



**Manchester
Metropolitan
University**

Jerardino-Wiesenborn, B and Paucar-Caceres, A and Ochoa-Arias, A (2019)
A Conceptual Framework Based on Maturana's Ontology of the Observer to
Explore the Checkland's Soft Systems Methodology. Systemic Practice and
Action Research. ISSN 1094-429X

Downloaded from: <https://e-space.mmu.ac.uk/623980/>

Version: Accepted Version

Publisher: Springer

DOI: <https://doi.org/10.1007/s11213-019-09502-y>

Please cite the published version

<https://e-space.mmu.ac.uk>

A conceptual framework based on Maturana's Ontology of the observer to explore the Checkland's Soft Systems Methodology

1. Bruno Jerardino-Wiesenborn

Universidad de Santiago de Chile, Departamento de Ingeniería Informática
Avenida Ecuador N° 3659, Estación Central, Santiago, Chile
bruno.jerardino@usach.cl

2. Alberto Paucar-Caceres

Manchester Metropolitan University Business School, UK
All Saints Campus, Oxford Road, Manchester, M15 6BH, UK
a.paucar@mmu.ac.uk

3. Alejandro Ochoa-Arias

Universidad Austral de Chile, Escuela de Ingeniería Civil Industrial sede Puerto Montt
Los Pinos s/n, Balneario Pelluco, Puerto Montt, Chile

Centro de Investigaciones en Sistemología Interpretativa. Universidad de Los Andes.
Facultad de Ingeniería. Núcleo La Hechicera. Mérida, Venezuela.
alejandro.ochoa@uach.cl

Corresponding Author:

Alberto Paucar-Caceres

Manchester Metropolitan University Business School
All Saints Campus, Oxford Road, Manchester, M15 6BH, UK
[**a.paucar@mmu.ac.uk**](mailto:a.paucar@mmu.ac.uk)

A conceptual framework based on Maturana's Ontology of the observer to explore the Checkland's Soft Systems Methodology

Abstract

This paper explores Checkland's Soft Systems Methodology (SSM) through the lenses of a theoretical framework that incorporates key concepts from Maturana's Ontology of the Observer (OoO) with the view of complementing Checkland's SSM application process.

We outline and examine paradigmatic compatibility between: Checkland's ontological position (reality is problematic/chaotic) together with his interpretivist epistemology (multiple perceptions enrich the ever-changing reality); and Maturana's OoO (we are immersed in the praxis of living in an ontological multi-universe). We argue that OoO resonates with key SSM theoretical underpinnings. After establishing compatibility between these two influential systems thinkers, we advance a conceptual framework in which Checkland's SSM learning process is re-visited through a the framework grounded on Maturana's OoO.

The proposed framework illustrates how key ideas drawn from Maturana's OoO can shed light into the way in which some of the main SSM devices (i.e.: Root definitions, Conceptual model) are used in the SSM process. By doing that, SSM is enriched and becomes more flexible as the stakeholders involved are placed within the domain of constitutive ontologies from which, a deeper dialogue can be promoted in a domain of coexistence in mutual acceptance. We argue that this is a suitable way to have more flexible and holistic views for a SSM intervention in particular to promote the learning process and debating proposed changes amongst the stakeholders involved. The proposed framework, when applied, may enhance the power of SSM learning process and when adopted can have substantial implications to complement the SSM process.

Keywords: Problem Structuring; Systemic Learning; Soft Systems Methodology; Ontology of the Observer; Multi-methodology.

1. Introduction

Over the last two decades, developments in Management Science/Operational Research

(MS/OR) have evidenced the emergence of Multi-methodology, a practice that combines techniques, methods and methodologies from a variety of different systems thinking paradigms according to their perceived relevance in describing or dealing with any particular set of issues (Mingers 1997a, 1997b; Mingers and Brocklesby 1997; Jackson 1997, 1999).

Over the last two decades, multi-methodological approaches that tend to pick from both the hard and soft systems spectrum, selecting the most relevant methods and techniques from each, have been widely reported in management science practice (Mingers 1997a; Munro and Mingers 2002; Brocklesby (1995, 1997, 2007); Paucar-Caceres and Rodriguez-Ulloa 2007).

Multi methodological approaches have certainly enhanced MS/OR, and systems practice. This trend however needs to be carefully considered, particularly when methods from different paradigms are mixed because in some combinations we might face a case of paradigm incommensurability. Certain combinations of methodologies married to a particular paradigm, seem to be less problematic particularly when their epistemologies seem to share a common ground, for instance methodologies anchored in soft/interpretive and Maturana's phenomenological paradigms, and they both share certain assumptions in their criticism to the positivist epistemological stance. In this paper, we aim to further investigate the comprehensive dialogue of two systemic methodologies namely Checkland's SSM and the systemic approach derived from Maturana's OoO.

As it has been widely reported in the management science and system literature, Soft Systems Methodology fits under what is called the interpretivist paradigm, Jackson (1982, 1991, 2003); Mingers (1984). The main tenets of this paradigm are that reality is complex, it is socially constructed; and a product of continuous interactions between people (interpretivist). Under this paradigm, the aim of any intervention is therefore to understand reality through the interpretative process in which meaning is attributed. No perspective exhausts the richness of reality or distorts the nature of things; each view is unitary but not universal. Therefore, the paradigm from an interpretivist purview is to enhance the comprehension of a complex reality.

Maturana and Varela's work on the nature of living, the biological nature of cognition and knowledge has been having far reaching influence on the systems and, various others fields, Maturana and Varela (1980; 1987); Maturana (1988a, 1988b, 1997); Mingers (1995); Maturana and Bunnell (1997). Despite Maturana's own view that autopoiesis relates only to living systems, the autopoiesis as a metaphor seems to have acquired the status of a key concept in systems theory (Jackson 2000, cited by Reynolds, 2004). Along these arguments, this paper aims to extend the use of Maturana's ideas presented on the OoO as being relevant to academics and practitioners the field of management sciences. It proposes a theoretical framework informed by OoO concepts/ideas, by exploring how key concepts from Maturana's OoO, might help to expand and to complement Checkland's SSM process.

In this paper, we explore this possibility and concentrate on one methodology from the interpretive camp; SSM and OoO by Maturana. Maturana's ideas have been widely exposed and debated in the systems field and have exerted a strong influence in this arena (Mingers, 1995). Additionally (and despite the popularity of multi-methodology and the wide use of SSM), combinations of Checkland's approach with Maturana's ideas have been neglected in the OR field. The only exception being the work by Reynolds that proposes the use of Maturana's ideas into the work of Churchman's social design (Reynolds 2004); and the article by Brocklesby (2007) in which the work of Vickers and Maturana are juxtaposed to explore in more detail the theoretical SSM underpinnings.

Following Brocklesby (2007), we aim to further explore the complementarity between SSM theoretical underpinnings (Vickers' epistemology enquiring systems) and Maturana's core ideas. We also concur with Brocklesby in that, by exploring this complementarity, we too aim "to consider what theoretical and practical benefits there might be in terms of enhancing our understanding of the SSM process or improving its practice either by plugging gaps left by Vickers or through a more detailed understanding" (Brocklesby, 2007:162).

We hope that this initial exploration of grafting Maturana's concepts and the consequences of his powerful thinking not only give insights as to how to enhance the SSM process but will encourage researchers to venture similar conversations between the OR rich interpretive set

of approaches and, then use these in conjunction with ideas or concepts emerging from the field of systems thinking that proved to be a successful dialogue so far. A previous account about a possible linkage between Maturana and Checkland's has been presented in Paucar-Cáceres and Jerardino-Wisenborn (2019).

