

# A Foundation of a First-Person Perspective Systems Analysis

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## ABSTRACT

This paper builds a theoretical foundation of a first-person perspective systems analysis (1ppSA). First, the theoretical existence of 1ppSA is presupposed, and second, we presuppose that phenomenology is a basic theory of 1ppSA. With the two presuppositions we investigate whether it is possible to use Activity Theory (AT) as diagrammatic resources in order to build the foundation of 1ppSA. Although they are concerned with the study of consciousness, phenomenology and AT are not practical to use alone respectively. They are considered worth combining because they are complementary. Phenomenology provides a meta-methodology that helps us become conscious of the structures and conditions from which our conviction concerning a world is constituted. AT has diagrammatic resources for visualizing the structures and conditions. This research shows that the use of AT diagram along the attitude and methods of phenomenology can realize the theoretical foundation of 1ppSA.

## Keywords

Systems analysis, first-person perspective, phenomenology, activity theory, information systems.

## INTRODUCTION

Specialists concerned with information systems (IS) have been practicing systems analysis along with some user participation. The systems analysis (SA) and its methods are basically based on the third person perspective (3pp) or objective one. The philosophical assumption of 3ppSA is that the world of concern is 'out there'. The world and its associated IS are inevitably assumed to be stable systems. They are often considered problematic because it is difficult for them to adapt with the changes of environments.

By posing a fundamental question in his book, Prigogine suggests that the future is under perpetual construction instead of it being given (Prigogine, 1997. P.1). Dissipative structure theory shows that although a change is imposed from outside, the response of a system is determined by its own internal dynamics. It implies that the agency of change is business professionals at the workplace but not IS specialists outside. It is theoretically possible to consider that business professionals practice SA. Here we call it as a first-person perspective system analysis (1ppSA).

There is a practical request for 1ppSA as well as a theoretical one. The growing trend of empowerment in management may show the practical significance of 1ppSA. Taking into account the importance of IS, we can logically expect the empowerment also in SA, that is, SA by business professionals.

However, it is not easy for changes to take place at organizations. It is because business professionals have a variety of different ideas often conflicting. Sociologists suggest there is a higher possibility of consensus or accommodation if we are conscious of the structures or conditions from which our thought and needs come. For example, Giddens (1993, p.28) says, "The more we know the conditions of our own actions and the overall development of our society, the more we are able to gain influences over various affairs of our lives." It suggests that we can be liberated from the structures and conditions which govern our thought and specific IS needs if we become conscious of our own structures and conditions, and further that we can know how the IS needs are constituted on them.

Here it is necessary for us to remind ourselves that SA belongs not to engineering but to science that reveals the world. Unlike the natural world, the human world is not 'out there'. The world is one perpetually constructed by business professionals as suggested by dissipative structure theory. As part of SA, business professionals have to lay down or enact the world and be conscious of the structures and conditions that help them lay down the world.

The study of 1ppSA is still a very low-key theme in IS researches in contrast to that of 3ppSA. One of the possible reasons is that no foundational theory or philosophical base of 1ppSA is shared among researchers. We are inspired by the two

researches. One is research by Kosaka (2010), who shows that 1ppSA is regarded as an instance of phenomenology. The other is by Kaptelinin and Nardi (2006), who argue that phenomenology and activity theory (AT) have strong links in seeing tools as mediators of human experience.

Therefore, the aim of our research is to build a theoretical foundation of 1ppSA. First, we presuppose the theoretical existence of 1ppSA. We further presuppose that phenomenology is a basic theory of 1ppSA. With the two presuppositions we investigate whether it is possible to use AT as diagrammatic resources to build the foundation of 1ppSA in accordance with phenomenology.

This paper continues as follows. Next is the review of literature, followed by the discussion of the theoretical existence of 1ppSA. Then we discuss reasons for appropriating phenomenology and AT, and show their core concepts. Then, we argue about how we can perform phenomenology with AT for 1ppSA. Finally we make discussion and conclusions.

## REVIEW OF LITERATURE AND PRACTICES

Alter (2005) mentions: “SA methods for business professionals or workers are basically missing from the field of IS universe.” Also for the researches, Vermesch (1999) says methodology of a 1st person perspective has been neglected especially in researches.

