

The Cambridge Companion to
VYGOTSKY

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- external cultural activities into internal processes via psychological tools, and mediated learning in relation to high and low incidence disabilities.
- Applied studies aimed at creating disability-specific psychosocial profiles of different handicapping conditions along with constructing disability-specific sets of psychological tools and disability-specific mediation techniques.
 - Perfected “dynamic assessment” procedures for children with handicapping conditions to effectively connect them with remedial methodologies.

YRJÖ ENGSTRÖM

14 Putting Vygotsky to Work The Change Laboratory as an Application of Double Stimulation

INTRODUCTION

This chapter examines Vygotsky's *method of double stimulation* as a basis for formative interventions in the workplace. I argue that double stimulation is radically different from such intervention approaches as the *design experiments* currently discussed in educational research. Double stimulation is, above all, aimed at eliciting new, expansive forms of agency in subjects. In other words, double stimulation is focused on making subjects masters of their own lives.

First, I will present Vygotsky's double stimulation as a theoretical and methodological idea. I will then examine recent notions of “design experiments” and point out some serious limitations in these experiments. Second, I will introduce the Change Laboratory method developed in the Center for Activity Theory and Developmental Work Research and used for ten years in formative interventions in workplaces. Third, I will discuss this method as an application and expansion of double stimulation. Fourth, I will demonstrate the practical implementation of Change Laboratory with an example from a project carried out in Finnish post offices. Fifth, I will conclude the chapter with a discussion of some methodological and theoretical implications of the Change Laboratory method for further development of Vygotskian research, especially as it is applied in the context of the workplace and organizations.

VYGOTSKY'S METHOD OF DOUBLE STIMULATION

In his quest for a new psychology based on cultural mediation of higher mental functions, Vygotsky was very conscious of the need to build a methodology that would correspond to the character of the theory.

This methodology [study of reactive responses based on the S-R formula], which easily establishes the response movements of the subject, becomes

completely impotent, however, when the basic problem is the study of those means and devices that the subject used to organize his behavior in concrete forms most adequate for each given task. In directing our attention to the study of specifically these (external and internal) means of behavior, we must conduct a radical review of the methodology of the psychological experiment itself. (Vygotsky, 1999, p. 59)

The methodology Vygotsky, Leont'ev, and Luria developed has been characterized by different names. Vygotsky (e.g., 1997a, pp. 68; 1997b, pp. 85–89; 1999, pp. 57–59) used at least the names "experimental-genetic method," "instrumental method," "historical-genetic method," and "method of double stimulation," somewhat interchangeably. In this paper, I will use the "method of double stimulation."

As van der Veer and Valsiner (1991, p. 169) put it, in double stimulation experiments, "the subject is put in a structured situation where a problem exists (...) and the subject is provided with active guidance towards the construction of a new means to the end of a solution to the problem." Vygotsky described the methodology as follows:

The task facing the child in the experimental context is, as a rule, beyond his present capabilities and cannot be solved by existing skills. In such cases a neutral object is placed near the child, and frequently we are able to observe how the neutral stimulus is drawn into the situation and takes on the function of a sign. Thus, *the child actively incorporates these neutral objects into the task of problem solving*. We might say that when difficulties arise, neutral stimuli take on the function of a sign and from that point on the operation's structure assumes an essentially different character. (Vygotsky, 1978, p. 74, italics added)

By using this approach, we do not limit ourselves to the usual method of offering the subject simple stimuli to which we expect a direct response. Rather, we simultaneously offer a *second series of stimuli* that have a special function. In this way, we are able to study the *process of accomplishing a task by the aid of specific auxiliary means*: thus we are also able to discover the inner structure and development of higher psychological processes.

The method of double stimulation elicits manifestations of the crucial processes in the behavior of people of all ages. Tying a knot as a reminder, in both children and adults, is but one example of a pervasive regulatory principle of human behavior, that of *signification*, wherein people create temporary links and give significance to previously neutral stimuli in the context of their problem-solving efforts. We regard our method as important because it helps to *objectify* inner psychological processes... (Vygotsky, 1978, pp. 74–75)

It is important to note that the second stimuli, the *mediating means*, were not necessarily given to the subjects in any ready-made form.

