19][17]. They assume that coherence of a community is based on common activities[2]. Wenger [38] called it „joint enterprise": not the interest of the participants makes a community but common actions and procedures. Wenger distinguishes it clearly from Communities of Interests, which do not need to have a shared practice. Jean Lave and Etienne Wenger [19] analysed the different forms of learning processes, by which a beginner becomes a full member of a community. It is important to realise, that a community of practice is not mainly characterised by the presence of participants common goals as is roughly the case with a homogeneous community of interest. Furthermore, the building of boundaries against other communities is not based on formal organisational rules. (In contrast to other authors who extend the term *community* by emphasising the aspect of common interests; e.g. [4], [20], [32]).

Both, Wellman and Wenger show how the analysis of virtual communities might be useful in understanding how persons relate to each other using web-based learning environments. Their thesis is based on constructivism, theory of action and social network analysis. The current support of role-based interaction provided by computer science is not reflecting these insights on the characteristics of communities in an appropriate way. In the computer science literature, sociological role concepts and research on communities is only partially taken into account. There is a gap between theories in social science and the design of community systems. We propose to carefully look into possibilities to support the dynamical development of roles to enable flexible development of communities. Thus, we will try to derive possible technical support mechanisms for community systems directly from the sociological role concept.

From a sociological point of view there are three different analytic levels which can be applied to the phenomenon of communities: aspects of system, action and structure (e.g. [17]). Thus, the following three characteristics are relevant for the **definition and analysis of communities**:

(1) Communities develop a shared social identity and social unity [40] based on communication processes. The elements of such an entity consists of relationships (network) of communication which refer to role-expectations (Luhmann [22]). That means communities build a boundary against their environment by processes of selection (systems-theoretical aspect, [22]). In this sense communities are a kind of social system.

(2) In distinction from organizations such as enterprises, communities build themselves (informal character) by mutual engagement, commitment and activities. Cultivating shared, social values and norms based on behaviour-expectations (action aspect). Roles are based on behavior expectations which are extended to patterns of behaviour-expectations (see section 2.2). It is an ongoing process of interaction and social negotia-

[2] In 2003, an experiment of Strijbos and his colleagues shows that roles are an important aspect for supporting coherence [34].

tion. The exchange of ideas, knowledge and beliefs as well as collaboration, mutual support and shared understanding are central for communities [40]. Communities exchange knowledge about a domain to develop individual capabilities. They foster interactions and social relations "involving the heart as well as the head" ([41], p. 29).

(3) To maintain their capability of action, communities develop specific roles. Roles find expression in behaviour-expectations of a role-actor. Following Luhmann, expectational structures are social structures [22] (structure aspect).

Another distinction of communities concerns the size (e.g. small groups). For instance, Wellman distinguishes communities between "dense, bounded groups" and "sparse, unbounded networks" [39]. Furthermore on-line (virtual) communities are characterised by the fact that their communication processes are computer-mediated (by information technology). In contrast local communities regularly meet face-to-face [17].

If we analyse collaborative learning, knowledge exchange and interaction in virtual communities, we have to ask for the kind of expectations persons have towards the behaviour of each other in informal social relations. These expectations refer to the analysis of roles. Roles are a necessary element in supporting cooperative activity and learning. The forming of communities, which share interests, values and a practice of learning, are positively influenced by social roles: they have a structuring, coordinative and supportive function for the communities. The network of a communities' social relations can be considered as a web of interactions, and communication acts between participants playing their roles. In section 3.1, the first example of the empirical study shows that the participants discuss about expectations. Nevertheless before presenting the empirical study we describe the term role.

2.2. The term "Role" and Role-Mechanisms

The development of social roles in community systems is hardly systematically analysed and intentionally supported. Social roles in communities refer to social interaction: the individual participant (ego) realises himself and his counterpart (alter ego) in roles. *Ego* expects a specific behaviour of *Alter*. Ego tries to anticipate how *alter ego* might behave. Therefore, the analysis of roles is necessary for two reasons. On the one hand, social systems create and change themselves by reciprocal expectations towards behaviour (this is also presented by Luhmann's social system theory; [22]). These expectations are related to social roles. On the other hand, informal social relations and communities can only develop and build up, if the participants accept the conditions under which they can interact and the scope of options which determine their activities.

