

# **FROM COMMUNITIES OF PRACTICE TO BOUNDARY CRITIQUE: AN EXTENDED APPROACH**

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## **ABSTRACT**

In the critical systems thinking (CST) literature, particularly in the theory of boundary critique, the process of marginalisation has been studied mainly taking into account those elements (issues, values, and agents) that are not fully included or excluded of a social design (Midgley, 2000). Taking this theory into account, this paper presents an extension of the theory of boundary critique by using elements of the social learning theory proposed by Wenger's (1998, 2000, 2010b): Communities of Practice (CoP). In doing so, the proposal includes the idea of considering the marginalisation process as one described by different forms of participation and non-participation that build the participants identity and their concerns. To achieve this, this paper is organised as follows. The first section presents the main aspects of the CST research approach and the systemic intervention bases to establish the context of the discussions about marginalisation process. The second section presents the main aspects of the CoP framework. The third section presents the proposal of an extended version of the marginalisation process, applying some CoP concepts. We conclude by presenting a practical example of implementation of this extended approach and discussing the implications of this approach for CST research.

**Keywords:** Communities of Practice, Boundary Critique, Process of Marginalisation, Periphery, Participation and non-participation

## **CRITICAL SYSTEMS THINKING AND SYSTEMIC INTERVENTION**

Critical Systems Thinking (CST) is a research approach to systems practice that was first developed in the 1980s. CST has centred its contributions on three themes of debate (Midgley, 1996, p. 11):

- Critical awareness: examining and reexamining taken-for-granted assumptions, along with the conditions that give rise to them.
- Emancipation: ensuring that research is focused on “improvement”, defined temporarily and locally, taking issues of power (which may affect the definition) into account.
- Methodological pluralism: using a variety of research methods in a theoretically coherent manner, becoming aware of their strengths and weaknesses, to address a corresponding variety of issues.

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There have been a variety of CST proposals for a critical, systemic and pluralistic approach to the design of action research (e.g. Flood and Jackson, 1991; Flood & Romm, 1996b; Jackson, 2000). However, we will focus on one particular proposal, systemic intervention, given that this has the advantage of focusing on boundary critique as well as methodological pluralism and has as one of its principles that of generating learning about the process and the outcomes of the situation intervened (Midgley, 2011). We will discuss these below.

### **Systemic Intervention and the theory of boundary critique**

Systemic intervention is a CST research perspective proposed by Midgley (1997, 2000). Midgley defines systemic intervention as “purposeful action undertaken by an agent to create change in relation to reflection on boundaries” (p. 129). This definition involves a cycle as follows:

- Critique – about exploring different possible boundaries and associated values that could be employed in an analysis, and choosing between them. Dialogue between stakeholders may be important here (Ulrich, 1983), but the researcher still has a pivotal role because a level playing field in dialogue cannot be assumed.
- Judgement – Here, the idea is to judge which theories and methods might be most appropriate, given the boundaries already chosen. Midgley talks about the “creative design of methods”, which involves understanding the problem situation in terms of a series of systemically interrelated research questions, each of which might need to be addressed using a different method, or part of a method. Furthermore, it allows us to mix methods from different paradigms (or even invent new methods) to address the research questions. The set of questions may evolve as events unfold and understanding of the situation develops. The interactive set of methods that emerges is usually different from (or more than) the sum of its parts (Midgley, 1990, 2000).
- Action – this involves using the set of methods to stimulate improvement.

The philosophical underpinning of systemic intervention is what Midgley (2000; 2011) called ‘process philosophy’. This refers to grant analytical primacy to the boundary concept, and viewing knowledge of agents and the world as secondary. Therefore, Midgley (2011) suggests that:

We should theorize about the nature of the agent (and agency) in exactly same way that we theorize about the world, exploring different possible boundaries for understanding agency, and making a contextually meaningful decision on what perspective(s) on agent(s) and agency are going to be most useful. (p. 7)

In relation with his approach, Midgley’s proposal for exploring boundaries builds on prior work by Churchman (1970) and Ulrich’s (1983) theory of boundary critique. The term “boundary critique” was first coined by Ulrich (1996) in relation to both his and Churchman’s ideas of boundary and improvement. Churchman (1970, 1971) points out that what is to be included or excluded is crucial to determining improvement in a problem situation: a change in boundaries could mean a change in the notion of improvement in a particular situation. He also presents the idea of boundaries as social or personal constructs

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that define the limits of the knowledge to be considered pertinent. In addition, boundaries also define who is considered pertinent (people who generate the knowledge). Thus, Churchman (1979) argues, as much information as possible should be “swept in” to definitions of improvement, allowing the most inclusive and most ethical position on improvement to emerge (Midgley, 2000).

Ulrich takes the ideas of Churchman, but he also presents the need to take a practical action to limit the sweep-in process. Therefore, he develops a methodology called “Critical Systems Heuristics” (CSH), which can be used to explore and justify boundaries through debate between stakeholders. According to Ulrich (2003), this process is called systemic boundary critique. He also supports his idea of boundary critique with Habermas’ ideas that consider rationality to be dialogical, with language as a tool and the need for an ideal speech situation (a situation where any assumption can be subject to critique, and all viewpoints can be heard). However, Ulrich points out the need to pragmatise the ideal speech situation because it is utopian. Consequently, he claims that systems thinking and critique must be linked:

Systems thinking without critique is blind with respect to its underpinning boundary judgements and their normative implications; critique without systems thinking is boundless, and ultimately empty, in that its object and context of valid application remain arbitrary. (Ulrich, 2003, p. 327)

Moreover, Ulrich (1983) points out the need to take into account not only those who are “involved in” any decision about the concerned system but also those “affected but not involved”. Additionally, he argues that the process of setting boundaries is intimately linked to value judgements (normative evaluations) and empirical observations (or judgements of facts):