In experimental studies, we do not necessarily have to present to the subject a prepared external means with which we might solve the proposed problem. The main design of our experiment will not suffer in any way if instead of giving the child prepared external means, we will wait while he spontaneously applies the auxiliary device and involves some auxiliary system of symbols in the operation. (...) In not giving the child a ready symbol, we could trace the way all the essential mechanisms of the complex symbolic activity of the child develop during the spontaneous expanding of the devices he used. (Vygotsky, 1999, p. 60)

Van der Veer and Valsiner (1991, p. 399) point out the fundamental challenge that this methodology poses to the experimenter who wants to control the experimental situation.

The notion of experimental method is set up by Vygotsky in a methodological framework where the traditional norm of the experimenter's maximum control over what happens in the experiment is a special case, rather than the modal case. The human subject always "imports" a set of *stimulus-means* (psychological instruments) into an experimental setting. These stimulus-means are in the form of signs that the experimenter cannot control externally in any rigid way. Hence, the experimental setting becomes a context of investigation where the experimenter can manipulate the structure of the investigation in order to trigger (but not "produce") the subject's *construction* of new psychological phenomena.

In other words, the subject's *agency* steps into the picture. To fully appreciate the radical potential of the methodology of double stimulation, we need to reconstruct Vygotsky's more general conception of intentionality and agency. Vygotsky described this artifact-mediated nature of intentional action as follows:

The person, using the power of things or stimuli, controls his own behavior through them, grouping them, putting them together, sorting them. In other words, the great uniqueness of the will consists of man having no power over his own behavior other than the power that things have over his behavior. But man subjects to himself the power of things over behavior, makes them serve his own purposes and controls that power as he wants. He changes the environment with the external activity and in this way affects his own behavior, subjecting it to his own authority. (Vygotsky, 1997a, p. 212)

Vygotsky (1997a, p. 213) pointed out that voluntary action has two phases or "two apparatuses." The first phase is the design phase in which

the mediating artifact or "the closure part of the voluntary process" is, often painstakingly, constructed. The second phase is the execution phase or "actuating apparatus," which typically looks quite easy and almost automatic, much like a conditioned reflex.

Classic examples of culturally mediated intentionality include devices we construct and use to wake up early in the morning. Vygotsky's examples of voluntary action are mostly focused on individual actors. This must not be interpreted as neglect of collective intentionality. According to Vygotsky's famous principle, higher psychological functions appear twice, first interpsychologically, in collaborative action, and later intrapsychologically, internalized by the individual.

V. K. Arsen'ev, a well-known researcher of the Ussuriysk region, tells how in an Udeg village in which he stopped during the journey, the local inhabitants asked him, on his return to Vladivostok, to tell the Russian authorities that the merchant Li Tanku was oppressing them. The next day, the inhabitants came out to accompany the traveler to the outskirts. A gray-haired old man came from the crowd, says Arsen'ev, and gave him the claw of a lynx and told him to put it in his pocket so that he would not forget their petition about Li Tanku. The man himself introduced an artificial stimulus into the situation, actively affecting the processes of remembering. Affecting the memory of another person, we note in passing, is essentially the same as affecting one's own memory.

(Vygotsky, 1997a, pp. 50–51)

Vygotsky's colleague A. N. Leont'ev (1932) focused on the social origins of intentional action. He pointed out that signals given by foremen, the rhythmic sounds of a drum, and working songs gave collective work the necessary direction and continuance. The interpsychological origins of voluntary action – and collective intentionality – would thus be found in rudimentary uses of shared external signals, prompts, as well as in reminders, plans, maps, and so forth.

We see the radical potential of double stimulation and mediated intentionality every day in educational practice. Cheating in school is an enlightening example. What does a student do when he or she constructs a cheating slip while preparing for an exam?

The exam questions and the texts one must master are the "first stimuli," or the object, for the student. The cheating device, for example a paper slip, is the "second stimulus," or the mediating tool. The cheating slip is typically a small piece of paper that can be hidden away from the teacher's eyes and on which one writes what one considers to be the most essential information about a topic one expects to be included in the exam questions.

