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## NEW FORMS OF LEARNING IN CO-CONFIGURATION WORK

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### CO-CONFIGURATION AS A NEW TYPE OF WORK AND PRODUCTION

Steve Barley and Gideon Kunda (2001) argue that prevailing theories of organizing are based primarily on detailed observations of bureaucratic work, but that the nature of work today is sufficiently different to bring the applicability of these theories into question. Barley and Kunda's primary conclusion is that detailed studies of work should be reintegrated into organizational science in order to provide a solid empirical basis for post-bureaucratic theories of organizing. This argument is applicable in the study of organizational and workplace learning. Without a substantive understanding of the historically changing character of the work done in a given organization, theories of organizational and work-based learning are likely to remain too general and abstract to capture the emerging possibilities and new forms of learning.

Bart Victor and Andrew Boynton (1998) provide a useful historical framework for such a reintegration of organization, work, and learning. They identify five types of work in the history of industrial production: craft, mass production, process enhancement, mass customization, and co-configuration (Figure 1).

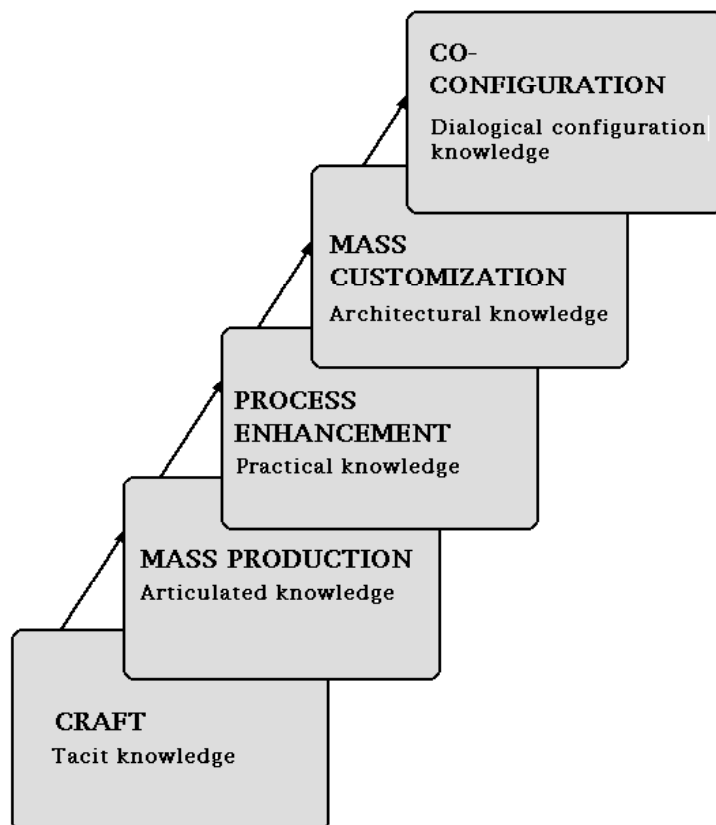


Figure 1. Historical forms of work (adapted from Victor & Boynton, 1998, p. 6 and p. 233)

Each type of work generates and requires a certain type of knowledge and learning. At present, the most demanding and promising developments are associated with the emergence of *co-configuration work*. A critical prerequisite of co-configuration is the creation of customer-intelligent products or services which adapt to the changing needs of the user.

“The work of co-configuration involves building and sustaining a fully integrated system that can sense, respond, and adapt to the individual experience of the customer. When a firm does co-configuration work, it creates a product that can learn and adapt, but it also builds an ongoing relationship between each customer-product pair and the company. Doing mass customization requires designing a product at least once for each customer. This design process requires the company to sense and respond to the individual customer’s needs. But co-configuration work takes this relationship up one level – it brings the value of an intelligent and ‘adapting’ product. The company then continues to work with this customer-product pair to make the product more responsive to each user. In this way, the customization work becomes continuous. (...) Unlike previous work, co-configuration work never results in a ‘finished’ product. Instead, a living, growing network develops between customer, product, and company.” (Victor & Boynton, 1998, p. 195)

We may provisionally define co-configuration as an emerging historically new type of work that has the following characteristics: (1) adaptive ‘customer-intelligent’ products or services, or more typically integrated product/service combinations, (2) continuous relationships of mutual exchange between customers, producers, and the product/service combinations, (3) ongoing configuration and customization of the product/service combination over lengthy periods of time, (4) active customer involvement and input into the configuration, (5) multiple collaborating producers that need to operate in networks within or between organizations, (6) mutual learning from interactions between the parties involved in the configuration actions.