The facts we observe, and the way we evaluate them, depend on how we bound the system of concern. Different value judgements can make us change boundary judgements, which in turn make the facts look different. Knowledge of new facts can equally make us change boundary judgements, which in turn makes previous evaluations look different, etc. (Ulrich, 2003, p. 334)

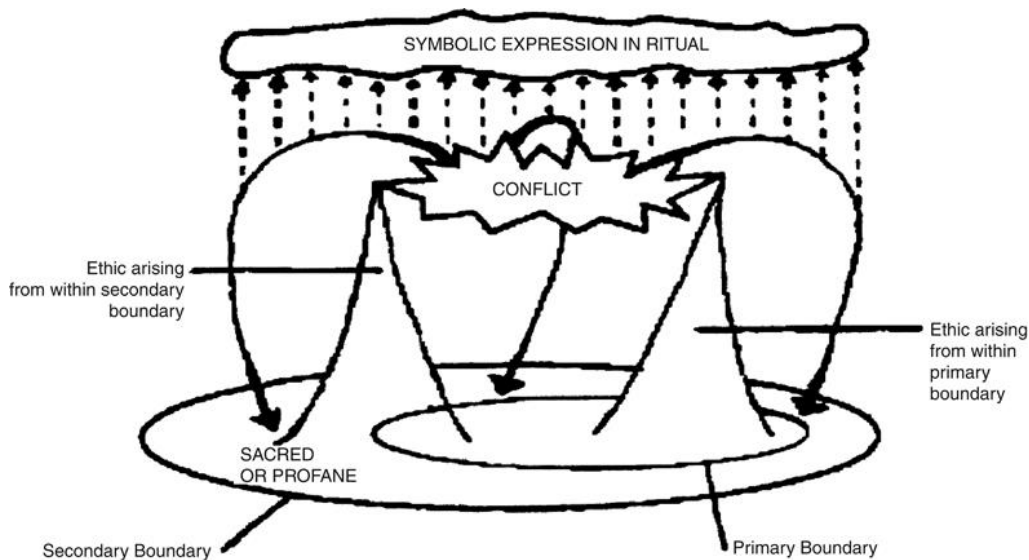
In addition to looking at inclusion and exclusion, Midgley (1992, 2000) also proposes the analysis of marginalisation as part of boundary critique: There are situations where particular stakeholders and issues are marginalised (neither fully included nor fully excluded from the system) and subject to strong labelling and ritual treatment (Córdoba, 2009). He argues that if one group makes a narrow boundary judgement and another makes a wider one, there will be a marginal area between the two boundaries. Therefore, when two ethical boundary judgements come into conflict, the situation tends to be stabilised by the imposition of either a sacred or a profane status on marginal elements. Regarding this issue, Foote et al., (2007) say that “Midgley (2000) talks about marginalized people and issues being made ‘sacred’ and ‘profane’ to indicate the potency of the valuing or devaluing that they are subject to” (p. 647).

When marginal elements become profane, the primary boundary and its associated ethic is focused upon and reinforced and the secondary boundary ignored. Conversely, when

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marginal elements are made sacred, the secondary boundary is focused upon and reinforced. The whole process is symbolically expressed in ritual (behaviour that contains certain stereotypical elements that involve the symbolic expression of wider social concerns). This ritual is formed by the struggle between the two groups to impose controls on any activities relating to the marginalised area (Midgley, 2000). Figure 1 presents the model of marginalisation and conflict proposed by Midgley (2000).

In summary, the basic idea of boundary critique is, thus, to reflect on different possible boundaries in order to challenge taken-for-granted assumptions regarding issues, values judgements on these issues, and people (including the identities and roles of agents such as researchers and participants) included in, marginalised by, or excluded from a social design. Reflection on the problem situation or social design should be considered in terms of what is and ought to be, and how the “ought to” might be realized (Midgley and Ochoa-Arias, 2001; Midgley et al., 2007).



**Figure 1. Margins, ethics, sacredness, profanity and ritual (from Midgley, 2000, p. 144)**

These aspects of the theory of boundary critique provide a general mechanism to make the critical boundary judgements, highlighting the importance of stakeholder involvement and dialogue with new participants (Midgley, 2000). However, this general mechanism can be further developed with the support of other research perspectives that shed lights to different kinds of stakeholder participation (including different types of stakeholders' issues and values) within the context of marginalisation process (Midgley et al, 2007). The next section presents a proposal of mechanism for different forms of participation in the theory of boundary critique, taking elements of social learning theory into account.

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### **COMMUNITIES OF PRACTICE (COP)**

Based on the systemic intervention principle of generating learning about the process and the outcomes of the situation intervened (Midgley, 2011), this perspective can be enriched from other research perspectives that focus attention on the interactive aspect of negotiating meaning (Harwood, 2012). Before we present the proposal to enrich systemic intervention, this section will present the basic components of the theory of communities of practice (CoP) proposed by Wenger (1998) as this theory will contribute to this goal.

#### **CoP main concepts**

According to Wenger (2000), a social definition of learning should take into account the historic and social aspect of competence and experience of each participant within the social system. Hence, learning is an interplay between social competence (which social systems have established over time) and personal experience (which each participant has as member of the specific social systems he or she is in). Learning so defined is a dynamic, two-way relationship between people and the social learning systems in which they participate. This two-way relationship can be seen as a convergence or a divergence between competence and experience. If convergence takes place, deep expertise is the type of learning that results; if divergence takes place, innovative learning is the type of learning that can occur.