The term "role" has a long tradition. At first it could be found in the work of Mead [24] who was a protagonist of a role concept in the context of symbolic interaction (further contributions by [8], [18]). Mead assumed that society is composed of interactions. These interactions develop role structures. In contrast the functionalistic perspective (e.g. [21], [28]; [5]) is characterised by the idea that society determines roles, which are defined by a set of normative expectations and sanctions. Both paradigms try to explain the relationship between individual and society or between person and system. The functionalistic approach suggests the existence of objective structures which determine the individuals' behaviour. In contrast, the symbolic interaction approach emphasises that roles are formed on the subjective will of the actors. The role theory was criticised especially in the 1950's - 1970's as not being fully able to explain the complexity of social systems. Thus, role theory was no longer considered as a complete sociological theory, but the term role was integrated as a basic term in contemporary social science. A more detailed description of the sociological

and social-psychological role theory can be found in Biddle & Thomas [3][1]. Contemporary social systems theory, especially Luhmann' s theory, included "role" as a basic term [22] as well as other role transitions in recent contributions e.g. Ashforth in 2001 [1] and Montgomery (1998 [26]; 2000 [27]).

Roles are often defined as sets of activities performed by individuals [7]. "A role is a set of prescriptions defining what the behaviour of a position member should be" ([1] p. 29). But this is not enough to understand role behaviour in community systems. To put it roughly, a role is the sum of all behaviour expectations of a social system towards a concrete role actor. The role actor is in a certain position, which is linked to tasks and functions. From our point of view, a **role** has the following **four characteristics**:

(1) Position: A role always includes a position, which is linked to functions and tasks. Originally, the term "position" refers to a social stratum in a society or to the hierarchy level in a business enterprise (e.g. organisational chart). The position of a role also indicates the social position. Positions have relations to other relevant positions in a social system (static aspect of structure [37]). Thus, the matrix of positions mirrors the structure of the social system. (This is also valid for informal, emerging roles. The only distinction is the level of consciousness and awareness i.e. level of explicit integration of position, tasks and functions. The turn to formal roles is gradual.)
In the empirical study (section 3) all participants had the same positions as persons who have to negotiate an interesting topic for the whole community. There is no specific designation (name) for this position. The position also includes the task, i.e. what to do.

(2) Function/Tasks: The position implies special functions and tasks, usually in the form of explicit and documented expectations, rights and obligations, which are addressed to the role actor by the social system (e.g. job descriptions and task assignment).
If we examine virtual communities we find the same phenomenon: There are persons on certain positions like administrator, authors, lurker and contributor (persons who discuss something). The name of the position often includes what to do (task and function of the position). Often, virtual communities have a website, a kind of document, that describes the uses of the different positions: the administrator has another access right as the normal contributor. For instance, the administrator can delete files or can change other persons contributions. Contributors do not have this right.

Both aspects – 1 and 2 – are used by the computer science view. Software engineers use roles to administrate and manage access rights for persons in technical systems. For instance, Sandhu et al. [30] created a role-based access control model (RBAC) for a better support of the administration of technical systems. However that is not enough to understand role behaviour. A role is a more complex phenomenon than a task/job because it develops in a network of social expectations and possibilities for positive or negative sanctions. "Roles exist in the minds of people", because "expectations are beliefs or cognitions held by individuals" [14]. The work of Ilgen and Hollenbeck (1991) distinguish between jobs and roles as structure of an organisation. "Jobs are viewed as a set of established task elements" that are objective, bureaucratic and quasi static [14]. Roles also include informal implicit expectations based on social interaction (follow aspects 3 and 4).

(3) Behaviour-Expectations: The role concept covers more than only the formal job description. There are also expectations which are not explicit. It includes informal notions and agreements [10].
If you contribute to a discussion in a virtual platform you should acknowledge certain rules, e.g. how to contribute without nonverbal behaviour, what is on-topic or not, how to formulate politly, what are "emoticons" etc. Virtual communities assume that these

facts are known. It is mostly an informal agreement and commitment. If participants do not keep to this agreement, they can expect to somehow become excluded. This is called negative sanction.

(4) Social Interaction: Within certain limits the role actor can actively form a role he or she has taken. However, this forming depends on the interaction with other participants in the social system. Roles are the result of a negotiation between the role actor and those with whom he or she interacts, face-to-face or virtual. The role actor *transforms* the role expectations into concrete behaviour (aspects of role-making; see below). Each participant will fill out the same role (slightly) differently [31].