Discussion of methodologies for 1ppSA is almost absent in theoretical and philosophical senses. However, a few methods for business professionals are recently appearing on the scene. Their developments are mostly based on the practical needs coming from the experiences of practitioners. For example, Alter (2004) mentions that his motivation for the development is based on his consulting experience, and developed his work systems method based on theories including the idea of inheritance for knowledge representation. In case of Whitaker (2007), he criticizes that conventional IS methodologies are predicated on logical empiricism, and instead advocates a first person perspective in SA. He developed a SA method by which a systems specialist emulates a worker. Korpela et al (2002) are developing a SA method called ActAD, and it is based solely on AT. As a pioneering work for systems analysis by business professionals there is SSM developed by Checkland (1999) and his colleagues. SSM is based on not phenomenology but system thinking.

As reviewed above, prior research related to 1ppSA is not necessarily based on a theoretical base as far as a philosophical one is concerned. The review of literature, therefore, shows that our research interest is worth study.

## THEORETICAL EXISTENCE OF 1PPSA

We explore into Prigogine (1997) and Stacey et al’s thinking about an organization to make sure the theoretical existence of 1ppSA. Stacey et al (2000) applied the science of complexity and the history of philosophy about nature and human to understand the source of stability and change in human organizations.

Stacey et al (2000, p.19) argue that self-organization as cause can be understood in one of two fundamentally different ways, the first being formative and the other being transformative. They use a concept Formative Teleology in which there is an end state, or final form, knowable in advance. The final form is enfolded in the sense that whole exists in some sense before the parts. The purpose is to reach this enfolded end state.

In human organizations, the final end states are chosen by choosing-managers. They say that the today’s dominant management discourse is built on Rationalist Teleology as an explanation of choice and Formative Teleology as an explanation of how the choosing manager and social dynamics work. There are assumptions that human action is essentially an individual action and that managers are objective observers who stand outside the processes of the organization and design them according to rational criteria to do with goal achievement (ibid, p.158).

They relate their analysis of philosophical thinking with that of chaos theory and dissipative structure. In the theory of dissipative structure formulated by Prigogine (1997), the system itself has a potential for producing unpredictable behavior. The pattern of behavior is caused by fluctuations that are small variations in the interactions between entities of the system. He asked a fundamental question in his book (Prigogine, 1997, p.1) “Is the future given, or is it under perpetual construction?” The future for every level of the universe is seen as under perpetual construction. In human organizations people jointly create the meaning of what they are doing when they act into the unknown, co-creating their future in interaction with others (Stacey et al, p.194). These features, unknowable futures emerging in here-and-now interactions, are essentially what Stacey et al defined as the causal framework of Transformative Teleology (ibid, p.97).

Formative Teleology with Rationalist Teleology explains the dominant discourse of conventional SA, because expert systems analysts practice systems analysis as an external observer. In contrast, Transformative Teleology can provide findings for 1ppSA. It is participation, that is, members of an organization participate in SA to create their futures. The participation is not

a peripheral one around expert systems analysts. Organization members are major players in SA. Being conscious of the structures and conditions, they create their future and meanings with colleagues. Their participation is not occasional but perpetual. They are expected to practice SA as one of their works. Here we can see the theoretical existence of lppSA in Transformative teleology.

Kosaka (2012) also clarifies the theoretical existence of lppSA by creating a topology of systems analysis in two dimensions. One is the distinction of subjective and objective stance. The other is the concern to working knowledge at workplaces. Each grid is marked by a different philosophy. He finds lppSA and phenomenology in a grid of subjective stance with concern to working knowledge.

## REASONS FOR APPROPRIATING PHENOMENOLOGY AND ACTIVITY THEORY

SA roughly consists of two phases: the laying down of a world and the derivation of IS needs. For the earlier phase of SA, phenomenology is considered a basic theory. First of all, that is because “phenomenology ends where objectifying science begins” (Husserl, 2002, p.43). There are a few prior researches suggesting that phenomenology is a basic theory of lppSA. For example, Whitaker (2007) tried to create a method to use phenomenology with hermeneutics in IS design. Kosaka (2010) discusses that phenomenology can be considered a basic theory for a lppSA in terms of problem of knowledge, mode of knowledge, and methods. The reasons why we take phenomenology as a basic theory are summarized as follows: First, it is a philosophy of consciousness concerned with a first person perspective. Second, it helps us have opportunities to go back to the structures and conditions. Third, it helps us lay down a world.