In other words, co-configuration is more than just smart, adaptive products. “With the organization of work under co-configuration, the customer becomes, in a sense, a real partner with the producer.” (Victor & Boynton, 1998, p. 199) Co-configuration typically also includes interdependency between multiple producers forming a strategic alliance, supplier network, or other such pattern of partnership which collaboratively puts together and maintains a complex package which integrates material products and services and has a long life cycle. Co-configuration requires flexible ‘knotworking’ in which no single actor has the sole, fixed authority – the center does not hold (Engeström, Engeström & Vähäaho, 1999).

Co-configuration is a very demanding mode of work and production. It offers radical strategic advantages when the objects of work demand it. Medical care is a case in point. An increasing percentage of patients have multiple chronic illnesses for which standardized, single-diagnosis care packages are inadequate. In Helsinki, 3.3% of the patients use 49.3% of all health care expenses, and 15.5% of patients use 78.2% of all resources. A significant portion of these patients are so expensive because they drift from one caregiver to another without anyone having an overview and overall responsibility for their care. Co-configuration work is a strategic priority because the different caregivers and the patients need to learn to produce together well coordinated and highly adaptable long-term care trajectories.

It is not unusual to see co-configuration attempts falter. An observer of one such attempt described her findings with the help of a game metaphor as follows.

“The actors are like blind players who come eagerly to the field in the middle of the game, attracted by shouting voices, not knowing who else are there and what the game is all about. There is no referee, so rules are made up in different parts of the field among those who happen to bump into one another. Some get tired and go home.” (Kangasoja, 2002)

A precondition of successful co-configuration work is dialogue in which the parties rely on real-time feedback information on their activity. The interpretation, negotiation and synthesizing of such

information between the parties requires new, dialogical and reflective knowledge tools as well as new, collaboratively constructed functional rules and infrastructures (Engeström & Ahonen, 2001).

## THEORY OF EXPANSIVE LEARNING AS FRAMEWORK AND CHALLENGE

Processes of learning may be effectively differentiated along two key dimensions, one representing the given vs. newly emerging nature of the object and activity to be mastered, the other one representing the famous distinction between exploitation of existing knowledge vs. exploration for new knowledge put forward by James March (1996). Treated as dichotomies, these two dimensions yield a matrix of four basic types of learning at work (Figure 2).

		EXPLORATION			
		INCREMENTAL EXPLORATION -Structuring (Norman, 1982) -Articulation (Spinosa, Flores & Dreyfus, 1997) CONTEXT OF EXPERIMENTATION	RADICAL EXPLORATION -Expansion (Engeström, 1987) -Reconfiguration (Spinosa, Flores & Dreyfus, 1997) CONTEXT OF TRANSFORMATION		
OLD OBJECT, OLD ACTIVITY				NEW OBJECT, NEW ACTIVITY	
		ADJUSTABLE EXPLOITATION -Tuning (Norman, 1982) -Customary disclosing (Spinosa, Flores & Dreyfus, 1997) CONTEXT OF PARTICIPATION	TRANSFERABLE EXPLOITATION -Accretion (Norman, 1982) -Cross-appropriation (Spinosa, Flores & Dreyfus, 1997) CONTEXT OF TRANSMISSION		
		EXPLOITATION			

Figure 2. Four types of learning<sup>1</sup>

*Transferable exploitation* (the lower right-hand field of the matrix) is transmission of existing knowledge in order to cope with a new object and a new activity. The stepwise appropriation of well-established Japanese quality management techniques by American companies facing new competitive pressures and market conditions is a good example (Cole, 1999). Don Norman's (1982) concept of accretion and the more recent concept of cross-appropriation (Spinosa, Flores & Dreyfus, 1997) illuminate different aspects of this type of learning.