Because the cheating slip is small, it cannot contain too much text. To create a good cheating slip, the student must carefully select the most relevant and useful aspects of the topic and represent them in an economic and accessible way on the slip. Thus, the construction of a cheating slip is truly what Vygotsky described as creating an external auxiliary means for mastering an object. The construction, contents, and use of the cheating slip bring into light and objectify the inner psychological process of preparing for the test. If we get access to the construction, contents, and use of cheating slips, we learn much more about students' learning than merely by reading and grading their exam answers. That is why I occasionally ask my students to prepare cheating slips and to cheat in my exam. Then, at the end of the exam, I collect their slips and the actual answers.

Cheating is an important form of student agency. By creating and using a cheating slip, the student controls his or her own behavior with the help of a tool that he or she made. The hard part is the construction of a good cheating slip – the design phase or the "closure part" of the agentic action. When asked, students often report that the execution part is surprisingly easy. If the slip has been well-prepared, it is often enough that the student merely glances at it – the details seem to follow from memory as if a floodgate had been opened. This is the phenomenon of *instantaneous recollection* or reconstruction of a complex meaningful pattern with the help of a good "advance organizer" (Ausubel, Novak, & Hanesian, 1978; Ausubel, 2000), "orientation basis" (Haenen, 1995; Talyzina, 1981), or "germ cell model" (Pavydov, 1990). In other words, learning to cheat well is extremely valuable.

At the same time, cheating is contestation of the given activity of school-going. By constructing and using a cheating slip, the student takes a risk but also creates a new mediating tool for the mastery of the entire testing situation, which is really the core of traditional schooling. This goes far beyond merely quantitatively enlarging or "amplifying" one's memory. Good cheating is a way to beat the system. John Holt gave a vivid picture of the beginnings and inner contradictions of this type of agency when he described how elementary school kids learn to calculate the risk for cheating.

She knows that in a recitation period the teacher's attention is divided among twenty students. She also knows the teacher's strategy of asking questions of students who seem confused, or not paying attention. She therefore feels safe waving her hand in the air, as if she were bursting to tell the answer, whether she really knows it or not. [...] It is also interesting to note that she does not raise her hand unless there are at least half a dozen other hands up.

(Holt, 1964, p. 12)

Agency is constructed and manifested in actions of testing and goes beyond the limits of what is required and allowed. This is what double stimulation is all about. In actions of good cheating, students are making double-stimulation experiments.

DESIGN EXPERIMENTS AND THEIR LIMITS

Design experiments were suggested by Brown (1992) and Collins (1992) to bridge the gap between educational research and practical educational innovation.

Design experiments ideally result in greater understanding of a learning ecology – a complex, interacting system involving multiple elements of different types and levels – by designing its elements and by anticipating how these elements function together to support learning. Design experiments therefore constitute a means of addressing the complexity that is a hallmark of educational settings. (Cobb et al., 2003, p. 9)

For Collins, Joseph, and Bielażyc (2004, p. 33), the methodology of design experiments, or design research, is basically a linear progression of six steps, starting by "implementing a design" and ending by "reporting on design research." Because the process begins with implementation, the making of the design in the first place is not even included in the methodology. Thus, there is no need to consider the issues of who makes the design or what theory or principles are used for the design. In a similar vein, Cobb and his coauthors (2003) seem to take it for granted that it is the researchers who determine the "endpoints" for a design experiment.

In addition to clarifying the theoretical intent of the experiment, the research team must also specify the significant disciplinary ideas and forms of reasoning that constitute the prospective goals or endpoints for student learning. (Cobb et al., 2003, p. 11)

The stepwise linear notion of design research is also supported by Banman–Ritland (2003, p. 22): Cyclic iterations serving the refinement of the design complement but do not challenge the basically linear image. Cobb and coauthors do mention that design experiments that conceived by researchers create discontinuity – but that does not seem to require any further reflection:

The intent is to investigate the possibilities for educational improvement by bringing about new forms of learning in order to study them. Consequently, there is frequently a significant discontinuity between typical forms of education (these could be studied naturalistically) and those that

The emphasis on completeness, finality, and closure may be partly explained by the idea of design experiments as "refinement." The implication is that the researchers have somehow come up with a pretty good model which needs to be perfected in the field.