Phenomenology is not a SA methodology. It is a basic theory for objectifying sciences (Husserl, 2002, p.43). However, the practical usefulness of phenomenology has been considered problematic as often mentioned by various researchers. Vermersch (1999) says, “Phenomenology gives us a clue and indicates the requisite epistemology but does not seem to provide the know-how, nor does it specify the practice”. Whitaker (2007) says, “Phenomenology and hermeneutics offer insights that can inform better IS design and development practices, however the difficulty lies in developing practices based on these theories.”

Since it is a sort of thinking activities, SA needs diagrammatic resources. Cognitive researchers revealed the utility of diagrammatic expression. One is that a human goes through a process where he finds a new aspect of a problem by drawing his inspiration from the diagrams while he is illustrating them (Suwa, 1999). Another is that diagrammatic expression as externalization resources of internal ideas helps to find new solutions by facilitating reflection (Yamazaki and Miwa, 2001). IS practitioners and researchers also acknowledge the importance of diagrams in IS development. However phenomenology does not provide any diagrammatic resources.

Here we appropriate Activity Theory (AT), its diagrammatic resource in particular, to realize the foundation of lppSA. AT provides a research framework of consciousness (Nardi, 1996). It is known that AT is consistent with the idea of phenomenology (MacDonald, 2000). However, it should be noted that AT is seldom used by practitioners. Bannon (1997) says, “The complexity of AT has frightened off many practitioners from actually trying to apply activity-theoretical concepts in practical situations.”

Therefore, our research interest in more detail is to investigate whether AT can be used as diagrammatic resources to realize the foundation of lppSA in accordance with phenomenology. We will show that they are complementary in that phenomenology is a meta-methodology for the foundation and that AT provides diagrammatic expressions to it.

## CORE CONCEPTS OF PHENOMENOLOGY AND ACTIVITY THEORY

### Phenomenology

Phenomenology was primarily originated by Husserl. The term phenomenology designates a science, a complex of scientific disciplines; but it also designates at the same time and above all a method and attitude of thought (Husserl, 1999, p.19). It has two kinds of methods: transcendental and eidetic reductions. The attitude of thought is epoche and intentionality. Epoche is the first thing we need to do in transcendental reduction.

Husserl (2002, p.363) mentions that consciousness is of an intentional experience. Intentionality refers to the notion that consciousness is the consciousness of something. Consciousness is not a screen that mirrors various shapes and colors but a mechanism that stretches out towards objects.

Concerning epoche, we live in a world and usually believe in the existence of the external world. Epoche is an attitude with which we suspend our naïve belief in the existence of the external world in order to encounter with phenomena as they are originally given to our consciousness.

This can be understood by the idea of the phenomenological world mentioned by Merleau-Ponty (2002, pp.xxii-xxiii): “The phenomenological world is not the bringing to explicit expression of a pre-existing being, but the laying down of being. Philosophy is not the reflection of a pre-existing truth, but, like art, the act of bringing truth into being.”(ibid, pp.xxii-xxiii)

Husserl proposed transcendental reduction as a method by which people return to the original scene in order to lay down or enact a world. Human has a primordial mode of perception that constitutes an identity (i.e., an image of conviction) from its manifold of presentations (various meanings derived from signs). The identity transcends its manifold of presentations. It goes beyond them. In the constitution of the identity and its manifold of presentations, the configuration of ‘immanence – transcendence’ that helps a person capture the world as a convincing being is a basic structure of knowledge. Husserl called this configuration of ‘immanence – transcendence’ as the ‘noesis – noema’ structure. The noematic field is that of the unitary, the noetic (noesis) that of the ‘constituting’ variety factors (Husserl, 2002, p.288).

Every reduction, says Husserl, as well as being transcendental is necessarily eidetic (Merleau-Ponty, 2002, p.xvi). It [eidetic reduction] is done by imaginative free changes or variation by which one attempts to reduce phenomenon into the absolutely necessary and invariable components. Merleau-Ponty also refers to this: “... a knowledge of facts is never sufficient for grasping an essence and the construction of ‘idealizing fictions’ is always necessary ...” (Merleau-Ponty, 1964, p.75).