There are two mechanisms to generate that dynamic of meaning making between competence and experience. The first, participation—having or taking a part, along with others, in some activity—suggests action and connection. The second, reification, is the process of giving form to experiences by producing objects that congeal these experiences into “thingness”, which reflects and shapes those experiences (Wenger, 1998). Therefore, participation and reification are woven to make and negotiate meaning. This negotiation of meaning is the nature of the practice that participants experience in their social systems they are in.

In this interplay between participation and reification, which consequently creates the practice, learning is seen as the meaning making regarding the competences and experiences. Hence, a social definition of learning is the interplay between competences and experiences that defines practices and are generated through mechanisms of participation and reification where meaning is created and negotiated.

This definition of learning involves the idea of different ways to participate in the social learning systems where we are. Those different ways to participate are called modes of belonging (Wenger, 1998 and 2000) or modes of identification (Wenger, 2010a):

- **Engagement:** doing things together, producing artifacts. It is the active involvement in mutual process of negotiation of meaning. This generates direct experience in the social system where we are.
- **Imagination:** creating images of the world and seeing connections through time and space by extrapolating from our own experience. This generates indirect experience to understand the social systems where we belong.

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- **Alignment:** coordinating our energy and activities, perspectives, interpretations and contexts, thus that actions have the effects we expect. This generates experiences where power is required to negotiate that alignment.

These three modes of belonging are analytical aspects of the dynamic of social learning systems formation. They coexist and every social learning system involves each to some degree and in some combination. However, they help to understand the differences between social systems (e.g. community, nation, institution) because they describe different ways of participation and identification. Regarding the differences between social systems, Wenger (1998, 2000) proposes three main constitutive elements of the social learning: communities of practice – CoPs, boundaries (and their combinations with other CoPs), and identity.

### **Constitutive elements of social learning systems**

- **Communities of Practice:** according to Wenger (2000), the basic building blocks of a social learning system are the communities of practice, because they are the social “containers” of the competences that make up such a system. According to Wenger (2006):

Communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavour: a tribe learning to survive, a band of artists seeking new forms of expression, a group of engineers working on similar problems, a clique of pupils defining their identity in the school, a network of surgeons exploring novel techniques, a gathering of first-time managers helping each other cope. (p. 1)

Three characteristics are crucial in defining CoP:

- **The domain:** A CoP has an identity defined by a shared domain of interest.
- **The community:** In pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information.
- **The practice:** The members of a CoP are practitioners. They develop a shared repertoire of resources (experiences, stories, tools, and ways of addressing recurring problems).

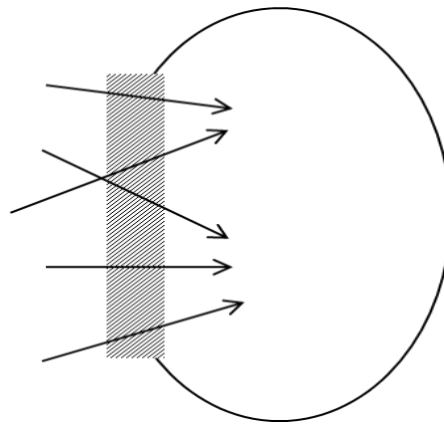
- **Boundaries, constellations, and peripheries:** according to Wenger (1998, 2000, 2010a), in social learning systems, the value of communities and their boundaries are complementary. Here, boundaries are a result of different enterprises, different ways of engaging with one another, and different repertoires, therefore, different practices. These boundaries are places of interest for communities to learn. Learning between boundaries implies that participants are able to recognise an experience of meaning among each other and to develop enough of a shared sense of competence: some intersection of interest, acknowledgement of differences and common ground, evaluation of those different competences between communities, and ways to engage and translate between repertoires so that experience and competence actually interact.

In addition to boundaries, there are constellations of practices, which consist of communities and boundaries that define diversity in the way people engage with the

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practice and in the way bridges are constructed to enhance the ongoing production of local meanings as part of constellations. They can be seen as larger configurations of interconnected practices (Wenger, 1998).

Furthermore, the idea of considering communities, boundaries and constellations leads to take into account the notion of peripherality. This concept stems from seeing communities of practices as a source to provide peripheral experiences to people who are not on a trajectory to become full members. In doing so, the CoP can offer them various forms of casual but legitimate access to a practice without subjecting them to the demands of full membership. This kind of peripherality can include observation, but it can also involve actual forms of engagement (Wenger, 1998). Therefore, the periphery is defined as the region that is neither full inside nor fully outside and has a degree of permeability (see figure 2). However, this region can easily become a zone where marginalisation occur, within established regimes of competence: certain members are marginalised because their experiences and competences are repressed, despised, feared, or ignored. This region also is determined by the boundaries that the different practices create, however it has the implication of allowing different levels of participation (this topic will be extent in terms of “identity”).



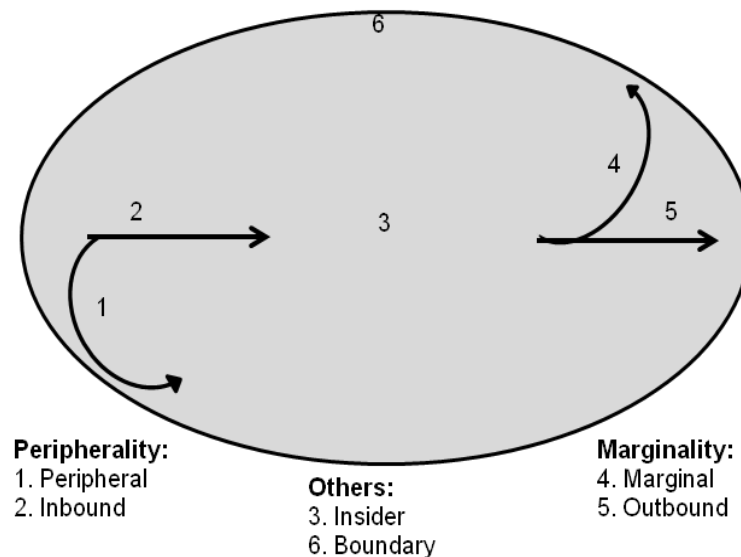
**Figure 2. Boundary and Periphery (adapted from Wenger, 1998)**