Design experiments were developed as a way to carry out formative research to test and refine educational designs based on theoretical principles derived from prior research. This approach of progressive refinement in design involves putting a first version of a design into the world to see how it works. Then, the design is constantly revised based on experience, until *all the bugs* are worked out. (Collins, Joseph, & Bielażyc, 2004, pp. 18; emphasis added)

Design research should always have the dual goals of refining both theory and practice. (Collins, Joseph, & Bielażyc, 2004, p. 19)

Collins, Joseph, and Bielażyc (2004, pp. 18–19) compare educational design research to the design of cars and other consumer products, using *Consumer Reports* as their explicit model for evaluation. They do not seem to notice any significant difference between finished mass products and such open-ended, continuously coconfigured products as educational innovations (for coconfiguration, see Victor & Boynton, 1998; Engström, 2004). A strange obsession with "completeness" runs like a red thread through their argument. "Thus, in the jigsaw, all pieces of the puzzle come together to form *a complete understanding*" (Collins, Joseph, & Bielażyc, 2004, p. 23; emphasis added). What this overlooks is that "one can never get it right, and that innovation may best be seen as a continuous process, with particular product embodiments simply being arbitrary points along the way" (von Hippel & Tyre, 1995, p. 12).

To sum up, in discourse on "design experiments," scholars do not usually ask: Who does the design and why? It is tacitly assumed that researchers make the grand design, teachers implement it (and contribute to its modification), and students learn better as a result. This linear view ignores what sociologists teach us about interventions as contested terrains that are full of resistance, reinterpretation, and surprise from the actors in the design experiment.

Intervention is an on-going transformational process that is constantly re-shaped by its own internal organisational and political dynamic and by the specific conditions it encounters or itself creates, including the responses and strategies of local and regional groups who may struggle to define and defend their own social spaces, cultural boundaries and positions within the wider power field.

Crucial to understanding processes of intervention is the need to identify and come to grips with the strategies that local actors devise for dealing with their new intervenors so that they might appropriate, manipulate,

THE CHANGE LABORATORY AS AN APPLICATION
OF DOUBLE STIMULATION

Formative interventions in the Vygotskian sense need to be understood as formation of *critical design agency* among all the parties: researchers, teachers, and students or, respectively, researchers, managers, workers, and clients. Such critical design agency includes the will and courage to say "no" – to challenge the designs offered previously... Students form specific cognitive "endpoints" in complex learning ecologies and actively make sense of and reconfigure the tasks and the context of the tasks among the participants. In other words, what is initially presented as the problem or the task is interpreted and turned into a meaningful challenge several times over in the process of the intervention.

The Change Laboratory method develops work practices by the participants in dialogue and debate among themselves, with their management, with their clients, and – not the least – with the interventionist researchers. It facilitates both intensive, deep transformations and continuous incremental improvement. The idea is to arrange, on the shop floor, a room or space in which there is a rich set of representational tools available for analysis of disturbances and for constructing new models of the work activity. The Change Laboratory method was initially designed to be used by a work team, or a unit, initially with the help of an interventionist. Subsequently, expanded versions of the Change Laboratory method have been developed for the use of two or more organizations or organizational units seeking to enhance their collaboration.

The central tool of the Change Laboratory is a 3×3 set of surfaces for representing the work activity (Figure 14.1). Practitioners participating in the Change Laboratory process face the surfaces and also each other. A scribe is usually appointed from among them, to record intermediate outcomes of the discussion on the three surfaces. One or more researcher-interventionists are present to guide the process. A video projector is important because videotaped work situations are typically used as material in the laboratory sessions. Each session is also videotaped for research and to facilitate the reviewing of critical laboratory events in subsequent sessions.