With transcendental and eidetic reductions “he attempts to transform this automatic conditioning into a conscious conditioning” (Merleau-Ponty, 1964, pp.48-49). With a conscious conditioning, it becomes possible for a person to lay down a world, i.e., an image of conviction.

### Activity Theory

Vygotsky and others developed AT in response to their dissatisfaction with introspective psychology and the behavioral theory of stimulus-response scheme. There are several important aspects in AT. The most important one is considered the idea of mediation. A simple model of relation between stimulus and response is replaced with a triangular model in which an artifact i.e., a sign or a tool, mediates a relation between subject and object in Figure.2 (Vygotsky, 1978, p.40). Mediation by an artifact is not merely a psychological idea. It is an idea that breaks down the Cartesian walls that isolate the individual mind from the culture and the society (Engeström, 1999). The use of signs leads humans to a specific structure of behavior that breaks away from a biological development and create a new form of a culturally-based psychological process (Vygotsky, 1978, p.40). Therefore, AT takes it for granted that a minimal meaningful context for an individual action must be included in the basic unit of analysis, while many psychological theories use human action as the unit of analysis (Kuutti, 1996).

The second important aspect is object-orientedness. AT is based on the materialistic philosophy, and assumes that humans live in an objective reality that determines and shapes the nature of subjective phenomenon (Bannon, 1997). Thus, an artifact is both enabling and limiting: it empowers the subject with the historically collected experience and skill crystallized to it, but it also restricts the interaction to be from the perspective of that particular artifact only; other potential features of an object remain invisible to the subject (Kuutti, 1996). For example, IS is constituted as an outcome, and then becomes in use phase an artifact that facilitates or restricts human thinking. It should be noted that the nature of subjective phenomenon in object-orientedness is constituted by some humans toward an object through mediation by artifacts. The object that becomes an artifact later often works against the other people. Therefore, AT has a capability to reveal both the constitution of an artifact and the reification by the artifact.

Engeström (1987) and his colleagues explicated the framework of activity as a logical interaction by including a community. They expanded its original activity theory to the current one in which there are three types of mediation: an artifact, social rules, and the division of labor in a large triangle (see Figure.3). Social rules are norms, customs and social relations, more specifically for example, distribution rules of outcome. The division of labor is an organization of tasks in the community. It is related to a transformation of the object to an outcome. It is that the division of labor is a kind of structure, and that social rules are of conditions. Engeström (1987) calls this model as human activity structure.

These diagrams help us understand an activity at different levels: The large triangle is concerned with motives of persons in a collective activity of the community. The small one is concerned with a goal of an individual action. Motives are related to human needs.

## BUILDING A FOUNDATION OF 1PPSA

The aim of our research is to build a theoretical foundation of 1ppSA by using the diagrammatic resources of AT in accordance with phenomenology, which is regarded as a foundation theory for building a 1ppSA methodology.

### Epoche and Diagrammatic Expressions

We need to practice epoche or to suspend for a moment our recognition of the certainties of common sense and a natural attitude to things. It is because, being the presupposed basis of any thought, they are taken for granted, and go unnoticed, and because in order to arouse them and bring them to view (Merleau-Ponty, 2002, p.xv).

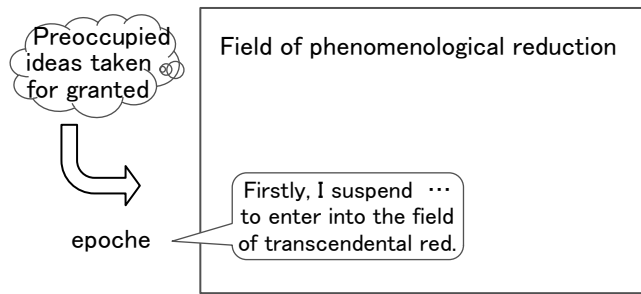


Figure.1 Epoche

To practice epoche is to enter the field of phenomenological reduction (Figure.1). It is the field where, with noesis and noema, we arouse the certainties of common sense and a natural attitude to things. Therefore, to start drawing an activity with the diagrammatic resources in the field of phenomenological reduction means to practice epoche.