The paper is organized as follows: After this introduction, in section 2 we sketch the SSM process as one of the systemic methodologies advocating the learning paradigm in MS/OR and discuss Vickers' appreciative systems as the key notion underpinning SSM epistemology. In section 3, we present Maturana's argument on the ontology of the observer and the ethical implications emerging from it. In section 4, we proposed a conceptual framework to re-visit SSM from the perspective of Maturana's OoO. In section 5, we discuss ways in which the proposed framework can be used to enhance and strengthen the SSM intervention as a learning process. Finally, in section 6, we reflect on the implications of the framework proposed and suggest possible ways of using the framework in practice as well as advancing an agenda for further research.

2. Soft Systems Methodology: an epistemology for a learning process and making sense through the flux of life.

During the 50s and 60s, a number of approaches with a clear problem-solving purpose appeared in management science/operational research (MS/OR). These methods assumed the organisational world to be objective and subject to be modelled in mathematical terms. This was later called the hard approach.

Checkland (1981) locates the emergence and development of what he called the *optimisation* paradigm in management sciences/operational research (MS/OR) in the late 50s and 60s. This was mainly an extension into management of what was the functionalist paradigm from the social sciences (Burrell and Morgan, 1979). The belief that organisations can be seen as objective worlds was certainly underpinning the early developments of classical MS/OR methods and techniques. Furthermore, these approaches relied on the assumption that the decision maker acts in full possession of rationality or 'bounded rationality', Simon (1947,

1960) and the ability to choose between different alternatives generated in full knowledge of what the problem is and where s/he wants to be. The Optimisation Paradigm and the development of ‘solving methods’ are generally associated with classic Operational Research techniques and the so called ‘hard’ approaches.

During the 1970s, the effectiveness of the MS/OR hard Approaches was seriously challenged. The ‘failure’ of Management Science and Operational Research was strongly debated by Churchman (1971) and Ackoff (1979) in the USA and Checkland (1972, 1980) in the UK. The core of the argument was that in situations in which the problem is not well defined, Systems Engineering and the rest of the Hard Approaches did not offer a suitable methodology. The Hard approach worked successfully when the problem and objectives to achieve were well defined but in situations when the ‘problem’ itself is not clear, the hard approaches fail to give useful insights. Checkland (1981, 1999) argues that this is mainly because these approaches see the situation as an engineering problem; looking at ‘how to do things’ when ‘what to do’ is already defined. In contrast, Soft Systems Thinking proposes to abandon the goal-seeking model arguing that not only the ‘hows’ of the problematic situation (not of the ‘problem’) should be studied but, more importantly, the ‘whats’ of the situation must be debated. It proposes the use of ‘systems’ or more appropriately ‘holons’ as mental constructs for perceiving the problematic situation with the view of improving (not ‘solving’ it) and learning from it. Systems Thinking, in the UK, has been generally associated with Soft Systems Methodologies.

Under this paradigm, organisations and humans are believed to be fundamentally different to the physical world; and in order to gain knowledge of their actions we need to attempt to interpret their meaning and perceptions. This is the main claim of the interpretative paradigm; under it, ‘soft’ issues relating to the different ways that people perceive and feel the problematical situation are the ones that need to be investigated and explored.

The *learning* (Checkland, 1981), interpretivist (Jackson, 1982; Mingers, 1980, 1984) paradigm is the one that underpins systemic methodologies that, abandoning the search for a ‘solution’ to the problems, instead seek to learn from the process of any intervention. Ackoff

(1993) calls this the ‘design approach’ comprising methods that attempt to dissolve *systems of problems* or *messes*. He argues that these methodologies differ substantially to those of the ‘optimisation’ or ‘research approach’ in that they aim to tackle the context or environment where the mess takes place and trying to alleviate or dissolve the systems of problems rather than solving it. Jackson (2003) groups the methodologies of this paradigm under Systems approaches that ‘Explore Purposes’; here he includes Soft Systems methodology (SSM); ‘Strategic Assumption Surfacing and Testing’ developed by Mason and Mitroff (1981) and ‘Interactive Planning’ proposed by Ackoff (1981). From these methodologies, SSM is widely the most used and more widely accepted systemic approach in the ‘soft’ end of the OR/MS methodological spectrum

Checkland, has widely acknowledged the importance of Vickers’ appreciative systems theory as the underpinning theory during the process of developing SSM (Checkland, 1999: A50). In particular the way that Vickers describes human activity as being rarely ‘goal-seeking’ oriented activity but rather as a ‘regulatory’ aimed to attaining of maintaining relationships through time. Drawing from the whole corpus of Vickers writings Checkland has developed a model in which the structure of an appreciative system that represents the life-world or *Lebenswelt*, that is the flux of the totality of a person's immediate or everyday experiences, interactions, etc. Checkland’s model represents:

“the interacting flux of events and ideas unfolding through time. This is Vickers’s ‘two-stranded rope’, the strands inseparable and continuously affecting each other’. Appreciation is occasioned by our ability to select, to choose. Appreciation perceives (some of) reality, makes judgments about it, contributes to the ideas stream, and leads to actions that become part of the events stream”. (Checkland, 1999: A51)

Essentially, at the core of its nature, SSM articulates an appreciative, *learning* process which takes the form of an enquiry process in a situation that people are concerned. This process leads to action in a never-ending learning cycle: once the action is taken, a new situation with new characteristics arise and the learning process starts again. Furthermore, for Checkland, the very essence of Geoffrey's most important legacy is the of 'appreciation' which underlies all his work. Based on this notion, SSM develops a knowing device which helps to make

sense of the process by which ‘we create the webs of significance that define and constitute for us the perceived world we inhabit.’ (Checkland, 2005:287).

Therefore, according to Checkland, the real world is an ever-changing flux of events and ideas and ‘managing’ means reacting to that flux. We perceive and evaluate, take action(s) which itself becomes part of this flux, leads to next perceptions and evaluations and, doing more actions and so on. It follows that SSM assumes that different actors of the situation will evaluate and perceive this flux differently, thus, creating issues through which the manager must be able to adjust and to cope. Here, SSM offers systems ideas to managers as a helpful tool to tackle problematic situations arising from the issues.

The basic structure of SSM rests on the idea that in order to tackle real-world situations, we need to make sure that the ‘real-world’ is separated from the ‘systems thinking world’. This distinction is crucial for SSM because it guarantees that we will not see systems ‘out there’, (that is in the real or physical world). SSM urges us to consider ‘systems’ as abstract concepts whose use can eventually help us to bring some improvements to the situation concerned. SSM takes reality to be problematical and ceases to worry about modelling it systemically.

Overall, SSM seeks to work with different perceptions of reality, facilitating a systemic process of learning in which different viewpoints are examined and discussed in a manner that can lead to purposeful action in pursuit of improvement. SSM provides a systemic methodology by which participants learn what changes are feasible and desirable given the peculiarities of their problem situation. SSM best known general mode starts when a problem situation is perceived and somehow structured. From this *perception*, the stakeholders, will *select* relevant systems and express them in basic root definitions. A *model building* construction follows as means for *predication* of conceptual models. All activities of a purposeful action are carried out by individuals in the form of Human Activity Systems (HAS). These then will be *compared* with the perceived situation before taking *action*, Checkland and Tsouvalis (1997). Figure 1 shows the basic *four phases* (*Perceive/Select; Predicate; Compare; and Take action*) disaggregated in the well-known SSM 7-stages to be followed when applying SSM to a real-world situation. Throughout this paper when reaching

SSM into OoO, we will refer to the aggregated format (4 stages) but also to the SSM 7-steps when necessary.

As we already mentioned before, our aim is, using the framework the OoO, to take a fresh look at the process of SSM and in particular at the learning process that its application conveys. Although Checkland claims that SSM facilitates a learning process, by and large the SSM literature does not make it clear how this can be achieved.