- Identity: the social aspect of learning does not mean a displacement of the person. On the contrary, it is an emphasis on the person as a social participant. This person is a meaning-making entity for whom the social world is a resource for constituting an identity. Here, learning is becoming a certain person; it is to negotiate knowledge with respect to the regime of competence of a community (Wenger, 2010a). In talking about identity from a social perspective, Wenger (1998) points out that the concept of identity serves as a pivot between the social and the individual. It is built through the negotiation of meanings of experiences of membership in communities. Wenger (1998, 2010b) explain identities as a complex ongoing structure of the negotiated experience. That is, an identity is a layering of events of participation and reification by which we construct who we are through the negotiation of meaning. This negotiated experience can also be interpreted as the membership in a community, the different nexus that the individual has within different communities, and the connections that he or she has with broader constellations enterprises.

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Identity can also be examined as a learning trajectory. This implies the temporal, ongoing, non-linear, and historical notion of the identity. In the context of CoP, several types of trajectories can be described. Peripheral trajectories (some trajectories never lead to full participation, but instead have enough access to be significant to the identity-building process). Inbound trajectories (initially they are peripheral, but they have the intention of becoming insider trajectories in a future, so they are an investment in the identity-building process). Insider trajectories (once a member becomes a full participant, his or her identity keeps being negotiated). Boundary trajectories (some trajectories find their values in the boundaries to link communities). Outbound trajectories (some trajectories lead out of a community). In summary, identities as learning trajectory are defined by where we have been and where we are going (see Figure 3).

Identity can be seen as the significant forms of participation understood in the context of learning trajectories. Here, two cases of interaction between participation and non-participation are distinguished (these cases are related to the idea of boundary and periphery previously presented). Peripherality refers to when a degree of non-participation is necessary to enable a kind of participation that is less than full. Consequently, the participation aspect dominates and defines non-participation as an enabling factor of participation. This aspect of the participation-non-participation interplay helps to characterise a process called “legitimate peripheral participation” (Lave & Wenger, 1991), whereby being peripheral can help someone take part in the initial activities of the community without engaging fully, whereby this kind of participation is legitimised by the community. Marginality refers to when a form of non-participation prevents full participation. Consequently, the non-participation aspect dominates and defines a restricted form of participation. In other words, full participation is not possible because participants are repressed, ignored or blocked. These forms of participation-non-participation can be described in terms of the trajectories presented above (see Figure 3).



**Figure 3. Relationships of participation-non-participation and types of learning trajectories (adapted from Wenger, 1998)**



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### **The notion of power**

To Wenger (2010b), learning and power imply each other. He argues that CoP is based on the creation of practices, and this creation takes place in response to power, not as an outcome of it. Therefore, he describes power as constituted by two intertwined processes: the modulation of identification and the modulation of accountability.

Modulation of identification refers to the different degrees of identification that we can have to different communities and their practices. This modulation makes one accountable to the communities' regimes of competence. This process implies that identity is shaped both inside-out and outside-in. As it was presented in the previous section, the modulation of identification can be a result of experiences of participation or non-participation on the one hand, and a result of an exchange between individual processes of engagement to identify and collective processes where others identify (to the individual). This modulation process includes the modes of belonging described previously (engagement, imagination, and alignment) as people shapes their identities through direct experience, images of the world that locate them in various contexts, and following directions or negotiating plans to pursue effective practices.

Modulation of accountability is the complement process of identification. It includes the elements that define competence in the different constitutive elements of the social learning systems that should be explored to account for tensions between and within communities:

- Regime of competence in terms of CoP processes includes the ability to engage with other members, the ability to understand the enterprise, and the ability to have access and manage the repertoire. Here, the level of learning focus, social capital (sense of community), and self-awareness (about repertoire) can be evaluated and challenged.
- Regime of competence in terms of boundary processes includes the ability to have access and understand the knowledge between communities, the ability to adapt and apply decisions across boundaries, and the ability to be accountable and be committed to explore multiple perspectives.
- Regime of competence in terms of identity processes includes the ability to generate deep connections, to expand their identities' features, and to be proficient to participate actively.

The basic mechanism where these two types of modulations co-exist is the interplay of participation and reification; in other words, by acting with others in the community and producing the practice. Here, the negotiation of meaning can be seen as the interdependent nature of modulation, where identification (the identity part) and accountability (the regime of competence of the CoP counterpart) define each other (Handley et al., 2006). For instance, the identification (or not) of ourselves to a practice (neurosurgery) is translated into a regime of accountability (be competent as neurosurgeon) – (or not be competent). Among all the constellations of practice, this process is repeated to negotiate the proper meaning for our identities and our communities.