The horizontal dimension of the surfaces represents different levels of abstraction and theoretical generalization. At one end, the *mirror* surface is used to represent and examine experiences from work practice, particularly problem situations and disturbances, but also novel innovative solutions. Videotaped work episodes as well as photographs, stories, interviews, customer feedback, performance statistics, and so forth, are used as mirror data.

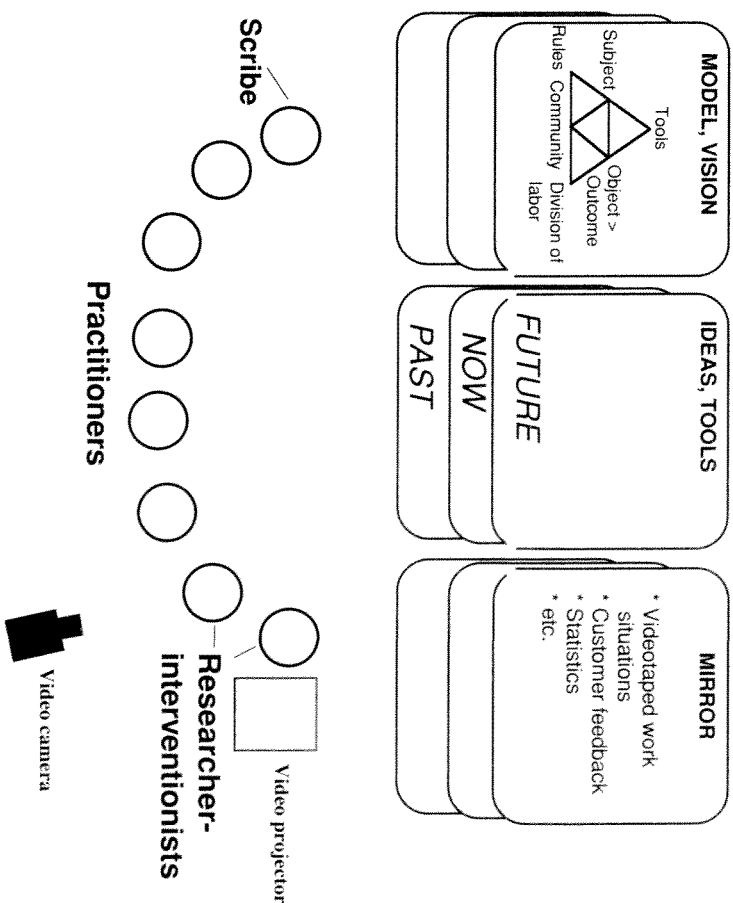


FIGURE 14.1. Prototypical layout of the Change Laboratory.

At the other end, the *model/vision* surface is reserved for theoretical tools and conceptual analysis. The complex triangular model of an activity system (Engeström, 1987, p. 78), displayed schematically in Figure 14.1, is used to analyze the development and interconnections of the work activity under scrutiny. Systemic roots of specific, but recurring problems and disturbances are traced and conceptualized as inner contradictions of the activity system. In addition to the general model of activity system, more specific conceptual models are often used. For instance, in a series of interventions, medical practitioners developed a model for negotiated collaborative care of patients with multiple chronic illnesses in Helsinki. The model itself became the central conceptual tool for further laboratory processes in the field (Engeström, 2001; Engeström, Engeström, & Kerosuo, 2003).

The third surface in the middle is reserved for *ideas and tools*. In analysis of problem situations and in the design of a new model for the work activity, intermediate cognitive tools (Norman, 1993) such as schedules and flowcharts of processes, layout pictures and diagrams of

organizational structures, categorizations of interview responses, formulas for calculating costs, (or techniques for idea generation and problem solving (including simulations and role-playing), are often needed. As the participants move between the experiential mirror and the theoretical model/vision, they also produce intermediate ideas and partial solutions to be experimented with and tested. These, too, are represented on the middle surface.