The stability of a formally established organisation is based on explicit formal roles and less on informal, emerging, implicitly developing roles. The role-development for these roles is not as dynamical as roles in communities. Communities have only few formal roles but a lot of dynamically developing informal roles. Both, formal or informal roles require a kind of role-development. Formal roles can be handled more easily, because they can be considered quasi as static. Web-based systems require a different support: a socio-technical solution which enables role-development in computer-mediated communication. The term role-development consists of several mechanisms. The description of these mechanisms is the basis for the technical options (section 4).

Roles are gradually developed in social systems by perceiving the repetition of social interaction patterns based on patterns of expectations. Repeated and anticipated behaviour leads to expectations which characterise a role. The development of roles is accompanied by the shaping of interaction patterns for role-taking and role-making etc. These patterns can metaphorically be described as *role-mechanisms*. The following differentiation of **role-mechanisms** is derived from the role concept (see above):

(A) Role-assignment: There are two types of role-assignment: active and passive. A person assigns a concrete role to another person (active role-assignment). A person takes a concrete role and other participants agree more or less explicitly (passive role-assignment). In section 3 we give an example of a role-assignment. A community-participant has specific expectations of another participant: "Please, provide more information about structure." The expectations can be explicitly or indirectly conveyed with an expression and they may be positively or negatively sanctioned.

(B) Role-taking: For a person acting in respect to the expectations of a specific role, we use the term role-taking. "Role taking (…) is a process of looking at or anticipating another's behaviour by viewing it in the context of a role imputed to that other", Turner ([36], p. 316). Role taking is related to expectations which can be potentially enforced by sanctions being imposed on the role actor. A person can decide to take a role. She has the opportunity of accepting the role or not[3]. She can also develop a personal attitude towards the expectations of a role – even if she has already taken the role. This so-called role-distance means a critical distance to the role someone has taken [7]. The role distance includes a competent, critical, evaluative attitude towards the expectations, which specify a role. This attitude does not imply a fundamental refusal of the role or a behaviour which does not comply with the role [37].

Furthermore, the distinction between class – an abstract role, which may be taken by various persons – and instance – role being taken by a concrete person (role actor) – is to be considered. In virtual communities the existence of a role "facilitator" can be general-

[3] It is not possible to freely decide every type of role taking, e.g. taking socio-biological roles (such as father or mother) can be considered as mandatory.

ly accepted on the level of the class. Nevertheless, not every person is allowed to take this role, e.g. persons who are newcomers at a discussion platform.

(C) To allow someone's role-taking: Persons can take roles, without doing this as a response to expectations of others. Someone can claim to take a role, which already exists (e.g. expert in virtual communities to a certain topic) or can introduce a new role (e.g. conflict-mediator). If those, who have the right to assign certain roles, do admit or support someone to take this role, the role-taking is approved or an assenting/passive assignment has taken place. New roles can be developed by persons who take this role.

(D) Role-change: A person can in principle hold various different roles (role-set, [25]). For example, she can be a *scaffolder* in a virtual community and structures the discussion. The next time she is a regular contributor. Other persons can be taken by surprise if she on the one hand structures and on the other hand does not, although it would be necessary. Thus, it is important for participants to comprehend the role-change.

(E) Role-making: It characterises how a person *lives* (plays) a role, and how she transforms the expectations into concrete behaviour. Role-making is embedded in social interaction: Role-making refers to two or more participants, which negotiate the expectations being significant for a role [7]. The problem (from the community's point of view) is that the role actor has a certain attitude to the role (role-distance) and this attitude can differ from what the original expectations have intended [8] (*intra-role-conflict*).

(F) Role-definition: If some expectations are addressed more frequently than others and are accepted, a new role results from this repetition. The process of the role-definition is supported particularly if the processes of role-assignment and role-taking are reflected and articulated. The role-definition becomes a part of the self description of a community. For example if it is specified explicitly that a virtual community wants to have a function *gate-keeper*, a specified form of the role facilitator, who deletes spam or other disagreeable information, then the tasks of the role facilitator are extended.

(G) Inter-role-conflict: If a person takes more than one role, a conflict between the roles can occur. For the participants of a community it is important to understand the potential inter-role-conflicts [25]. These result from different demands on different roles. For example, a person takes the two roles such as facilitator and participant at the same time. In the first situation, she structures the participants' discussion and therefore should take a neutral standpoint. In the second role she provides her own content and argues for her own opinion. Thus, there is a conflict in the person' different interests.