It is worth noticing that we are not the first ones to address these SSM difficulties by using Maturana's ideas. In an influential and inspiring paper Brocklesby (2007) acknowledges that there are strong similarities between Vickers' (SSM' source of theoretical basis) and Maturana's 'explanations of the process that underpins how human beings individually and collectively think about their worlds and take actions in these'. But he also remarks about SSM difficulties when applied, particularly as to how the learning process advocated by SSM claims takes place. He points out:

“[...]. Certainly there is an acknowledgment that ‘learning’ is the key mechanism; however quite how it works remains shrouded in mystery. [...] The difficulty is that while learning, communication and interaction are clearly pivotal to the SSM process, there are no compelling theories about how these processes work. Quite how the social process envisioned in SSM leads to the expected outcome is unclear. Reaching accommodation is left as some form of trick that the user must somehow conjure up as best he or she can, and/or as something that magically occurs as a result of learning. Maturana's contribution to this question revolves around his very detailed and elaborate theory of social process.” Brocklesby (2007:165).

He also concludes that although Maturana's 'theory of social process provides a useful basis for better understanding the complex process through which diverse perspectives might be transformed into sustainable agreements' Brocklesby (2007:167). But warns that there are some challenges ahead and that in order to make some progress, users of SSM and others

systemic approaches need to understand the main process underlying the social process.

The present paper addresses these challenges by suggesting ways of guiding the SSM intervention using OoO key ideas as pointers and themes for reflexions. By doing this we hope to contribute to enhance SSM learning processes endeavours.

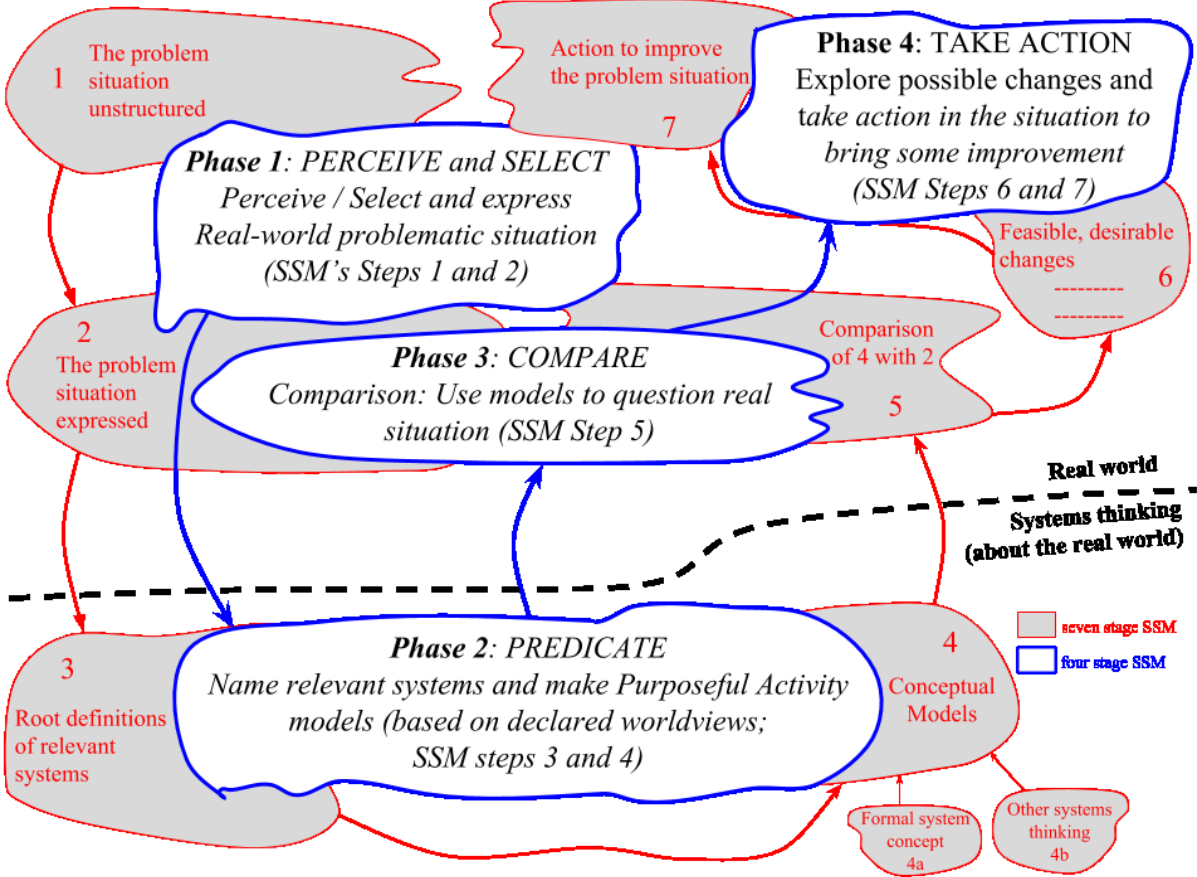


Figure 1: The SSM cycle: Four phases (Perceive/Select; Predicate; Compare; and Take Action) and SSM 7 steps/stages (Source: The authors based on Checkland 1981, 1991)

3. The Ontology of the observer

The concepts of the theory of autopoiesis and biology of cognition form part of Maturana’s earlier work developed in the 70s. In the 80s, Maturana incorporated these ideas and

developed a more extensive and comprehensive and sophisticated onto-epistemological framework. These ideas manifest themselves in what Maturana calls the path of *constitutive* ontologies (Maturana 1988a). In the next section, we outline these ideas and introduce Maturana's Ontology of the Observer (OoO) basis.

According to Maturana, the question of 'what is reality' is the most important question humanity faces (Maturana, 1988b). In fact, how we respond to that question has ontological and epistemological implications. At the same time, the answer takes different paths depending on whether or not we consider the observer as a biological entity. To consider the observer as a biological entity, as the BoC indicates, it implies accepting that when we experience we cannot distinguish between illusion and perception. In fact, we can only confirm that what happened to us was an illusion, only when we contrast that illusory experience with a new one (a posteriori).

In this regard, two comments are pertinent here: On the one hand: are we always able to contrast the experience we are having with a new one? Clearly, in the flow of living, we are not always going to and from one experience to another. On the other hand, the new experience makes evident to us that what was experienced was an illusion, even though the new experience, is subject to the same conditions of previous experience that we have declared an illusion. This is the biological basis that points us to the impossibility of having access to a reality independent of the one who observes it, mediated by his/hers biological structure.

Then all knowledge is not the result of having an objective ability to perceive the real-world as it is, on the contrary it is the result of a structural coupling (s-c), which implies a structural change, and which occurs as a dynamic and recurrent interaction (s-c) between an observer and the environment in which he or she are immersed (see figure 2). Both the medium and the flow of the internal dynamics themselves trigger structurally determined changes in the observer. The ability to learn lies in the plasticity of the observer (specifically his nervous system), from the perturbations from the environment, to trigger structural changes that compensate for external or internal disturbances.

The observing experience of an observer is an a-priori condition to the experience of

explaining any phenomenon in which the observer is involved. In this dynamic, experience as a praxis of living in language, does not need explanations or justifications, which is to say that, you can live without them. However, explanations occur in the praxis of living and, as such, they are also experiences, which Maturana calls: *second-order experiences* (Maturana, 1988a), since they are reflections of the observer- his praxis of living in language, about his praxis of living.

3.1 Ontological domains and the role of the observer

A short, seemingly simple phrase by Maturana and Varela is at the base Maturana's onto-epistemology: 'Everything said is said by someone' (who can be him or herself). (Maturana and Varela 1987:27). Maturana argues that we as observers when we live in our praxis of living and when faced with the task of explaining that praxis, can chose to follow two paths leading to live in either a domain of transcendental ontologies (independent of the observer) 'objectivity-without-parenthesis' or in a domain of constitutive ontologies (Observer is part of what he/she observes), a 'objectivity-in-parenthesis'.