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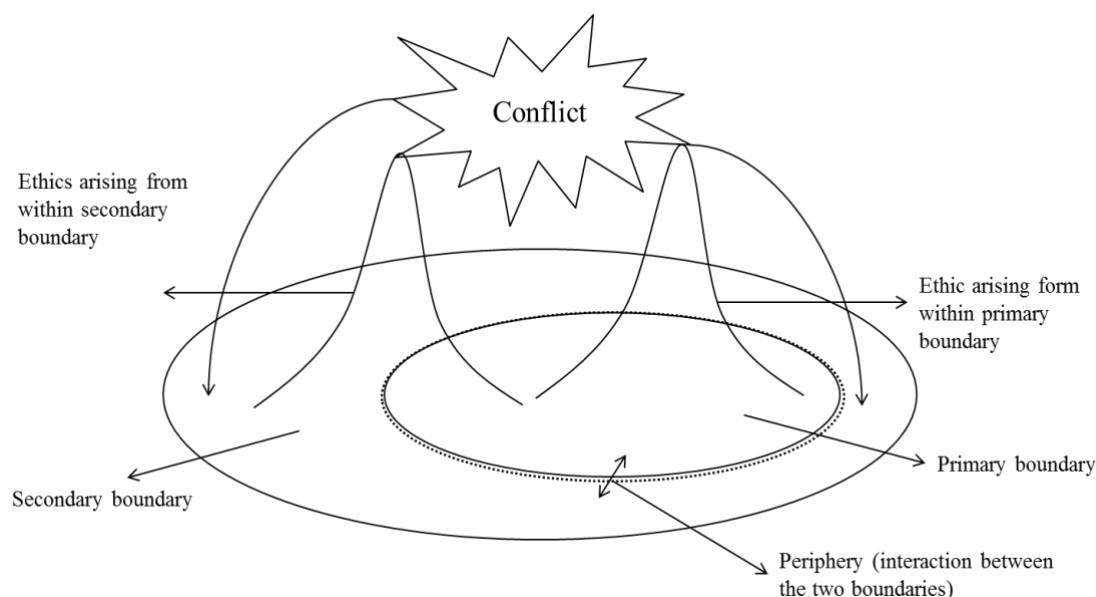
### **REFLECTION FROM COP TO THE THEORY OF BOUNDARY CRITIQUE**

This section presents the extension of some ideas from the theory of communities of practice to the theory of boundary critique in order to support the process of making boundary judgements.

In particular, the systemic intervention perspective can take advantage of the idea of peripherality and marginality related to different forms of non-participation (Wenger, 1998), where marginality is associated with restrictions on a member's participation and peripherality is associated with participation that is less than full. Therefore, the inclusion of the CoP framework can contribute to analyse a new type of non-participation related to the legitimate peripheral participation concept proposed by Lave and Wenger (1991). This distinction generates the possibility of having some degree of non-participation that enables a kind of participation, being legitimate for the community. The new type of non-participation (peripheral) can help understanding the marginalisation area as a dynamic process where different kind of roles, participation, identities of stakeholders are (or should be) present. This implies that the mechanism to make critical boundary judgements should consider the complexity of that marginal area counting for different types of stakeholder participation (i.e. different levels of involvements that include core and peripheral and take also marginalisation into account).

This proposal from CoP framework to the theory of boundary critique also applies to values and issues. There can be situations where a degree (less than full) of regime of competence (considering the modulation of accountability) is needed. This implies a certain level of understanding, interaction, access, coordination, and dialogue about the practice of the community, the meanings built in it, or the potential meanings and practices to be built. Hence, values and issues are considered within the CoP approach as well as the peripherality leads us consider possible peripheral values and issues in the process of boundary judgements. As Midgley and Pinzón (2011) argue, there are moments in an intervention where the parties have different values and issues to claim but some of them are considered "core" and the others "peripheral", for instance: "the key elements of the different perspectives that could give rise to conflict over the common concern, and the elements that are of central importance to one party but less so to the other, which might become the focus of bargaining" (p. 1552). Here, the application of the aspects of modulation of accountability is important to promote different levels of values and issues within the critical boundary judgements and avoid (or at least be aware of) marginalisation.

Figure 4 presents the marginalisation process (as in figure 1) (Midgley, 2000) but includes the "permeability" (dotted line) needed in the boundary concept based on the theory of CoP (as in figure 2).



**Figure 4. Boundary and periphery in the marginalisation process**

This proposal presents an alternative way to explore, reflect, and challenge boundary judgements. By acknowledging the stakeholder identity (with their issues and values) as one built throughout a process of participation and non-participation, where non-participation can take the form of peripheral (not just marginal), systemic intervention (and the theory of boundary critique) is enriched for three reasons. First, this distinction highlights the learning process as one of the main aspects to be considered within the systemic intervention (i.e. tracking different learning trajectories, as in figure 3, make us realize the process of marginalisation and distinguish it from other type of participation that can be legitimate). Second, with this proposal the “legitimation” process is subject to negotiation, participation, discussion, and debate. In other words, it makes the non-participation features an integral part of the marginalisation process before considering someone or something full included or excluded (i.e. it questions the need of considering someone or something peripheral in addition to questions about inclusion, exclusion, and marginalisation). Third, connecting the CoP framework with systemic intervention in such a way shed lights to the idea of the social nature of learning that might emerge within or between communities as reflections evolve during the interventions. In doing so, systemic intervention can also be supported by CoP framework in the broad analysis about participants’ identities (as Midgley et al., 2007 propose to improve) as negotiated experience, learning trajectory, and different memberships.

### A practical example

With the purpose of improving mathematical problem-solving (MPS) students’ abilities and helping researchers and users to get a richer understanding of computer-supported collaborative learning (CSCL) processes, a programme with different projects was designed and managed. Two of those projects called “Atarraya” (the first project) and “Wenaji” (the second project) were virtual learning networks to work for teachers, parents,

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and 207 students of tenth and eleventh grades of seven schools (Atarraya) and 231 students of fourth grade of four schools (Wenaji) of Bogota, during a period of two years (each project). Both projects promoted interactions between people from different social backgrounds (rural vs. urban schools, low socio-economical level vs. medium and high socio-economical level). Both projects gave opportunities to use a diversity of MPS strategies in the context of a virtual learning environment (VLE), designed with password restricted access, which allowed students to work together in tackling mathematical problems.