The analysis of roles should make the role-mechanisms conscious to participants to help and support to fulfil, or change expectations as well as making role-development comprehensible. According to the results of Strijbos et al. experiment [34], roles increase participants' awareness of interaction and efficiency through cohesion and responsibility. Thus, roles also support knowledge exchange and collaborative learning. In section 3, we analyse an experiment to show that roles are visible, and show how roles develop in computer-mediated community systems.

3. Explorative Study: how to find roles in web-based community systems

3.1. Description

In an empirical study we analysed the logged (text-based) dialogues of the communication during an explorative study with the web-based learning environment KOLUMBUS ([12], [15], [16]). The study of communication sequences intended to analyse roles and role-

mechanism such as role-taking and role-assignment. The design of the learning platform KOLUMBUS was based on communication theory, and requirements for collaborative learning and knowledge exchange. The aim was to use this learning system to initiate communication processes to enable mutual learning and shared understanding. For the evaluation of the functionality of this system, case studies and experiments were accomplished. In the context of an experiment (period 14 days), four small groups (3-5 persons each) had the task of identifying interesting topics and agreeing upon which one of them would be the main topic of a workshop for the whole group (12 persons). The discussion had to take place within the web-based computer-supported learning environment exclusively without any further communication outside the learning-system. The participants should settle the following:

- The participants should put forward three of their own ideas.
- The next step was to discuss others ideas.
- Finally they should vote on proposed ideas to find the most agreeable idea or contribution.

In order to analyse the material, i.e. logged dialogues, the first methodical step was to identify the communication dialogues and interaction sequences in the web-based system which were related to role expectations. Our first step was to expose social interaction patterns. On the basis of the methodology of Strauss & Corbins' grounded theory (text-analysis) [33] we selected those contributions which were not directly related to content and analysed their relevance to the development of roles. In a second step we analysed the role-mechanisms. We are therefore looking for types of behaviour (communication) patterns which establish roles, and we are looking for communications which contain expressions of expectation and activity. There are different types of being involved from the speakers point of view: On the one hand, the roles which are taken and/or claimed by the speaker himself (e.g. "I" or "my" etc.); on the other hand, the role, which is assigned by the speaker to somebody else. We found there were situations, where it had to be clarified as to who assigns roles (role-assignment), who takes which role actively/passively (role-taking) and whether or not the role-taking is accepted and/or confirmed (see examples 1 and 2).

First example: Active role-taking (1)

In the dialogue example 1 (figure 1), it is obvious that person A requests more structuring of the discussion several times. Thus, person A takes the role of a *scaffolder*. Person B agrees after some time and thereby she approves of her role as *scaffolder*. The expectations of person A are verified, as person B agrees. (With the term "we" she even speaks from the others point of view.) In this short section we cannot so far speak of a newly established role. It is the beginning of a process which establishes a new role by the repeated interaction pattern, which includes the participants confirmation.

Person A:	„Procedural remark: Please, directly annotate a contribution."
Person A:	„ Always, include your annotation on top, please. "
Person B:	„Okay"
Person A:	„Please, provide more information about structure: Titles, author, publisher and so on!"
Person B:	„Okay, your are right. But we are still exercising ;-)"

Figure 1: Active role-taking

Second example: Active role-assignment (2)

Person B suggests creating a new folder within the web-based learning environment but did not specify, who should do it (see figure 2). With "Let us create a folder" she addresses the group. This request is an attempt of assigning other group members a role. Person C supports this idea and claims the role of an author of a new proposal: "Let us create a single proposal". She already limits the possible action to person B and to herself (and does not address the whole group). Eventually, person A addresses C as the person who should create the folder. She assigns the role of an author to person C. Finally, person C accepts the role and carries out the activity. Thereby she implicitly accepts the role which person A assigns to herself (which can be called a *decision initiator*).

Person B:	„Well, it seems we're all interested in discussing PP. Let us create a folder to collect everything about this topic."
Person C:	„I agree. Let us create a single proposal."
Person A:	„Yes, of course, you (person c) should create a proposal and start a voting about it"
Person C:	„Okay."