For Maturana, the criterion of validation for scientific explanations (Maturana, 1988a), is centred in the proposition of a generative mechanism, that in its operation generates the phenomenon that wants to be explained. Then, the validity of scientific explanations does not depend on references to an objective reality independent of what the observer does. This is why Maturana regards himself as scientist because, according to his argument, the explanatory mechanism and the phenomenon to be explained belong to different and not intersecting phenomenal domains which characterizes a scientific non-reductionist practice. Therefore, this shows and confirms that a scientific explanation are not reductionist and does not consist in a phenomonic world since it does not confuse these two domains.

Essentially an observer, situated in the domain of transcendental ontologies, uses entities accepted as valid a priori (god, matter, nature, body, energy, etc.) in the formulation of his explanations which implies that these entities do not arise not from the praxis of living. In other words, an observer in this domain takes as valid an explanation, only if the entities

used in it are assumed as independent of what the observer does. An observer in the domain of transcendental ontologies, the question of his/her biological origin or condition is not present, and therefore the observer assumes that his cognitive abilities are enough to have access to reality in an objective manner. In this way, there can be different transcendental ontologies (different linguistic domains) where the differences are established by the different entities they use, always independently of what the observer does, in order to validate their explanations. Therefore, any claim, for an observer, in a domain of transcendental ontologies, that does not belong to this domain is intrinsically false. Here 'objectivity-without-parenthesis' is a way of being-in-the-world that claims that the real world 'is' independent of who the observer and what he or she does. From the domain of transcendental ontologies, it is not possible to be aware that there are other explanatory paths.

On the other hand, for an observer, in a domain of constitutive ontologies, validates his explanations as reformulations of his praxis of living with elements of his praxis of living. In other words: 'all doing is knowing and all knowing is doing' (Maturana and Varela 1987:27). In fact, an observer in this domain of ontologies, accepts himself as a living being and the biological condition that implies. Also accepts that every entity arises as the product of an operation of distinction in the praxis of living in language. An observer, in a domain of constitutive ontologies, is aware that each domain of reality (ontological domain) constitutes a domain of explanations (epistemological domain) of his praxis of living. Therefore, a domain of reality implies a domain of entities a criterion of distinction that allows 'to bring forth a world' a particular type of objects. In the same way, each domain of explanations implies a criterion of validation that allows to accept a reformulation of a praxis of living as a valid explanation. An explanatory disagreement, for an observer, in a domain of constitutive ontologies, is always an invitation to responsible reflection. Here 'reality with parentheses' is what the observer does, and it is what enables him to validate his explanations (Maturana 1988b). Therefore, ideally, we should live in this domain but in our daily praxis of living we 'swing' from one domain to another, and according to Maturana it is via our emotioning. And according to HM thinking, what makes it possible to go from one domain to another is the emotion of mutual acceptance.

3.2 Living in the domain of objectivity-in-parenthesis: Mutual acceptance

Maturana argues that *emotioning* is at the base of all our actions in the praxis of living. The emotion of mutual acceptance (love) in Maturana's onto-epistemology is explained as a biological phenomenon. Indeed, Maturana speaks neither of feelings nor of kindness when referring to love.

“I speak of the emotion that specifies the domain of actions in which living systems co-ordinate their actions in a manner that entails mutual acceptance, and I claim that such operation constitutes social phenomena” (Maturana, 1988a:64-65).

Consequently, Maturana argues that rational arguments can change if emotions and moods change. That is why, an observer operates in a domain of explanations according to one of the two domains of ontologies. In fact, we, human beings, (according to our *emotioning* state), place ourselves in one or another ontological domain. In practice, we ‘swing’ from one to another. If the observer is taken by emotions and moods, where the other emerges as a ‘legitimate other in the coexistence’ (emotion of mutual acceptance), it will be very natural to accept the different explanations as legitimate. This is so, for an observer in the domains of explanation of objectivity in parentheses, other forms of understanding and explaining phenomena coexist legitimately (hermeneutic knowledge). On the other hand, when the observer denies the emotion of mutual acceptance in coexistence, the unique explanations, the uni-verses (single universe) arise. Consequently, the other explanations are not accepted and turn into false, incorrect or misleading explanations.

However, Maturana goes further, arguing that *social phenomena* (social systems) are such only if the emotions that specify domains of co-ordinations of action are based on the emotion of mutual acceptance. Indeed, in an organisational setting: even if an organisation which develops a product or service has a dynamic of coordinations of actions among its employees, if the emotion of the personnel of that company is not one of mutual acceptance, then that organization is not a *social phenomenon*. As we will see in the next few sections, this for us, has great consequences when we incorporate Maturana's onto-epistemology into Checkland's Soft Systems Methodology.

4. Checkland's SSM learning process re-visited through a conceptual framework grounded on Maturana's Ontology of the Observer

Based on the above, now we advance the conceptual framework that we consider will allow to construct the central linkage between SSM and the OoO. We understand this bridge as the learning process because it is precisely on this aspect that both discourses focus their efforts to demonstrate that inquiring on reality, in addition to a process of discovering it, entails and implies a process of our own discovery as observers.

Brocklesby (2007) presents the previously commented theoretical link and concentrates on demonstrating the difficulties that the SSM methodology faces when it comes to answering for the scope of learning. It is our position that the learning process of SSM as suggested by Brocklesby is insufficient. Brocklesby does it from a dimension that considers SSM from what has been its mode of application and not in what are the implications considered from a perspective that gives SSM the possibility of being a learning device rather than a method to solve problems or as a problem structuring method. Even in the latter case, we understand that the process of structuring problems also implies a transformation of whoever formulates, suffers or observes it. Therefore, when Brocklesby asks for the What and How, we understand that he is demanding a level of consciousness that may not be transparent to who applies the SSM. In what follows, it is proposed that the main features or milestones of SSM (rich picture, RD, CM and culturally desirable and systemically feasible changes) can be conceived as spaces that recreate from the OoO a learning process. Therefore, this learning requires an evaluation process that is not clear in SSM and that we propose a strategy to do it, at least more evident. This evaluation process is not only for those who use SSM from the perspective of the consultant but also, and perhaps more importantly, from those who assume the use of SSM as a process of observing situations and learning to observe themselves in them. This poses an additional research route that we consider can enrich the systemic conversation about the role that systemic thinking has not only in thinking about the problematic situation but also for the self-observation of the actor who has become an observer. This last aspect will be developed in the following section.

4.1 The learning process of SSM as a structural coupling process

Throughout this paper, we have argued that it is possible to consider the systemic enquiry supporting the SSM process through the framework of ideas developed by Maturana. Such a possibility allows for enriching dialogue from a perspective that considers the observer as a fundamental part of the cognitive process. Maturana's approach is relevant not only because of its influence on systemic thinking but also, because it critiques the observer's "independence" from the phenomenon; an aspiration that continues to be relevant in the field of organisational management.

The framework is illustrated graphically in figure 2, in the form of a “conceptual model” in which we synthesize the 7 stages (mode 1) of SSM as an action-research intervention that manifests itself in the real world. Incorporated in the bottom part of Figure 2 we include the elements of OoO (i.e.: act of distinction of structured determined systems, structural coupling) that will help to ‘see’ the SSM process through the OoO perspective.

So, from the perspective of the OoO, the identification of a portion of the ‘real world’ as an ‘unknown’, ‘chaotic’ world that demands order, the different operations of distinction in the “praxis of living” in language are equivalent to the perception and source for the formulation of the problematic situation of the real world of SSM (illustrated on the right side of figure 2). It is noteworthy that the operations of distinction are the ways in which different perspectives account for the real world. These perspectives in this instance, are not conscious of themselves and consider their distinction as the only one possible constituting it in irrefutable beliefs or truths.

From the perspective of OoO, what the whole process of SSM does is to ‘comprehend’ the different perspectives of a situation considered problematic. From the OoO, this exercise of comprehension is understood as the result of a vocation to solve problems in order to restore the relational dynamics that make possible the interaction between people in mutual acceptance (Maturana 1997). This is essentially ‘observing the world’ from a situation that considers a given perception as inappropriate. That is to say, it does not correspond to what is

expected and it is for this reason that the observer will have to apprehend what is proper and improper of the situation thus perceived. It is important to note that the “proper” is not, at this stage, the object of doubt or questioning.