### Transcendental Reduction and Diagrammatic Expressions

Phenomenological reduction is to examine how we have constituted an image of conviction concerning an object through meanings derived by a variety of signs or tools as well as social rules and the division of labor. Phenomenological reduction consists of transcendental and eidetic ones.

In phenomenology transcendental reduction is a method by which we return to the original scene in order to understand or relay down our life world. In the field of transcendental reduction, transcendental subjectivity is exercised with noesis and noema. Every intentional experience has a noema and therein a meaning through which it is related to the object (Husserl, 2002, p.374). In the system of all possible 'subjective modes of appearing', it [every real natural thing] can be noematically constituted as self-identical (ibid, p.375). Therefore, the noematic field is that of the unitary, the noetic [noesis] that of the "constituting" variety factors (ibid, p.288). In short, transcendental subjectivity constitutes a world as a noema by intentionally integrating [i.e., noesis] direct experiences as givenness.

In order to relate AT diagrams with phenomenology, we paraphrase in AT terms what Husserl describes. A noema corresponds to 'result' in Figure.2 or 'outcome' in Figure.3. The object in phenomenology corresponds to the object in AT diagrams. Various appearances or experiences concerning the object are sensed through meanings by various signs. A person (subject) has an experience that creates a meaning through the mediation of a sign as an artifact, social rules and the division of labor. Like this, every intentional experience has a meaning to the object. The same person may have a different experience that creates a meaning by appropriating a tool as an artifact. A noema is perceived by the person as self-identical at the location of the 'result' or 'outcome' of AT diagram.

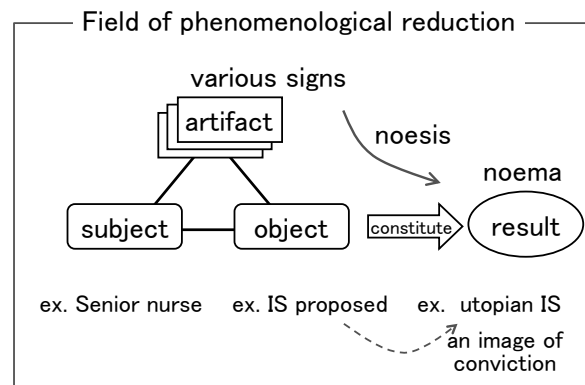


Figure.2 Transcendental Reduction

Here is a simplified example to understand a relation among an object, multiple senses (meanings), and a perception (constitution). For example, let's say that there is a glass in front of a person. He senses a circle as it so appears when he takes a look at it from above, and senses a rectangle from the side, and then perceives a tube as that which appears. And still further, he senses a mouth from an angle and then perceives a glass as an image of conviction. Humans have this primordial mode of cognition that constitutes 'that' which appears from various appearances.

The agency of constituting a 'noema' concerning an object through meanings is called 'noesis' in phenomenology. Therefore it is considered that one who draws AT diagrams in 1ppSA exercises noesis with mediation by artifacts, social rules and the division of labor (Figure.3).

### Eidetic Reduction and Diagrammatic Expressions

Eidetic reduction is necessary in the following reasons. Knowledge of facts is never sufficient for grasping an essence and the construction of 'idealizing fictions' is always necessary (Merleau-Ponty, 1964, p.75). This is done by imaginative free changes or variation by which one attempts to reduce phenomenon into the absolutely necessary and invariable components. The need to proceed by way of essences means "...that our existence is too tightly held in the world to be able to know itself as such at the moment of its involvement, and that it requires the field of ideality in order to become acquainted with and to prevail over its facticity" (Merleau-Ponty, 2002, p.xvi). Eidetic reduction can be practiced by changing signs or tools as artifacts, for example, taking into account aesthetics in addition to the usual signs such as efficiency and effectiveness.

Another reason is that we are always in a community to survive. The associated structures and conditions by which we constitute an outcome are needed to be included in the reduction. Mediation concerning a community has to be taken into account as well as mediation between subject and object. By taking a community into account AT diagram depicts this additional mediation as the division of labor and social rules (see Figure.3). Idealizing fictions are practiced also in this mediation, for example, taking into consideration a flat organization instead of the existing hierarchical one as the division of labor.