<sup>1</sup> I am grateful to Professor Risto Tainio for ideas that led to the formulation of the matrix.

*Adjustable exploitation* is gradual acquisition and internalization of the existing knowledge and skills embedded in the given activity. This type of learning is manifest in apprenticeship-type settings. Norman (1982) describes it as tuning, and Spinosa, Flores and Dreyfus (1997) as customary disclosing,

*Incremental exploration* is construction of new knowledge by experimentation within the given activity. Norman (1982) talks about this type of learning as structuring, while Spinosa, Flores and Dreyfus characterize it as articulation. This type of learning is often associated with the implementation of complex configurational technologies, such as the computer-aided production management systems analyzed by Fleck (1994).

“Each configuration is built up from a range of components to meet the very specific requirements of the particular user organization. Configurations therefore demand substantial user input and effort if they are to be at all successful, and such inputs can provide the raw material for significant innovation. (...) the specific implementation/innovation process with configurations is a matter of learning through the struggle to get the overall system to work, i.e., a process of ‘learning by trying’: improvements and modifications have to be made to the constituent components before the configuration can work as an integrated entity.” (Fleck, 1994, p. 637-638)

“This is a more fundamental process of learning, much more like the trial and error nature of genuine experimentation than the secular accumulation of improvements in carrying out essentially the same activity.” (Fleck, 1994, p. 648)

Fleck’s case brings us into the transitional zone between incremental exploration and radical, expansive exploration. *Radical exploration*, or expansive learning (the upper right-hand field of the matrix), begins when experimentation is not anymore aimed only at making a well-bounded new technology work in the framework of a given, pre-existing activity. Radical exploration is learning what is not yet there. It is creation of new knowledge and new practices for a newly emerging activity, that is, learning embedded in and constitutive of qualitative transformation of the entire activity system. Such a transformation may be triggered by the introduction of a new technology, but it is not reducible to it. Radical exploration is the most poorly understood and historically most interesting type of learning. It is what the theory of expansive learning (Engeström, 1987) is focused on, and what Spinosa, Flores and Dreyfus (1997) call reconfiguration.

“In cases of reconfiguration, a greater sense of integrity (as experienced in articulation) is generally not experienced. Rather, one has the sense of gaining wider horizons.” (Spinosa, Flores and Dreyfus, 1997, p. 26)

The four types of learning are not mutually exclusive. To the contrary, as shown already by Bateson (1972), expansive learning processes involve sub-processes or layers of the other types of learning, but these gain a different meaning, motive and perspective as parts of the expansive process.

The escalating cyclic character of expansive learning through a sequence of learning actions ascending from the initial abstract ‘germ cell’ to the concrete whole of the system to be mastered is reasonably well understood (Davydov, 1990, Engeström, 1987, 1999b, 2001a). In this respect, the theory of expansive learning provides a central framework for the analysis and design of learning processes in co-configuration settings.

What is not so well understood is how such basically forward-oriented expansive learning actions are intertwined with horizontal or sideways movement across competing or complementary domains and activity systems, particularly characteristic to co-configuration. In a series of studies, we have identified patterns of such horizontal movement in expansive learning processes situated in organizational fields moving toward co-configuration work: boundary crossing (Engeström, Engeström & Kärkkäinen, 1995), multi-voiced dialogue (R. Engeström, 1995), negotiated knotworking (Engeström, Engeström & Vähäaho, 1999), and cognitive trail-blazing (Engeström, in press). While still provisional, these findings provide significant starting points for building a conceptually solid and empirically well-grounded *next-generation version of the theory of expansive learning that puts the horizontal and inter-organizational dimension of learning in the center.*

## THE LANDSCAPE OF LEARNING IN CO-CONFIGURATION

Learning in co-configuration settings is typically distributed over long, discontinuous periods of time. It is accomplished in and between multiple loosely interconnected activity systems and organizations operating in divided local and global terrains and representing different traditions, domains of expertise, and social languages. Learning is crucially dependent on the contribution of the clients or users. Learning is embedded in major transformations, upheavals, innovations, implementations and movements. It takes place in heterogeneous patchworks and textures of small and large, unnoticeable and spectacular actions, objectifications, trajectories and trails.