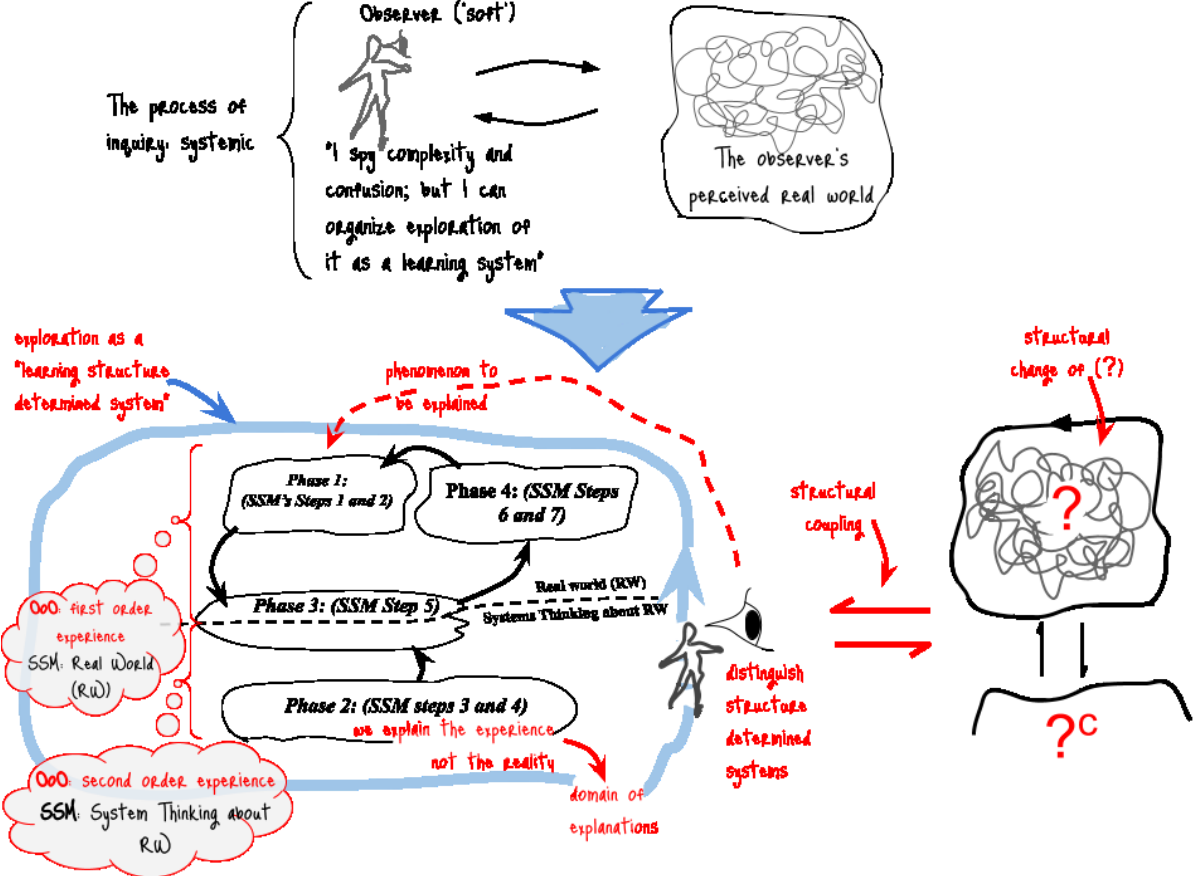


Figure 2: The learning process of SSM as a structural coupling process (based on Checkland and Scholes, 1999 figure A2 pg. A-11)

In phase 1 (which corresponds to stage 1 and 2 of SSM), it is relevant for an SSM practitioner to make every effort to put himself/herself in the place of all those involved in the problematic situation. Indeed, the way to enrich this mode of facing the challenge is from a relational dynamic of mutual acceptance, where all perspectives (*Weltanschauungen*) are presented as legitimate, but not necessarily desirable for those involved. To our

understanding, this is only possible if the domain from which it is observed is a domain of constitutive ontologies, since it is accepted that there is a multiverse in relation to the situation considered problematic and questions any possibility of a transcendental ontology that is thus revealed as improper (that is to consider it as an idea instead of a belief). This experience is what makes it possible that a situation seen in terms of different and particular *Weltanschauungen* is not considered a cognitive obstacle but as an learning opportunity. For the OoO the situation considered problematic occurs as a first-order experience in the praxis of living in language.

Phase 2 of SSM (which corresponds to stages 3 and 4 of SSM of mode 1) is understood from the OoO perspective as a second-order experience (see figure 2) where, in phase 2, the “praxis of organizational living” (the praxis of living that unfolds in the organization) is made explicit from the praxes embodied by different *Weltanschauungen*. At this stage, an organizational learning process allows the different actors involved in the formulation of root definitions and conceptual models to become "observers", as their own “praxis of living” are considered as valid standpoints. From there they participate in the task of investigating/understanding the perspectives of others, insofar as they recognize them as "observers", each one of them embodying a certain perspective. In this instance of learning, the foundations are laid for the act of perceiving the other as a “legitimate other”, this is a learning in the praxis of organizational living. It is a condition that makes possible a linguistic domain of the third order.

Maturana explains these domains as follows:

“Furthermore, I also claim that with languaging observing and the observer arise; the former as the second-order recursion in consensual co-ordinations of actions that constitute the phenomenon of distinction and the latter in a third-order recursion in which there is the distinction of the operational realisation of observing in a bodyhood. Indeed, when languaging and observing take place, objects take place as distinctions of distinctions that obscure the co-ordinations of actions that these co-ordinate. Finally, when languaging, observing and objects take place, the phenomenon of self-consciousness may take place in a community of observers as a fourth-order recursion of consensual co-ordinations of actions in which the observer distinguishes his or her bodyhood as a node in a network of recursive distinctions.” Maturana (1988a:47)

So, in phase 2, SSM is in the domain of explanations, i.e. SSM participants are located within different explanatory domains when they deploy the root definitions and conceptual models from the different *Weltanschauungen*. This allows them to propose different criteria for distinction that are shared among the different observers (here, CATWOE is understood as the categories that define the criteria for distinction). What is important here is that the explanatory path of objectivity-in-parenthesis will allow for greater flexibility and the possibility of formulating different root definitions and conceptual models (phase 2), since it is a second-order experience, as shown in figure 3. In addition, the comparison process allows for a continuous debate between explanations and perceptions that are now considered as a process of learning in which each previous perception ‘hides’ and ‘unhides’, by considering the other possibilities that the root definitions and conceptual models propose. This is a learning about the praxis of organizational living, as each one of the involved is capable of grasping the others praxes of organizational living as possibilities. In doing so, we are initiating a *third-order experience*, in which each root definition and conceptual model together with the observer form a structure: the observer and the observed are co-determined. The observer, therefore, occurs in “... in a third-order recursion in which there is the distinction of the operational realisation of observing in a bodyhood...”. (Maturana, 1998a).