The network was created for being used by heterogeneous groups of four students. Initially the heterogeneity was based on gender and school membership. The dynamic was cyclical. The first step in the implementation phase was the application of a MPS test and a survey of attitudes towards mathematics, ICT, and collaborative work. A post-project test and survey was applied at the end of each school year. Every three-four weeks, a set of mathematical problems was loaded onto the VLE. The expected dynamics around each set of problems was as follows: the problems were expected to be discussed by the students in each group, first in the computer room, and then via the VLE when students were able to use it. After three-four weeks of on-line discussions, students had to present their solutions in the VLE (Atarraya) or in their math class (Wenaji). This cycle was repeated eight times (during the school year there were eight sets of four problems). In addition, in Wenaji, some initial special math classes were designed to discuss diverse strategies to solve mathematical problems.

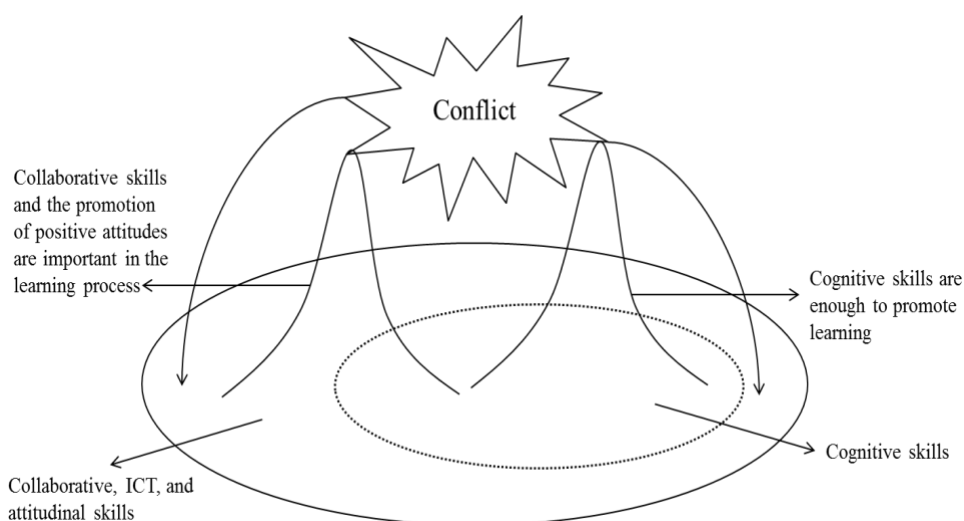
During the project, monthly voluntary meetings, including teachers and researchers, were held, in order to evaluate the evolution of the project. In these meetings, teachers presented an oral report of what was happening with the VLE and the problems they and their students encountered. Additionally, researchers presented a number of reports related to the records of interactions and discussed the problems raised by the teachers. These reports supported the reflections doing throughout the project life.

During the entire projects some sources of conflicts between boundaries regarding who and what ought to be included, excluded or marginalised were studied. In this analysis, the concept of peripherality (from the CoP approach) was also considered. These reflections have been documented previously (i.e. Barros-Castro et al., 2013). However, the use of the extended model of marginalisation process (figure 4), with the “periphery” and its implications, has not been presented before this publication.

One of the first sources of conflict analysed was about the projects purposes in terms of what kind of skills the project wanted to improve. In this sense, two main purposes were identified: First, to improve students’ mathematical problem-solving skills, taking advantage of a cooperative effort carried out by students and teachers around carefully designed mathematical problems about diverse MPS strategies. Second, to improve students’ collaborative and ICT skills and positive attitudes. These purposes were discussing in each project (see figure 5). Initially, in Atarraya project, there was a focus on the VLE and the generation of collaborative skills, regardless the cognitive skills about

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MPS. After Atarraya project, participants realised that this selection had had a negative impact on the promotion of mathematics learning. Therefore, in Wenaji (first year) there was a change in the focus of attention: The first objective (that about MPS skills) was highlighted. This change marginalised the idea of promoting collaborative, ICT, and attitudinal skills. In doing so, the project did not take advantage of the possible synergies that these objectives can generate to enhance mathematics learning. However, during the second year of Wenaji project, the notion of peripherality helped to work on those goals seeing the collaborative, ICT and attitudinal skills as a peripheral concern within the project purpose to support improvement of students' MPS skills. Therefore, the fact that Wenaji was a CSCL project about MPS and that the project included face-to-face interactions as well as virtual ones helped teachers and researchers in their understanding of both purposes, discussing about collaboration, ICT and attitudes. Consequently, the way to overcome this source of conflict was to promote mathematics discussions inside and outside the classroom (face to face and using the VLE, respectively), taking advantage of the peripheral status of collaborative, ICT and attitudinal skills.