The vertical dimension of the surfaces represents movement in time, between the past, the present, and the future. Work in the Change Laboratory typically starts with the mirror of present problems. It then moves to trace the roots of current trouble by mirroring experiences from the past and by modeling the past activity system. The work then proceeds to model the current activity and its inner contradictions, which enables the participants to focus their transformation efforts on essential sources of trouble. The next step is the envisioning of the future model of the activity, including its concretization by means of identifying "next-step" partial solutions and tools. Subsequently, the stepwise implementation of the new vision is planned and monitored in the Change Laboratory. Such a cycle of expansive learning induced in the Change Laboratory typically takes ten or twelve weekly sessions and one or two follow-up sessions after a few months. One cycle often leads to the next one, and within the cycles there are smaller cycles of problem solving and learning (see Engeström, 1996a).

The Change Laboratory is based on separation and embeddedness simultaneously. It is located in the workplace as close to the shop floor as possible; yet, it is a room protected by walls. The boundaries between Laboratory and practice are made permeable by encouraging movement across them. Practitioners may use the Laboratory space for reflection outside the scheduled sessions. During the sessions, they may go out of the Laboratory space to check the reality on the shop floor. Representations of work are brought into the laboratory from work and are brought out of the laboratory onto the walls of the actual work space. Such shifting of contexts has been found crucial in solving complex problems, such as those involved in the implementation of new machinery on the shop floor.

A striking feature of the adaptation process was the use of different physical settings for responding to a single problem. In most of the cases studied, engineers needed to investigate the same issue in two different locations (the plant and the lab). They often shifted repeatedly between locations before they could understand and resolve the problem.

(Tyre & von Hippel, 1993, p. 7; see also Engeström, Engeström, & Kärkkäinen, 1995)

What is the similarity between Vygotsky's double stimulation and the Change Laboratory method? In the Change Laboratory method, the original task or "first stimulus" of Vygotskian designs is represented by the *mirror* in which a challenging problem or disturbance is presented by means of experientially powerful examples, often on video. The "first stimulus" needs to be acknowledged and articulated by the participants. This first step is commonly an emotionally charged process in which resistance and denial play an important part.

In Vygotsky's accounts, the "second stimulus" is initially a neutral or ambiguous artifact that is filled with meaning and mediational potential by the acting subject. The notion of "neutral stimulus" is, however, problematic. There are no neutral objects – every artifact has inherent affordances materially and historically inscribed in it. Even an empty sheet of paper is not neutral. It affords or "invites" writing and drawing actions, but it does not afford many other kinds of actions. A closer look at Vygotsky's work reveals that the notion of neutrality is actually not meant to be taken in any absolute sense. Vygotsky repeatedly used the example of experiments related to him by Kurt Lewin:

In experiments involving meaningless situations, Lewin found that the subject searches for some point of support that is external to him and that he defines his own behavior through this external support. In one set of experiments, for example, the experimenter left the subject and did not return, but observed him from a separate room. Generally, the subject waited for 10–20 minutes. Then, not understanding what he should do, he remained in a state of oscillation, confusion and indecisiveness for some time. Nearly all the adults searched for some external point of support. For example, one subject defined his actions in terms of the striking of the clock. Looking at the clock, he thought: "When the hand moves to the vertical position, I will leave." The subject transformed the situation in this way, establishing that he would wait until 2:30 and then leave. When the time came, the action occurred automatically. By changing the psychological field, the subject created a new situation for himself in this field. He transformed the meaningless situation into one that had a clear meaning. (Vygotsky, 1987, p. 356)

In this case, the "first stimulus" was the problematic task of having to wait without any certainty of a return of the experimenter. To resolve the dilemma, the subject constructed a mediating "second stimulus," namely, the clock as a meaningful sign that would allow the subject to leave. Now the clock was neutral in the sense that it did not initially represent a specific point of time or alerting signal that would relieve the subject. But it did have a culturally pervasive meaningful structure – a display of the progress of hours and minutes. This *general* meaningful

structure had to be transformed into a *specific* meaningful sign for the subject and the situation. In other words, what can be used as "second stimulus" is not arbitrary. Instead of using absolute neutrality, it may be more useful to characterize the potential *second stimulus* as something that has culturally appropriate general affordances but also sufficient ambiguity and malleability so that the subject will have to transform it into a situationally effective mediating device by "filling" it with specific contents.