### A Simple Example

Here we show a simple example of a senior nurse in a fictitious hospital. The use of AT diagrams along with phenomenology is expected to help understand the relation among a subject, an object, mediation, an outcome and others. It is noted that we do not intend to show the usefulness of the theoretical foundation because we are not yet at a stage where usefulness is an issue for discussion.

When IS was planned, a senior nurse came up with an image of a utopia. Let's examine how her idea of a utopia was constituted as an image of conviction. IS department announced a plan of a new IS. The senior nurse responded to the plan by constituting her own image of utopia. Therefore, a subject is the senior nurse, an object is the IS planned. She appropriated several signs as artifacts (Figure.2). For example, for a sign of efficiency she appropriated, she sensed a decrease of time required in recording her work; for a sign of effectiveness, an easier accessibility of past care records; for a sign of the division of labor, a higher sharing of information among departments; for a sign of social rules or incentives, a more professional looking and so on. As she is a senior professional nurse, she expected, for a social incentive as a social rule, a more professional looking with IS use as well as an increased pay. With favorable meanings attached to the planned IS through mediation of various signs, she constituted, as an image of conviction, a utopian workplace with the IS at an outcome of AT diagram (Figure.3). It is thus possible for her as well as for others to understand how her conviction was constituted along with externalized structures and conditions.

### DISCUSSION AND CONCLUSIONS

The study of lppSA is almost missing in the field of IS discipline. Therefore, we tried to build a foundation of lppSA with phenomenology and AT. In the viewpoint of practicality, phenomenology and AT are still imperfect. We paid our attention to the fact that they are complementary. By combining the two, we have built a theoretical foundation of lppSA.

Through our investigation into lppSA, we learnt that to reveal a world by phenomenology is not to describe but to lay down it. Phenomenology helps us return to the proto-scene in which we constitute the world. Returning to the proto-scene is to reconstitute the world by entering into the field of consciousness where we are conscious of the structures, conditions, and meanings associated with artifacts. We may face a new structure, condition or artifact, and find new meanings about them, so that we are always open to reconstitute our world. The possibility of reconstitution is consistent with the perpetual construction of realities suggested by dissipative structure theory.

Through use of AT diagrams, the foundation of lppSA enables us to reconstitute our world by making us be conscious of structures, conditions and meanings associated with artifacts by visualizing them. Here we can remind of a message by Bourdieu (1990, p.90). "Ambition of sociologists is to become free from the principles which govern the present by

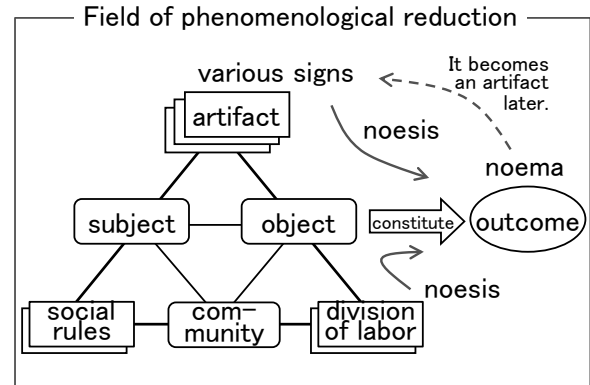


Figure.3 Transcendental and Eidetic Reductions

highlighting them among the present.” In the age of empowerment business professionals are probably expected to be lay-sociologists.

In addition to the above-mentioned benefits, we can expect other benefits in thinking about IS implementation. The foundation of lppSA helps us enact the world and its meanings where IS is placed as an artifact at the stage of implementation (see Figure.3). Meanings of IS can be made clear to business professionals in the light of their work lives governed by the structures of work assignment, conditions of motivation and various meanings associated with their survival in the organization. Thus we could understand possible outcomes of IS implementation in advance.

By using the foundation of lppSA, we could understand not only our own thinking but also other's. Such deep understanding of the constitution of the world would help us be ready to change in more consensus or accommodation than ever. Then we find IS needs within the accommodated image of the world.

Systems analysis usually consists of diagrammatic resources and a methodology. Our study focused mainly on diagrammatic resources and expression. We have just entered the initial stage of development of a lppSA methodology. Thus, what we examined is not effectiveness but efficacy. In other words it is equivalent to having build a sort of a hypothesis concerning the theoretical foundation of lppSA. Therefore there remains much work to start. We hope this study has paved a new avenue for researches on lppSA. It is expected to develop a concrete methodology based on the ideas of this study and examine its effectiveness.