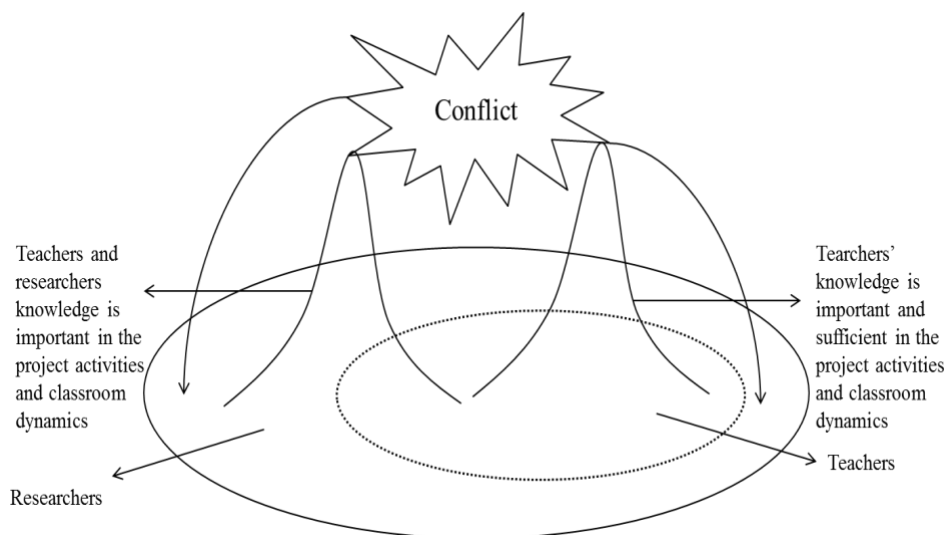


**Figure 5. Purposes: cognition vs. collaboration, ICT and attitudes**

Another source of conflict that happened in the projects has to be with the knowledge accepted to support projects activities. Figure 6 presents the conflict in terms of classroom control and project dynamics by teachers and researchers. In a narrow perspective, teachers were in charge of both dynamics, because they were the schools' teachers (with all the knowledge about the classroom dynamics). However, in a broader perspective, researchers could also help control the classes (including the special classes) and give students and teachers new knowledge about innovative ways of teaching and learning mathematics based on the MPS pedagogic strategy. However, due to teachers interest in continuing to work with their own mathematics materials and rhythm, and to researchers specialized knowledge at university level, this broader boundary generated conflicts that made marginalised (in Atarraya and Wenaji – first year) researchers knowledge. After reflection about the experiences and competences needed to support the project, there was a new level

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of engagement that allows a legitimate peripheral participation by researchers within the classroom activities.

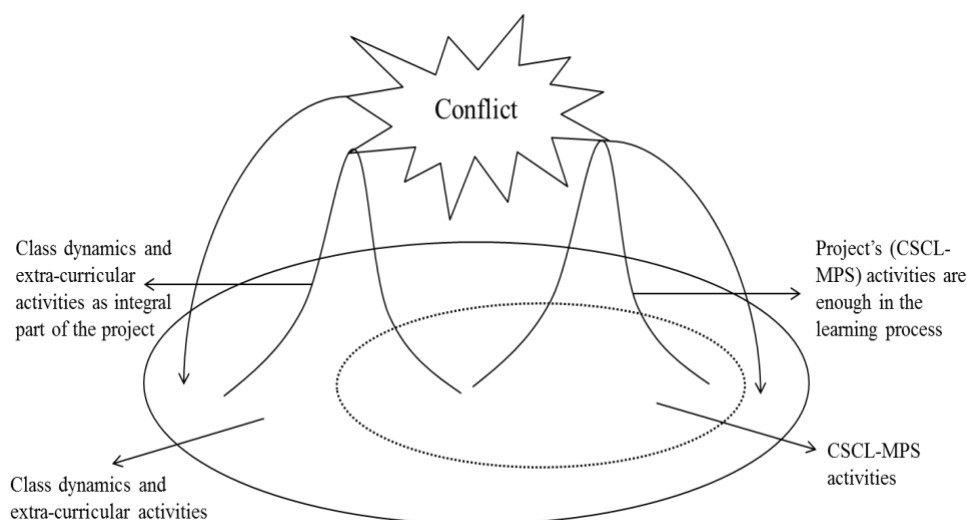


**Figure 6. Classroom and project dynamics**

A related conflict was generated by the fact that schools' extracurricular activities (and even the curricular activities and class dynamics) affected the project dynamic. In Atarraya, they were considered outside of the system being controlled (see Figure 7). However, during the implementation phase (and in the subsequent project – Wenaji), the idea of seeing the project as immersed in a school culture led us to consider the mathematics curriculum and class dynamics as factors to take into account in the design of the project and to track extracurricular activities to take advantage of them within the project. Therefore, although the project could not consider all the extracurricular activities, some peripheral concerns were approach by teachers:

- The success of the project can be affected by the selection of deadlines, dates for discussion of problems in the classroom, and dates to conduct tests. This was a complex task because of the different schedules and activities that each school had. Teachers from one school were always aware of these issues in the discussions. They proposed dates so that students could be more engaged in the Wenaji activities. For example, a discussion day could not be programmed a day before a school excursion, because excursion-caused anxiety could negatively affect students' concentration in mathematics discussions.
- The success of the project can also be affected by the selection of the problem topics. Teachers from other school helped us be aware of interesting topics taught in other subjects, for example, Spanish conquerors or Caribbean pirates in History classes.

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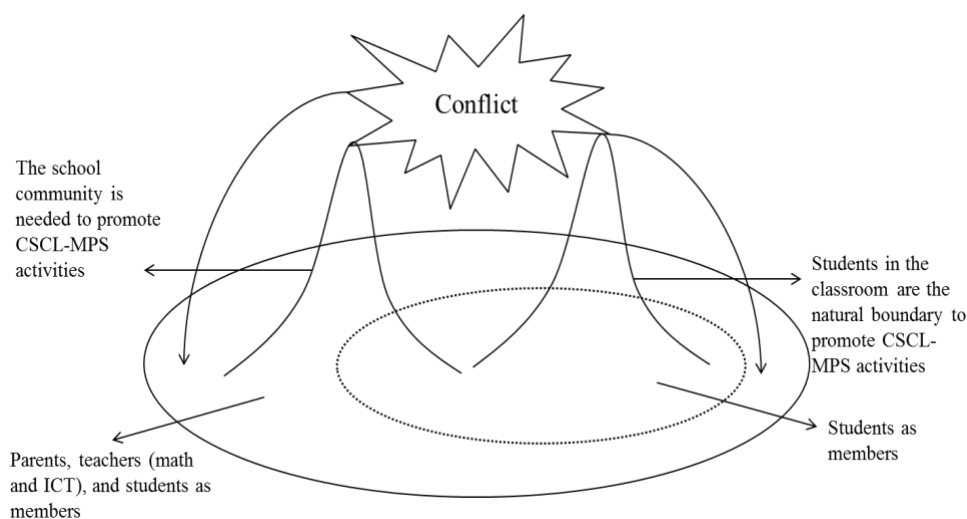
**Figure 7. Activities to be included in CSCL-MPS projects**