4.2 Root definitions and Conceptual Models as structurally determined systems

An explanation or design based on an interpretive understanding, as is the case of the SSM, will be within what Maturana considers a scientific undertaking. This means that we explain the experience not reality (see figure 2). As Maturana himself points out, every scientific explanation is a structurally determined system which implies that in the scientist observation, only structurally determined systems are distinguished. In Maturana’s words:

“... in other words, to claim that a scientific explanation entails the propositions of a mechanism that generates the phenomenon to be explained, is to claim that the observer can propose scientific explanations only in those domains of operational coherences of his or her praxis of living in which he or she distinguishes structure determined systems.” (Maturana, 1988a:36-37)

On the other hand, Maturana points out that scientific explanations are structurally determined systems and can only explain structurally determined phenomena. We hold that conceptual models, which are part of the learning process proposed in SSM, are structurally determined systems and generative mechanisms. Indeed, if we make operate the generative mechanism described by the conceptual model (CM) composed by operative and control activities, its functioning must give rise to the “praxis of organizational living” that is described from a particular *Weltanschauung*. In the SSM process, which corresponds to phase 3 (stage 5 of SSM), the conceptual model (operational and control activities) is adjusted by contrasting what conceptual models propose and the praxis of organizational living that can be distinguished in the real world. This process is done for each model in a dialogical process that can lead to the conjunction or formulation of new conceptual models structures. In other words, what has been apprehended is made relevant and coherent with what has been learned. It seeks the adjustment between the conceptual model and the praxis of organizational living. In fact, (and this happens in any SSM intervention) it will always be necessary to retake the first-rate experience to see if the activities included in the conceptual model are part of what happens in the praxis of living of those who experience the situation considered problematic. The praxis of organizational living affects and is in turn influenced by the dialogue that derives from the process of contrast/comparison.

The process of dialogue between conceptual models among themselves and the praxis of organizational living is arranged to give place to a learning that has as horizon the recognition of a community of observers. Thus, in its most primitive sense, what occurs is the transformation of the community of observers to a single structure (observer and the observed) that is considered absolutely dominant (it returns to the domain of transcendent ontologies). In effect, it is the imposition of a *Weltanschauung* on the others without the process of recognition of the other as legitimate (other) taking place. At its opposite end, there would be full openness for the constitution of a harmonious relationship that Maturana defines as "social dynamics" (where interactions between participants are established on the basis of mutual acceptance, namely, from the emotion of love).

After the adjustment of each one of the conceptual models (stage 5 of SSM), we proceed to discuss the advantages and disadvantages of each one in order to account for the “praxis of organizational living” and the horizon of expectations that they imply and exclude.

This flexible dialogue (as indicated in phase 4: which corresponds to stages 6 and 7 of SSM) is enriching the comprehension about the praxes and can lead to a reflect-learning process only if the conversations in the areas of dissent are based on the emotion of mutual acceptance which is the condition of possibility for phase 4. At this point it is important to remark that a crossroad is reached in the learning processes. On the one hand, it can give rise to a redefinition of the meaning of the “praxis of organizational living” or, on the other hand, reinforce the very praxis of organizational living that can now decide to live together, by way of accommodation, but without constituting a new order or praxis of life. In each case, they are qualitatively different learnings.

Figure 2 shows the SSM process as a way of interacting with the perceived world, where the recurrent and stable dynamics of disturbances generate a process such that we can carry out a learning system of *fourth order*. For this reason, it is possible to observe in figure 2 a structural coupling between the observer (who decides to use the 7 stages of SSM) and the perceived world. In fact, from the perceived world, perturbations are received; alterations that seek to be understood, structured (knowing the praxis of organizational living), and then explained, debated and designed (learning in the organizational praxis of living). All this in order to generate new perturbations in the situation considered problematic, as a human relational interaction that is observed as a structurally determined system (learning about the organizational praxis of living). The key then lies in the flexibility that the members of the intervention project team can achieve between themselves and the plasticity of the praxis of organisational living. Through this recurrent and stable dynamic of mutual interactions, intervention through the SSM learning process will become a cycle of lifelong learning. Finally, in the last stage of SSM, implementation of the design involves carrying out a transformation and incorporating actions to alleviate/change/dilute/transform the situation considered problematic. In OoO terms, the implementation of actions consists in unleashing new relational interaction dynamics in the situation considered as problematic, a ‘new’ structurally determined system that must be systemically desirable and culturally feasible (learning to transform a praxis of organizational living). Such changes can impel and favour the installation of the social phenomenon, that is to say, to trigger structural changes that make emerge dynamics in which the participants interact in mutual acceptance. Otherwise, the relational dynamics prior to the intervention remain and thus they are considered critical

to preserve the praxis of organizational living, accepting those changes that could be considered for the realization of the accommodation.

In this section we have advanced the OoO-based platform from which, we argue, the SSM learning process can be enhanced. In the next section we discuss ways in which this can be achieved.

5. The learning process as a process of transformation of the observer

The process of learning SSM from the notions of the OoO takes a reflective direction that goes beyond the 'imposition' of the phenomenon that is presented to the observer. In fact, experience of the first order disposes the observer in a being fused with the praxis of organizational living where it is not possible to notice, nor to distinguish, the operations of distinctions. While the actor/involved is in the praxis of organizational living, he/she is in a (unique) universe, the problematic situation as a unity embodies the observer and phenomenon as a distinction to be. In this phase 1 (figure 3), learning is associated with the processes of coordination of operations that occur and that are considered problematic as a *first-order experience*. In this way, observer and phenomenon appear only when the observer reflects on the experience in which he/she is, in which case the observer is recognized as such in a second-order experience. As a result of this reflection, it arises to discriminate the distinctions of an experience of first order. What we can notice in this new learning experience is a change of phenomenal domain since it is the condition of domain where the explanations occur and also the multiple interpretations of the praxis of organizational living as a possibility (the explanation of the praxis of organizational living ceases to be unique).

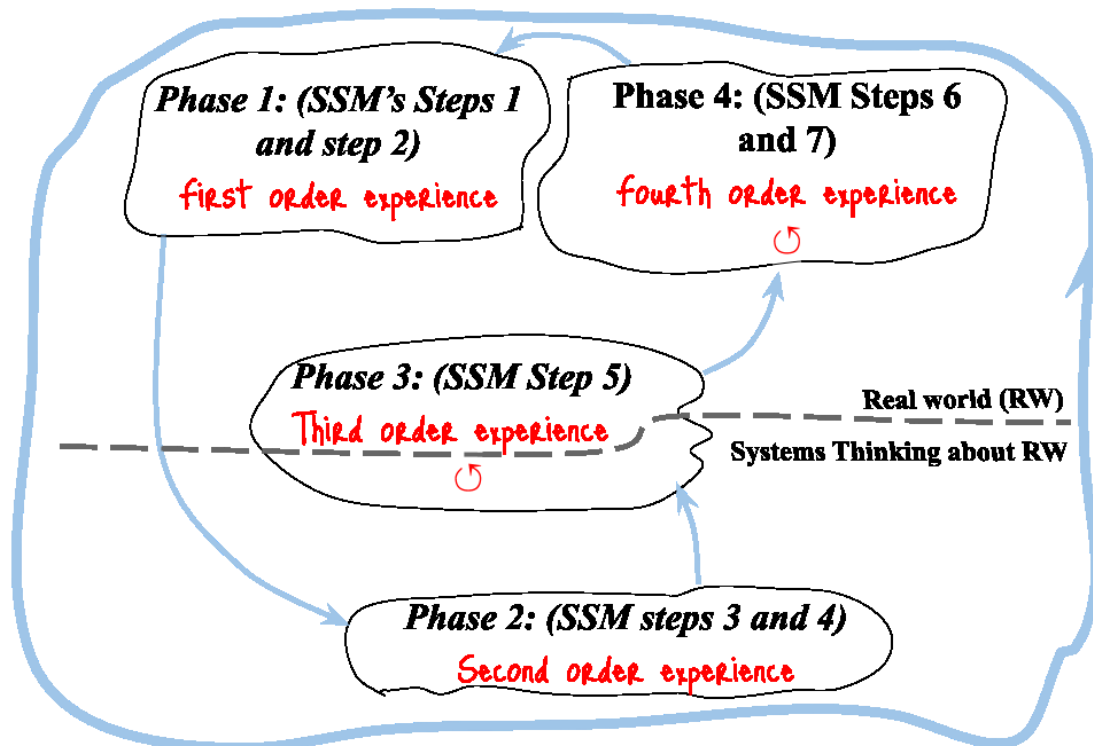


Figure 3: SSM learning process from OoO and its 4-order experiences.