In the Change Laboratory, the initial mediating "second stimulus" is typically a general conceptual model, commonly, but not exclusively, the triangular representation of an activity system (Engeström, 1987, p. 178; see also Figures 14.3 and 14.4). Such a model has a potentially meaningful general structure. However, to invest it with personal sense, it must be explicitly filled by the participants with specific contents that correspond to their assessments of the situation. The activity system model is used to make sense of the built-in contradictions that give rise to the troubles and disturbances depicted in the mirror. This model is also used as a vehicle of time travel, in the construction of a *vision* of the past and the future of the activity system.

In Vygotsky's theory, double stimulation engenders processes that lead to novel solutions, actions, concepts and skills. In the Lewinian experiment on "meaningless situations" described above, the subject literally broke away from an unacceptably dilemmatic, closed situation. Similarly, in Arsen'ev's account from the Udeg village, the villagers' action was an attempt at breaking away from an intolerable, closed framework of exploitation (for the developmental importance of breaking away, see Engeström, 1996b). These examples demonstrate that the formation of new solutions, concepts, and skills in double stimulation is much more than just a cognitive learning achievement. It is a liberating achievement of agency formation, which gives expansive personal and collective meaning to the associated cognitive and cultural learning contents.

In the Change Laboratory, the emerging new solutions and tools are represented on the surface in the middle surface. Breaking away from a dilemmatic and contradictory work situation requires construction of expanded objects, tools, communities, rules, and divisions of labor. In the Change Laboratory, the construction of such new solutions begins by means of articulating, naming, and modeling. These processes may be characterized as *objectification* (Moscovici, 1984) and *stabilization* (Smith, 1998). Breaking away requires stabilization to succeed.

In the Change Laboratory, movement happens in three dimensions. First, the gaze, the intellectual work, and the practical representational

work (writing, drawing, etc.) of the participants move horizontally *between the representational surfaces* of the mirror and the model, stopping occasionally in the middle to try and construct new solutions. Second, these processes move *between three layers of time*. And third, the discourse moves *between the participants and their various voices and social languages*, including, minimally, a work team or unit plus one or more researchers/interventionists, and optimally, also representatives of management and clients.

CHANGE LABORATORY IN FINNISH POST OFFICES

The Change Laboratory was first implemented in five pilot post offices of the Finnish Postal Service from February to August, 1996. The project, named *Delivery 2000*, was aimed at redesigning the delivery work of mail carriers. The project was set up and monitored by a tripartite steering group consisting of representatives of management, trade unions, and researcher-interventionists (for a more comprehensive analysis of the project, see Pihlaja, 2005).

The cultural tradition of mail carriers has been a combination of bureaucracy and individualism. The traditional hierarchical organization of the Postal Service has largely precluded innovations from below. Work processes have been meticulously rationalized and measured from above by procedures confirmed through collective bargaining. Individualism, in turn, stems from the fact that individual mail carriers have been free to go as soon as they have finished their individually assigned routes for the day. There has been little incentive for collaborative teamwork.

However, when we started our project, the Finnish Postal Service faced increasing competition from private companies entering the field. There was an urgent need to raise productivity and a looming threat of severe loss of jobs.

All the mail carriers of the five pilot post offices met mostly once a week for four months in their Change Laboratories (called *Room 2000* by the practitioners). Each session was structured around concrete tasks requiring the use of the Change Laboratory surfaces. Figure 14.2 depicts a session in one of them, the post office named Turku 52.

The room in Figure 14.2 was the regular coffee room of the workers, a few feet from the shop floor where the mail was sorted. In the post offices, the available material equipment was minimal: three flip chart stands, felt pens, and a VCR with a TV monitor attached. All the meetings in the five pilot offices were videotaped, as were samples of key work processes (sorting of mail, actual delivery) in each pilot unit at the beginning and at the end of the process. A number of interviews were