Finally, some conflicts about participants' trajectories during the projects can also be explained by the notion of peripherality in addition to marginalisation (see figure 8):

- Questions regarding whether parents and teachers (math and ICT) ought to be considered clients of the project in a similar way of students generated diverse configurations about participation and identities. First of all, parents were not included in Atarraya. But after reflecting on the possible advantages of working with them, Wenaji included parents as clients. In doing so, researchers wanted to share learning about the project (e.g. mathematics learning, ICT uses, collaboration, and positive attitudes to promote). However, some parents claimed that the project problems were not appropriate for their children. They complained about the time their children spent on the project and the project's activity's high level of difficulty. It seems that the amount of information and activities in which parents were involved overwhelmed them. They believed that the project generated too much pressure on their children, so they presented complaints. The idea of using an innovative approach for mathematics learning might have generated tension in parents about the skills required to tackle the problems. Hence, parents might have felt distressed about this proposal. Therefore, parents' identity could be seen as one of non-participation, although researchers' were willing to include them as full participants. These reflections brought up the question about the parents' role. If they are going to be part of the project but with an identity of non-participant, that identity should at least allow them to feel a legitimate peripheral participation instead of being marginalised. Therefore, they need to have a basic understanding of the community purpose and the way to support it. As a result of these reflections, during the second part of Wenaji, parents were invited to participate but as peripheral participants (and witnesses), only with the information about how to support children in their process. Besides, schools administrators were expected to look after the parents' perceptions as a way to overcome their marginal identity in the first part of the project.

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- Second, ICT teachers were considered as legitimate peripheral participants, because they can support the process of dealing with some ICT-related questions, while putting their experience and knowledge into a continuous dialogue about the entire project.
- Third, math teachers were considered as full participants. However, their knowledge, interests, and experience were not always considered as integral part of the project. Moreover, some of them did not completely understand the project enterprise (i.e. the innovative way – CSCL-MPS – of mathematics learning). For that reason, some of them stayed as peripheral or marginal participants. Other teachers did participate actively: they were teachers in the schools, learners of the innovative teaching strategies, and facilitators in the project implementation.



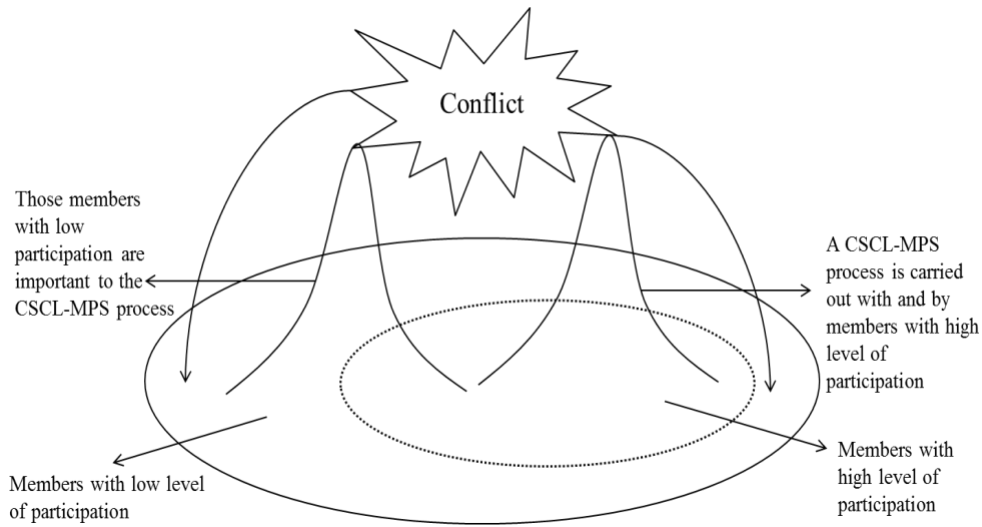
**Figure 8. School community vs. students as members**

- While students always were considered as full members of the projects, non-participation was observed when 75% (Atarraya), 77% (Wenaji, first year) and 67% (Wenaji, second year) of students remained passive students in the VLE. This situation shows factors of peripheral and marginal participation, therefore, conflicts between the “core” and the “periphery” (see figure 9). In analysing this conflict, it can be argued that students’ decisions about how to participate in the project can be analysed as legitimate peripheral participation, meaning students did not participate fully, but they were present to take relevant aspects into their own learning trajectories. Some of them shaped their identities as bridges between groups and take advantage of their positions into their learning processes. Some of them shaped their identities having marginal roles because of their lack of previous knowledge or extreme difficulties accessing computers and Internet (there was support for students in that situation; nevertheless, it was not sufficient in some cases). Some of them worked as active participants contributing to the project enterprise. In Wenaji (second year, in particular) active and peripheral students participated in groups, building a community of mathematicians that helped them to engage and identify with a new and broader community, in which



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the learning process could shape people's identities, taking advantage of the diversity of people involved in it.



**Figure 9: Core and Peripheral participants**

### Final reflections

Previous example shows the usefulness to combine elements from the CoP perspective with the systemic intervention approach, in particular, to consider the marginalisation process as one described by different forms of participation and non-participation. This proposal allows us exploring, reflecting, and challenging the boundary judgements taking some degree of non-participation that enables a kind of participation (peripherality) into account. It also helped us to reflect on those issues in the design and implementation of the project of a mathematical virtual learning network. Having presented this proposal of reflecting on different forms of non-participation within the marginalisation process in systemic intervention, the invitation is to incorporate and apply it in other practical cases to test it and generate new research questions around it.

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