Co-configuration presents a twofold learning challenge to work organizations. First, co-configuration work itself needs to be learned (learning *for* co-configuration). In divided multi-activity terrains, expansive learning takes shape as renegotiation and reorganization of collaborative relations and practices, and as creation and implementation of corresponding concepts, tools, rules, and entire infrastructures.

Secondly, within co-configuration work, the organization and its members need to learn constantly from interactions between the user, the product/service, and the producers (learning *in* co-configuration). Even after the infrastructure is in place, the very nature of ongoing co-configuration work is expansive; the product/service is never finished. These two aspects – learning *for* and learning *in* - merge in practice.

As a *general working hypothesis*, I propose that the expansive learning required and generated by co-configuration work may be characterized with the help of three central features.

1. It is *transformative* learning that radically broadens the shared objects of work by means of explicitly objectified and articulated novel tools, models, and concepts (see Engeström, 2001a, in press, Engeström, Puonti & Seppänen, in press). This transformative aspect of learning in co-configuration puts a heavy emphasis on *actions of design, modeling, textualization, objectification, conceptualization and visibilization* (Engeström, 1999b). We might say that this is the visible superstructure of new forms of expansive learning at work.
2. It is *horizontal* and dialogical learning that creates knowledge and transforms the activity by crossing boundaries and tying knots between activity systems operating in divided multi-organizational terrains (see Engeström, Engeström & Vähäaho, 1999, Engeström, Engeström & Kerosuo, in press). This horizontal aspect of learning in co-configuration puts a heavy emphasis on *actions of bridging, boundary crossing, 'knotworking', negotiation, exchange and trading*. This is the structure of situationally constructed social spaces, arenas and encounters needed in new forms of expansive learning at work.
3. It is *subterranean* learning that blazes embodied and lived but unnoticeable cognitive trails that serve as anchors and stabilizing networks that secure the viability and sustainability of the new concepts, models and tools, thus making the divided multi-organizational terrains knowable and livable (see Cussins, 1992, Engeström, in press). This subterranean aspect of learning in co-configuration puts a heavy emphasis on *actions of spatial transition and movement, repetition, stabilization and destabilization, and embodiment*. This is the invisible, rhizomatic infrastructure of new forms of expansive learning at work.

## METHODOLOGY

Developmental work research (Engeström, 1993) is an application of cultural-historical activity theory (Leont'ev, 1978, Engeström, Miettinen & Punamäki, 1999) in the study of work and organizations. Within cultural-historical activity theory, formative experiments and developmental interventions have been an

integral aspect of the methodology from the beginning (Vygotsky, 1978; for a recent discussion on interventionist methodology in developmental work research, see Engeström, 2000a).

Naturalistic social studies of science and technology (e.g., Latour & Woolgar, 1979) have been an influential model for ethnographic studies of professional work and discourse. Latour (1987) crystallized the quest of this research in his call: Follow the actors! Much of the recent ethnographic research in professional and industrial work has indeed focused on following the actors constructing their activities, social worlds and accepted truths by means of talk and text (e.g., Kunda, 1992, Darrah, 1996).

While this stance has surely been a healthy antidote to the tyranny of structures, there is a risk in focusing exclusively on actors. The professionals and their discursive interactions may appear as somewhat omnipotent constructors of their activities and social worlds. From the point of view of activity theory, this would mean that the material grounding and stubborn systemic dynamics of practical activities are lost or ignored, the resistance of objects is forgotten.

To an increasing degree, professional work and discourse are socio-spatially distributed among multiple organizational units and form long chains of interconnected practical and discursive actions. Actors become dispersed and replacable which renders the focus on actors increasingly vulnerable as a research strategy. What can keep radically distributed work and expertise together, coordinated and capable to act in concert when needed? I argue that the necessary glue is focus on the *objects* of professional work and discourse. As Knorr-Cetina (1997, p. 9) points out, “objects serve as centering and integrating devices for regimes of expertise that transcend an expert’s lifetime and create the collective conventions and the moral order communitarians are concerned about.”