Figure 2: Active role-assignment

3.2. Results and Conclusions of our empirical study

The empirical analysis of the role-related dialogues gives concrete indications as to how social roles can develop in web-based learning environments and community systems: This happened during processes of discussion and negotiation. By analysing the interaction patterns, it became clear that the *participants* had specific behaviour expectations of others – such as *author* (to add content and contributions) or *conclusion-maker*. Other roles are related to learning processes (*promoter of the procedure* and *decision-initiator*), others refer to technical problems (*technical-supporter*) or support the development of appropriate structures to cooperate (*scaffolder*). Furthermore the common situation of learning needs support so as to create and think about organisational conventions (*organisational-supporter*) and personal conflicts have to be solved (*conflict-mediator*). We presume that the support of flexible role-taking and role-assignment improves knowledge exchange, mutual learning and the development of shared understanding. The result of our analysis is an enumeration of nine possible roles, which can be derived from the text-analysis and rudimentarily be described on the basis of the observed behaviour (see table 1 below).

As the period of this particular explorative study was relatively short, it cannot be concluded that new roles were established. However it gives first clues as to the starting points for the development of roles in communities when using web-based communication. Due to the team structure which had already existed before the experiment started, the already existing roles were partially reproduced. Structures, which were completely new, have not been developed. However, some dialogues revealed, that the existing role structure might change if the observed interaction patterns were repeated more often in the web-based learning environment. New roles were then possible such as conflict-mediator and structure-giver. It has to be emphasised that we did not determine and assign any specific role for the experiment. Role taking and role assignment happened spontaneously – partially regarding the existing structure and partially regarding the specific requirements of the experimental tasks.

Role	Description	Examples from exploration (*original in german*)	Specific tasks during empirical study
1. Author (Editor)	Contributes content, communicates own ideas by writing short statements	Suggestion/Contribution/ Ideas; "thought-provoking impulse of Person A."	Add own contributions and ideas
2. Guest (only lurking)	Visitor, only interested in getting an orientation without making own contributions	„Good idea, seems relevant for our group, too."	Reads others contributions (gets inspiration for other groups)
3. Conclusion-Maker	Adds comments (conclusions) to the process of communication	„From my point of view, the conclusion looks like ...."	Has an essential influence on the content discussion
4. Promoter of the procedure	Makes the current procedure more transparent, supports task completion	„Have you all fallen asleep? You should either agree to this proposal or enter new proposals.	Promotes (accelerate) the voting process
5. Decision-initiator	Combines diverging contributions by relating them to a summarising statement	„Are we sharing this view of the problem?"	If divergent discussion, he/she initiates a concrete voting to reach a decision
6. Scaffolder	Support to cultivate cooperation	„Please, always include annotations on top."	Support common rules for holding discussion together
7. Organisational-supporter	Coach; helps to give another view of the activities (top-level)	„What about opening a kind of meta-discourse to discuss the procedure and negotiate our conventions?"	Support to think about organisational conventions (e.g. how to vote)
8. Technical-supporter	Solves technical problems	[Person B doesn't know, where the items are; the technical-supporter helps] „the items are stored and sorted automatically."	Explains the use of the technical system (e.g. where are the annotations stored?)
9. Conflict-mediator (CoM)	Acts as mediator in emotional conflicts	[2 persons have a dispute] „Right, second is similar to the first. I integrated both suggestions into one."	Intervention at emotional discussions (to enable the discussion to continue)

Table 1: Roles during the empirical Study

Table 2 (see below, next page) lists roles of our explorative study and those we found in the literature of computer-supported collaborative learning (CSCL) and knowledge management (the rows are not linked, it is only an enumeration). The three columns contain roles which are similar or have overlapping characteristics. However, some roles, which were at least suggested as a possibility in our empirical study, are different and cannot be derived from the literature. We take this as a clear hint that it is not sufficient to introduce and support predefined roles in community systems which have already been identified from existing case studies. It seems to be sensible to offer a flexible role-design which enables the development of new or the redefinition of existing roles.

To derive a definite set of features of role-design and role-development for technical systems was not the aim of our study. But it points out the necessity for supporting roles and role-mechanisms such as role-assignment and role-taking in web-based learning environments. In addition, the theoretical considerations of virtual communities referring to

empirical results encourages us to continue our research in supporting socio-technical role-development. From this point of view we derive requirements for the technical support of community systems (see section 4).