## REFERENCES

1. Alter, S. (2004). Desperately Seeking Systems Thinking in the Information Systems Discipline, *Proceedings of International Conference on Information Systems*, 757-769.
2. Alter, S. (2005). Sysperanto and the Work System Method, *Proceedings of the Americas Conference on Information System*.
3. Bannon, L. (1997). Activity Theory, The COTCOS project, <http://www.irit.fr/ACTIVITES/GRIC/cotcos/pjs/>, accessed as of November, 2011.
4. Bourdieu, P. (1991). Sociology of Sociology. Fujiwarashoten, in Japanese.
5. Checkland, P. (1999). Systems Thinking, Systems Practice, Wiley.
6. Engeström, Y. (1987). Learning by Expanding: An Activity-Theoretic Approach to Developmental Research, Orienta-Konsultit Oy.
7. Engeström, Y. (1999). Activity Theory and Individual and Social Transformation, in Y. Engeström, R. Miettinen, and R. Punamaki (Eds.) *Perspectives on Activity Theory*, Cambridge University Press, 19-38.
8. Giddens, A. (1993). Sociology, Jiritsushuppan, 1993, in Japanese.
9. Husserl, Edmund (1970). Crisis of European Sciences and Transcendental Phenomenology, Northwestern University Press.
10. Husserl, Edmund (1999). The Idea of Phenomenology, Kluwer Academic Publishers.
11. Husserl, Edmund (2002). Ideas: General Introduction to Pure Phenomenology, Routledge.
12. Kaptelinin, V. and Nardi, B. (2006). Postcognitivist Theories in Interaction Design, in V. Kaptelinin and B. Nardi (Eds.) *Acting with Technology*, The MIT Press, 195-236.
13. Korpela, M., Mursu, A. and Soriyan, H. A. (2002). Information Systems Development as an Activity, *Computer Supported Cooperative Work*, 11, 111-128.
14. Kosaka, T. (2010). Phenomenology as a Base of Systems Analysis, *Proceedings of the Mediterranean Conference on Information Systems*.
15. Kosaka, T. (2012). The Domain of a First-Person Perspective Systems Analysis, in H. Rahman, A. Mesquita, I. Ramos, and B. Pernici (Eds.) *Knowledge and Technologies in Innovative Information Systems*, Springer, 22-35.
16. Kuutti, K. (1996). Activity Theory as a Potential Framework for Human-Computer Interaction Research, in B. A. Nardi (Ed.) *Context and Consciousness*, The MIT Press, 17-44.
17. MacDonald, Paul, S. (2000). Phenomenological Factors in Vygotsky's Mature Psychology, *History of the Human Sciences*, 13, 3, 69-93.
18. Merleau-Ponty, M. (1964). The Primacy of Perception, Northwestern University Press.

19. Merleau-Ponty, M. (2002). *Phenomenology of Perception*, 2nd ed., Routledge.
20. Nardi, B. A. (1996). Concepts of Cognition and Consciousness: Four Voices, *Australasian Journal of Information Systems*, 4, 1, 64-79.
21. Prigogine, Ilya. (1997). *The End of Certainty*, Free Press.
22. Stacey, Ralph D., Griffin, D., and Shaw, P. (2000). *Complexity and Management*, Routledge.
23. Suwa, M. (1999). Visual Displays as Stimuli to Cognitive Processes, *The Journal of the Visualization Society of Japan*, 19 (72), 13-18 in Japanese.
24. Vermersch, P. (1999). Introspection as Practice, *Journal of Consciousness Studies*, 6, 2-3, 17-42.
25. Vygotsky, L. S. (1978). *Mind in Society*, Harvard University Press.
26. Whitaker, R. (2007). Applying Phenomenology and Hermeneutics in IS Design, *Informing Science Journal*, 10, 63-96.
27. Yamazaki, O. and Miwa, K. (2001). A Study of Changes of Problems Solving Processes by Externalization, *The Journal of Japanese Cognitive Science Society*, 8, 1, 1-14.

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