Objects should not be confused with goals. Goals are primarily conscious, relatively short-lived and finite aims of individual actions. The object is a heterogeneous and internally contradictory, yet enduring, constantly reproduced purpose of a collective activity system that motivates and defines the horizon of possible goals and actions (Leont’ev, 1978, Engeström, 1995).

Organizations may emerge through conversation, but they do not emerge for the sake of conversation. They emerge and continue to exist in order to produce goods, services, or less clearly definable outcomes for clients or users. If you take away patients and illnesses, you do not have hospitals. The object is not reducible to the raw material given or the product achieved. It is understandable as the trajectory from raw material to product in the emerging context of its eventual use by another activity system. Thus, the object of clinical work may be characterized as the trajectory from symptoms to treatment outcomes in the context of the patient’s life activity. The object is projective and transitory, truly a moving horizon. But it is also specific and concrete, crystallized, embodied and re-problematized in every patient and illness entering the clinic.

All this indicates that we need to trace the objects of expert work as they move in space and time, across various situations and boundaries. History is not made by singular actors in singular situations but in the interlinking of multiple situations and actors accomplished by virtue of the durability and longevity of objects (see Engeström, Puonti & Seppänen, in press). This calls for a conscious expansion of attention beyond the subjects, to include and center on the objects of work and discourse. This is indeed the spirit of the more recent work of Latour (1996, 1999), as well as that of Knorr-Cetina (1997, 1999) and Daston (2000).

In cultural-historical activity theory, the object of activity is regarded as the key to understanding change and learning (Leont’ev, 1978). Expansive learning is above all stepwise expansion of the object. The potential for such expansion is best discovered by means of change experiments, interventions which open up the zone of proximal development of the activity system (Vygotsky, 1978). Thus, the study of

expansive learning in co-configuration settings requires a longitudinal and interventionist approach which may be crystallized in the form of three methodological principles: (1) *follow the objects* of co-configuration work in their temporal and socio-spatial trajectories, (2) *give the objects a voice* by involving the clients or users in dialogues where the object is negotiated, (3) *expand the objects* by organizing intervention sessions where the producers and clients construct new shared models, concepts and tools to master their objects.

Our first major intervention studies in health care settings were conducted in the late 1980s (see Engeström, 1990, 1991). An overview of the 15-year lineage of this research is given in a forthcoming book titled *Collaborative Expertise: Expansive Learning in Medical Work* (Y. Engeström, in press). In the mid-1990s, researchers in the Center for Activity Theory and Developmental Work Research at University of Helsinki developed a new intervention methodology under the generic name of *Change Laboratory* (Engeström & al., 1996). Variations of this method have been used in a large number of intervention studies in settings ranging from post offices and factories to schools and newsrooms.

The Change Laboratory sessions are a *purposeful blend* of elements familiar from existing workplace practices and new elements brought in by the researchers. They are designed to serve as *microcosms* where potentials of co-configuration and knotworking can be experienced and experimented with.

“A microcosm is a social testbench and a spearhead of the coming culturally more advanced form of the activity system. ...the microcosm is supposed to reach within itself and propagate outwards reflective communication while at the same time expanding and therefore eventually dissolving into the whole community of the activity.” (Engeström, 1987, p. 277-278)

In practice, the methodological principles sketched above mean that selected objects of work in the research settings are first followed ethnographically. Critical incidents and examples from the ethnographic material are brought into a series of Change Laboratory sessions to stimulate analysis and negotiation between the participants. The laboratory sessions themselves are videotaped for analysis. The participants of the sessions engage in constructing shared models and tools to enhance their collaborative mastery of the object. The objects are again followed as the new tools and models are being implemented. Drawing on Vygotsky's (1978) method of dual stimulation, this methodology is an expansion of the design experiments described by Brown (1992). It allows for the collection of rich longitudinal data on the micro-interactions and cognitive processes involved in expansive learning as the participants make visible their work, moving between actions and activity, between the past, the present, and the envisioned future (see Engeström, 1999a, 2000).

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