Empirical Analysis	Literature	Literature
KOLUMBUS Explorative Study	Learning Processes, e.g. CSCL	Knowledge Management
Author	Teacher	Editor
Guest	Lurker	Co-Author
Conclusion-maker	Moderator, Gate-keeper	Leader KM
Promotor to the procedure	Tutor	Process Owner
Decision-initiator	Initiator	Chief Knowledge Officer
Scaffolder	Expert	Expert
Technical-supporter	Student	Administrator
Organisational-supporter	Mentor	Content Steward
Conflict-mediator	Reviewer, Enquirer	Cooperator

Table 2: Roles from the empirical study and literature

4. Supporting role-development in computer-supported community systems

In this section we discuss technical options (see table 3), which could support interaction based on roles and support their flexible development in computer-supported community systems (CSCS). Technical support may facilitate processes in communities, but they may also be problematic. In social science the role term is basically an analytical concept, but programmed functionality of roles in software systems creates a manifestation of the role concept, where the options and restrictions for action within a role are enforced at a certain level. These problems are similar to the problems that were discussed when Winograd and Flores [43][41] used Speech Act Theory as a foundation for the system COORDINATOR. The system required that users actively classify messages as speech acts. During normal communication the speech acts are implicit, and it is unusual that an expression is explicitly classified. Consequently, the system was not used as intended (e.g. [29]). In contrast, assigning roles to persons is usually more interactive and leaves more explicit traces in communication processes than the categorisation of speech acts. (Furthermore the term role is used in everyday life, e.g. at work, conferences, sessions; at theatre and cinema, role-games at internet, etc.) So if we derive technical role-support we would not foster static formal roles but dynamically use role-mechanism to support social interaction and make it more flexible.

To derive technical functionality we especially focussed on the mentioned activities and constellations in the context of role-taking and role-assignment. We assume that in most cases it is not possible to know in advance which roles will develop. Therefore the goal is to support the development of roles as flexibly as possible. The social interaction patterns described in section 2 (role-taking, inter-role-conflict etc.) are metaphorically understood as role-mechanisms, and for these mechanisms technical support may be useful. To make clear that a support can refer to an abstract role on the one hand and a role in concrete situations on the other hand, for example when a specific person takes a role, we distinguish between classes and instances. In table 3 we propose several possible support functionalities, which are not intended as a complete enumeration, but as a starting point. The descriptions should also be understood as limiting the possible actions within a role and the possible definitions of attributes of roles.

This depends on the domain, the specifics of a role and its context. We emphasise that it is not either reasonable or possible to develop a single cooperative system with all the

shown aspects of technical support of role-mechanisms nor to install them altogether and test them empirically. This would overwhelm users with an overload of functionality.

Role-Mechanisms	Class level	Level of instantiation
Role assignment	Defined roles are made available and can be assigned by drag und drop. A role-assignment is suggested as a possible action, with an appropriate display.	It is displayed which user has an authorisation for a role. The attempt of a role-assignment to another person is indicated.
Role taking	Preconditions can be defined, for example if only one person or several can take the role or if a role-owner can take more than one role. Contributions connected to a role are indicated automatically (selectable or predefined). Available roles are displayed permanently. A role can be taken by drag und drop (*to take a hat)*. Participants receive an awareness display if someone tries to take a role or release a role.	The involved participants have to agree. Preconditions are verified automatically to a concrete role-owner. The number of available functions and options are adapted to the individual role-owner (in dependence of other roles). Unavailable roles are greyed out. An attempt at taking a concrete role is indicated to everybody.
To allow role taking	A support for negotiating role-taking can be helpful: Per class of roles the modes of voting are specified (Veto or not; anonymous voting etc.). It is possible to specify restrictions. Conditions to release a role are defined (e.g. temporal).	A negotiation is initiated. Each participant can specify conditions. The voting is evaluated.
Role change	Conditions given to a role-change are transparent. Determining, which role-changes have to be announced in advance.	Concrete role-changes are indicated. Concrete role-changes are announced in advance.
Role making	A participant who takes a role or assigns a role is allowed to change parameters or examples, which describe the role.	The role-owner is allowed to choose between effects of a role-taking (e.g. special indication of contributions). It is possible to change the conditions/requirements of a specific role.
Role definition	Repeatable interaction patterns are made transparent (e.g. by recording und mapping) There is a list of parameters to describe roles (free annotations are possible) Examples of dialogues are collected, which show the expected behaviour of a role.	A simple click can be used to encourage repetitive behaviour of a nearby defined role, including role taking.
Inter role conflict	Interrelations between roles are illustrated in a graphical form.	The current roles of the participants are visible. Conflicts are made transparent, e.g. in preparation of a voting.