To be aware of this operation implies a different degree of consciousness from the previous learning moment since these two disjointed domains are not confused. Maturana (1988a:37-38) points out that:

“...a scientific explanation is the proposition of a generative mechanism that gives rise as a consequence of its operation to the phenomenon to be explained in a different phenomenal domain than the one in which it takes place, a scientific explanation constitutes and validates the existence of completely different nonintersecting phenomenal domains that are intrinsically not reducible to each other...”.

In terms of the learning process, this is an ability to ‘build’ on how much is affirmed refers to the way of accounting for the world.

From the OoO perspective, learning for the SSM practitioner consists in building a transition mechanism that reveals the praxis of organizational living from the viewpoint of the observer.

The formulation of the 'rich-picture' in phase 1 plays the role of re-signifying and disentangling from the praxis of organizational living and from one's own problematic situation, to those who experience it in order to allow them to realize their own narrative as one among other possible ones. For this reason, 'rich-picture' must provide mechanisms of 'disenchantment' with respect to the praxis of organizational living, which even implies the exploration of other perspectives that, without being proper to the praxis of organizational living, may be relevant to its understanding. The 'rich-pictures' will be a source of inspiration not only for the identification of possible root definitions, but also tools to identify situations that, without being the object of attention, reveal other possible learning spaces in relation to the praxis of organizational living.

The OoO, in phase 2 (figure 3), considers each actor as an observer who can potentially perceive the problematic situation without the urgency of resolving it. Consequently, not confusing the two domains implies a level of self-awareness, which lays the foundations for a praxis of organizational living, as a second-order experience.

In the process of constructing the conceptual models of SSM, these would be considered as constructs elaborated with the awareness that they correspond to a phenomenal domain different from the praxis of organizational living as a first-order experience. This confers the non-reductionist condition as it is understood in the framework of the OoO. SSM Phase 2 (figure 3) corresponds to the process in which the SSM practitioner assumes himself as an observer, so this posture is not one more methodical instrumental step, but a necessary condition to transform the observer as a member of a community where the other is perceived as an 'other'. This makes it possible that in phase 3 the process seeks to give coherence to what has been learned with what has been learned from the praxis of organizational living through dialogue, since the praxis of organizational living is affected and influenced by the exercise of reflection around the observation of those involved in their own praxis of organizational living and that of others. In SSM practice, this implies that the exercise of formulating root definitions can become a mechanism of 'peer observation' among those involved in the praxis of organisational living, regardless of whether they are part of the group that is following SSM. The proposal is to generate an incremental process of gaining awareness in the different actors of the praxis of organizational living of this new

coordination as observers of the very praxis of organizational living. The realization of knowing oneself as 'observer' and 'observed' gives rise to a different level of self-awareness, because each observer is in the presence of an experience that seeks to give coherence to the experience of first and second order. The action understood from SSM and assumed to fullness, is in knowledge of the other observers that co-understand the situation considered problematic, with their corresponding *Weltanschauungen*: multiversa emerges. This experience can only occur in a domain of constitutive ontologies. In effect, 'observing the observing' arises in a third order recursion in language, consequently, inhabiting this linguistic domain implies an experience where each observer is made conscious, and each observer apprehends that each root definition and the CM together with the observer or involved in SSM, form a structure. There will be as many structures as there are observers involved.

Then, the process of learning from SSM has as its final phase, the understanding of the community of observers as a linguistic domain of fourth order where the other arises as a legitimate other in coexistence with oneself (see figure 3). For a fourth-order experience, the others involved are required to distinguish a network of recursive distinctions where each distinguishes his or her corporeality that makes any recursive coordination with others possible. As we have explained, the SSM learning process may involve a transformation of the observer involved in the problematic situation that self-consciousness experiences and, as a consequence, is responsible for its doing. This SSM learning process is an attempt, not only to take charge of a response to complex situations, but it is also an inquiry that has as its central question: how do we do what we do while observing our relational doing? The learning process proposed from SSM results in a self-conscious observer, namely, a being that we distinguish by observing ourselves in observing ourselves as human beings who inhabit a social system or a non-social system.

That said, the learning that implies the realization of being co-constructor-observer of the relational dynamics demands of the 'observers' the capacity to return on those constitutive elements of their transition of a domain of transcendental ontologies to a domain of constitutive ontologies, in order to evaluate the demand that that observation-construction poses in the previous universe from which the problematic situation began to be sketched out. In summary, the OoO would suggest returning to the previous 'rich-pictures' formulated by

each one and as a whole, in order to evaluate their legitimacy in the light of what has been apprehended in the SSM intervention process. The importance of this is that on the basis of a domain of constitutive ontologies the different explanations, i.e. root definitions and CM as a product of the different 'rich-pictures', are an invitation to reflection beyond the particular problematic situation. This will allow everyone to proceed to evaluate the learning process that from the OoO is ascribed as possible to a praxis of living, as embodied by the methodology of SSM, which shares with the scientific eagerness in Maturana, the constitution of a community of observers. The distance travelled between the first iteration of the process and the possibilities of generating culturally feasible and systemically desirable changes will provide a measure not only of success in understanding and resolving a problematic situation, but also in increasing the capacities of those involved to recognize themselves structurally determined (biological condition of the observer) and to understand the formulation of their own observations as structurally determined.

6. Conclusions

In this paper, we have reflected on the possibility of combining two systemic approaches: SSM and the systemic concepts implied in the OoO. We argued that although the two approaches have different origins, the theoretical basis of SSM, Vickers appreciative systems resonates very well with Maturana's concepts. We offer an enhanced 7-Stages SSM that in many ways combined the best of the approaches has been offered enhance and complement the SSM intervention process. The following are conclusions advocating such a multi-methodological combination.

The exploration carried out on the link between SSM and Maturana's thought, especially Maturana's OoO, has allowed us to delve into what would be a reading of SSM from the viewpoint that Maturana formulated for a reconfiguration of the observer as a substantial part of the knowledge process. In this sense, the development of SSM is favoured as an intervention process in terms of a learning process that unfolds in at least three possible actors: the consultant, the practitioners and the members of the organization in general.

Learning for the consultant implies the development of the SSM as a methodology of conceiving the members of the organization as co-builders and observers of their own practice, which suggests learning SSM more as a praxis of living than as a specific method.

As far as the practitioners are concerned, the learning process is the unveiling of the condition of observers (not privileged in relation to the other actors) who learn to recognize the others as co-builders of praxis of organizational living and that in this process strategies are advanced that conceived from the OoO we consider it should enrich the SSM process by reflecting on the manner in which some of SSM most well known features (rich pictures, root definitions and conceptual models) are used in a systemic intervention.

The strategies refer to the recognition of the *rich pictures* as mechanisms to unleash the predominance of the relational dynamics that have been constructed in a certain moment and that when leaving aside the language (or in any case, its descriptive power), allows to explore the ways as the observer and the phenomenon are manifested as unity in the problematic situation. These rich pictures will be thus, not only be the starting point but also, an evaluation mechanism at the moment of considering how they are compatible or not with the advances that are formulated in the systemically desirable and culturally feasible changes.

As far as the use of *roots definitions* and *conceptual models* as ‘observations of observation’ is concerned, the framework allows the recognition of others as subjects in cognitive disposition and later with equality of potentialities that may or may not give rise to a process of deeper learning that would be explained from the OoO as the constitution of the other as ‘legitimate other’. The fact that this learning does not occur out of necessity, allows not only to demonstrate the limits of SSM, but in reality of any process of recognition of the systemic gaze as a position that still does not manage to consolidate its potential to plenitude. Nevertheless, this allows to have an ideal situation of learning that from the OoO can give rise to new processes of organizational intervention that involves all the members of the organization. In this case, SSM could be constituted in a form of realizing the OoO in the praxis of the organizational living, starting from the own peculiarities of this praxis and the discourses that constitute it.