Table 3: Role-Mechanisms and technical support

Furthermore it must be considered that useful role support should be context- and domain-specific: enterprises, where knowledge management is used, need different role support than CSCL systems or CSCS, because an enterprise includes more formal roles, or the redefinition of roles needs different kind of approval.

How can this functionality (table 3) help in the context of the empirical case study (section 3.1)? How would interaction during the case study be changed with a system with some of the proposed functionality?

For the case study (section 3) the groups themselves had not been organised in advance. All participants were able to create content and help to organise the discussion. But during the case study a moderator (facilitator) developed only in some groups, in others all were equally contributing as moderators. Given the new functionality, in a group with moderator the interaction may have looked like this: The participants contributed content, but were not relating to each others contributions. One participant – named moderator – proposes some rules and uses functionality to mark her contributions as "organisational". Other participants are easily able to agree on the proposals and to encourage the moderator to provide organisational comments, by clicking on specific symbols next to the entered item (role definition). This simple pattern of one participant proposing guidelines to organise the group-process and others agreeing on them happens several times. Finally the moderator proposes to reorganise the content. The functionality enabling this to be done is usually not activated, so as to avoid incomprehensible manipulation of the shared workspace by one participant. With an organisational contribution, the moderator requests permission to reorganise the workspace (role taking). This needs other participants approval. With the approval the participants can then select between: deny, grant permission for a certain period of time, grant permission generally, or create a role with the right to reorganise the content and to connect this role with the moderator (allow role-taking and role definition). A name for this newly created role can also be entered.

With this mechanism of granting, permission of use of critical functionality can be given to those participants with an outstanding position in the community, and binding these to a role can also help others to be aware of the problems with some functionality (like reorganising the content), as well as giving the group themselves a chance to perform certain changes in their work-space. At the moment, this critical functionality is only available to technical administrators. It is not usually open to the group itself. An even more concrete example can be found in the interaction: "Let us create a single proposal" (see empirical study section 3.1). Creating a new integrating proposal is only necessary, if earlier contributions cannot be changed. A copy operation within the system, which allows users to change their contribution afterwards, should usually be avoided so as to keep authorship clear and distinguishable, but in this interaction it is socially approved that one has the right to perform some integrating action on the content. This may also result in a general permission being given to a certain person to carry out these kinds of changes.

It should be made clear, that different community systems have to support different role-mechanisms, based on their primary functionality. For example EBAY.COM, to purchase by auction, has a different kind of interactions, than a news forum or discussion forum to solve technical problems of a certain software-product. The empirical experience described in section 3 gives some hints for plausible scenarios, where several of the listed mechanisms may function hand in hand. E.g. it seems possible on the basis of the behaviour of the members that a discussion forum suggests the introduction of the roles of editor and facilitator. It also seems plausible that it is necessary to support social interaction processes such as role-assignment, role-taking and role change and that it is possible to assure compliance with the social "rules" technically. The differentiation between the roles may be documented within the system for further development. Solutions are specific to the domain and system. We suggest that in different community systems parts of the mentioned functionality should be integrated and tested empirically in a concrete context.

5. Conclusion

This paper presented the term "role" from a sociological point of view as a foundation for building and supporting socio-technical community systems. The community building process (stages of development, e.g.[41]) differentiates social structures where roles are

central. The result is a set of dynamically developed roles – informal or (maybe later) formal roles. This development can be observed in any social community. We used an empirical explorative case study to show the relevance of the term role and role-development (section 3). In current technical systems roles are not actively and systematically supported. We think, that considering role-mechanisms (role-assignment, role-taking etc.) as a foundation for developing supportive functionality will help members to communicate more effectively and to exchange knowledge and to learn mutually. Obviously there is currently a gap between the role terms in computer science and social science. On the one hand, computer science assigns roles to persons as formal rights. Primarily access controls (authorizations) and assignments of tasks are controlled by static roles. This notion is present in today's cooperative computer-systems, like WMS, CSCL, knowledge management and community systems. On the other hand there is the sociological role concept: roles are a dynamic social interaction phenomenon. Participants interact on the basis of social roles and take a role for a certain period of time, to act and to get in contact with others. As an example the roles from an exploration with a CSCL-application were presented. In available technical systems no attention is paid to the dynamic development of roles in the sociological understanding.

We started with a detailed analysis of the sociological role concepts, and discussed its relevance for communities. From theory we have derived certain role-related actions (role-mechanism), e.g. role-taking and, role-assignment. This analysis leads to new options for supporting roles in community systems as well as collaborative software-systems.

6. References

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