The discussion here presented demonstrated that a linkage between Maturana’s OoO and Peter Checkland’ SSM can be built via a conceptual framework that enriches SSM learning process. Further research is needed to test in the real world how this framework will deliver the enhanced results. The authors already have embarked on this task as two of them already published reflections on the linkage between Maturana and Checkland (Paucar-Cáceres and Jeradino-Wiesenborn, 2019) and hope to report an application in another paper.

Furthermore, Maturana's work seems to provide a thought provoking arena to enrich and debate other efforts from the systemic milieu.

6. Acknowledgments

We wish to express our gratitude to ELAPDIS (Escuela Latinoamericana de Pensamiento y Diseño Sistémico (Latin American School of Systems Thinking and Design) as the school provided the space to discuss an initial draft of this paper (www.elapdis.org Puerto Montt, Chile 2018 and Huancayo, Peru 2017).

7. References

- Ackoff, R. (1979). The future of OR is past. *Journal of Operational Research Society*. 30 pp. 93-104
- Ackoff, R. (1993), *The art and Science of Mess Management*. In Mabey, C., Mayon-White, B. *Managing Change*, Paul Chapman Publishing, London,
- Ackoff, R. (1981), *Creating the corporate future*, Wiley, New York.
- Brocklesby, J. (1995) Using SSM to identify competence requirements in HRM, *International Journal of Manpower*, Vol. 16, N. 5-6, p. 70.
- Brocklesby J. (1997) Becoming Multi-methodology literate: an assessment of the cognitive difficulties of working across paradigms in *Multimethodology*, Mingers and Gill (eds.), John Wiley and Sons, Chichester.
- Brocklesby J. (2007) The theoretical underpinnings of soft systems methodology-comparing the work of Geoffrey Vickers and Humberto Maturana. *Systems research and behavioral science* 24(2): 157–169. Available at <http://cepa.info/2800>
- Burrell, G. and Morgan G. (1979). *Sociological Paradigms and Organisational Analysis*. Heinemann Educational Books.
- Checkland, P. B. (1972). Towards a systems-based methodology for real-world problem solving. *Journal of Systems Engineering* 3, 87-118
- Checkland, P. B. (1981) *Systems Thinking, Systems Practice*, Wiley.
- Checkland, P. B. (2005) Webs of Significance: The Work of Geoffrey Vickers. *Systems Research and Behavioral Science* 22, 285-290.
- Checkland P. B., Casar A. (1986) Vickers' concept of an appreciative system: a systemic account. *Journal of Applied Systems Analysis* 13: 3-17
- Checkland, P. B. and Holwell, S. (1998), *Information, Systems and Information Systems*, Wiley, Chichester.

- Checkland, P. B. and Poulter, J. (2006) *Learning for Action: A Short Definitive Account of Soft Systems Methodology, and Its Use for Practitioners, Teachers and Students*, Wiley.
- Checkland and Scholes (1999) *Soft Systems Methodology in Action*, Wiley.
- Checkland, P. and Tsouvalis, C. (1997), Reflecting on SSM: The Link Between Root Definitions and Conceptual Models. *Syst. Res. Behav. Sci.* Vol. 14 No. 3, pp. 153–168.
- Churchman, W. (1971). *The design of inquiring systems: basic concepts of systems and organization*. Basic Books
- Jackson, M. (1982), The nature of soft systems thinking: The work of Churchman, Ackoff and Checkland, *Journal of Applied Systems Analysis*, 9:17.
- Jackson, M. C. (1991) *Systems Methodology for the management Sciences*, Plenum press, New York.
- Jackson, M. C. (1997), *Pluralism in Systems Thinking and Practice*, in *Multimethodology*, Mingers and Gill (eds.), Wiley.
- Jackson, M. C., (1999) *Towards coherent pluralism in management science*, *Journal of the Operational Research Society* 50, 12-22.
- Jackson, M. C. (2000). *Systems Approaches to Management*. London, Kluwer Academic/Plenum Publishers.
- Jackson, MC (2003) *Systems Thinking: Holism for Managers*, Wiley: Chichester.
- Mason, R., and Mitroff, I. (1981). *Challenging Strategic Planning Assumptions*, Wiley, New York.
- Maturana H, Varela F. (1980). *Autopoiesis and Cognition: the realization of the living*. Reidel: Dordrecht.
- Maturana H. and Varela F. (1987) *The tree of knowledge. The biological roots of human understanding*. Shambhala, Boston and London.
- Maturana H. (1988a). Reality: the search for objectivity or the quest for a compelling argument. *Irish Journal of Psychology* 9: 25–82. Available at: <http://www.univie.ac.at/constructivism/papers/maturana/88-reality.html>
- Maturana, H. (1988b). Ontology of observing: The biological foundations of self-consciousness and the physical domain of existence. In: Donaldson R.E. (ed.) *Texts in cybernetic theory: An in-depth exploration of the thought of Humberto Maturana, William T. Powers, and Ernst von Glasersfeld*. American Society for Cybernetics (ASC) conference workbook. Available at: <http://ada.evergreen.edu/~arunc/texts/cybernetics/oo/oo3.pdf>
- Maturana H. and Varela F. (1994) *De Máquinas y seres vivos. Autopoiesis: la organización de lo vivo*. Second Edition. Editorial Universitaria, Santiago de Chile.
- Maturana H. and Bunnell P. (1997) What is wisdom and how is it learned? Paper presented in abridged form at the North American Association for Environmental Educators conference, July 1997. Available at: http://issuu.com/gfbertini/docs/what_is_wisdom_and_how_is_it_learned
- Maturana H. (1997) *La Objetividad: Un argumento para obligar*. Dolmen Ediciones. Santiago de Chile.

- Mingers, J. (1980). Towards an appropriate social theory for applied systems thinking: Critical theory and soft systems methodology. *Journal of applied systems analysis* 7:41-49
- Mingers, J. (1984), Subjectivism and soft systems methodology-a critique, *Journal of Applied Systems Analysis*. 11:85.
- Mingers (1995) Self-producing systems: Implications and applications of autopoiesis. Plenum Press. New York.
- Mingers, J., (1997a) Multi-paradigm Multimethodology, in *Multimethodology*, Mingers and Gill (eds.), Wiley.
- Mingers, J., (1997b), Towards critical pluralism, in *Multimethodology*, Mingers and Gill (eds.), Wiley.
- Mingers, J. (2000) Variety is the spice of life: Combining soft and hard OR/MS methods. *International Transactions in Operational Research* 7, 673-691.
- Mingers, J. and Brocklesby, J. (1997) Multimethodology: Towards a framework for Mixing Methodologies. *Omega, Int. J. Mgmt Sci.* Vol. 25, No. 5, pp. 489-509, 1997
- Mingers, J. and Taylor, S. (1992), The use of Soft Systems Methodology in Practice, *Journal of Operational Research*, Vol. 43, N. 4, pp. 321-332.
- Munro, I. and Mingers, J. (2002) The use of multimethodology in practice-results of a survey of practitioners. *Journal of Operational Research Society* 59 (4), 369-378.
- Paucar-Caceres, A. and Rodriguez-Ulloa R. (2007) 'An application of Soft System Dynamics Methodology (SSDM)'. *Journal of Operational Research Society* Vol. 58, 701-713, June 2007.
- Paucar-Caceres, A. and Jerardino-Wiesenborn, B. (2019): A bridge for two views: Checkland's soft systems methodology and Maturana's ontology of the observer, *Journal of the Operational Research Society*, DOI: 10.1080/01605682.2019.1578629
- Reynolds, M. (2004). Churchman and Maturana: Enriching the Notion of Self-Organization for Social Design. *Systemic Practice and Action Research*, 17(6) pp. 539-556.
- Simon, H. (1947). *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organisation*. Free Press.
- Simon, H. (1960). *The New Science of Management Decision*. Harper.