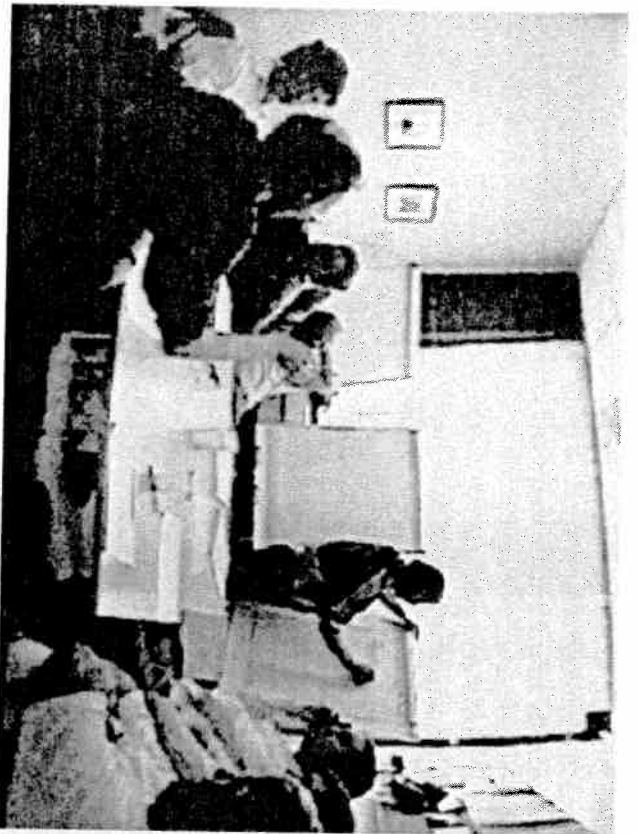


FIGURE 14.2. A Change Laboratory session in the post office Turku 52 (the researcher-interventionist sitting third from the left).

made with the workers in each site during the process. The workers also interviewed a number of their clients.

There were three main phases in the process. In the first phase, the workers analyzed the history and the present contradictions of their work activity. Figure 14.3 presents a summary of the results of this phase in the triangular model form used by the workers.

Question marks in the components of the triangle indicate possible contradictions. It was characteristic to the pilot post offices that they characterized their contradictions only in tentative and dilemmatic terms, typically in the form of questions concerning each component on its own rather than as aggravated tensions between components of the activity. After the first phase, the pilots met in a one-day conference where they reported and discussed their intermediate findings. Excerpts from their presentations illuminate the nature of the contradictions.

We've had lots of good ideas, and we've been thinking that we could do work which is something else than just delivering. We could for example handle some social services, we have quite a lot of old people in our area. But who would train us for that and in what time? And how does it impact the finances, the results, would it bring any revenue?

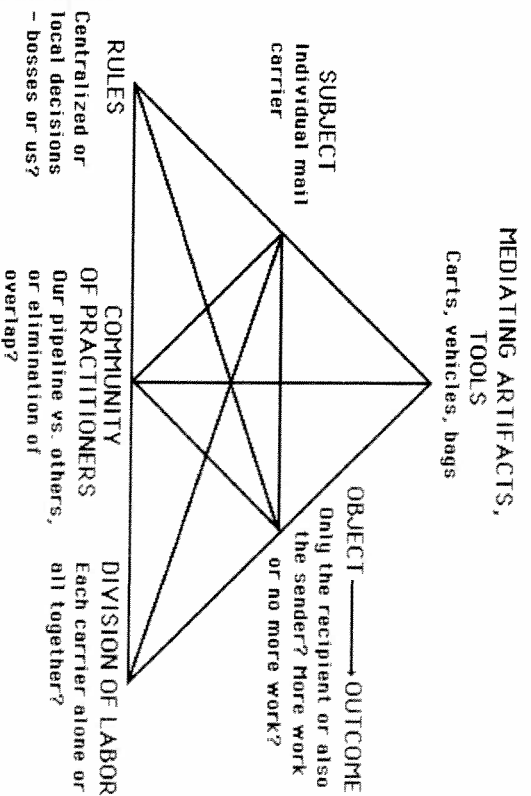


FIGURE 14.3. Summary of the current contradictions of delivery work identified by the mail carriers.

We also had this heated discussion, whether we should expand our object or not.

So it's the old way of thinking, a bureaucrat's way: I'm sitting here and I won't do anything else. I'll go home after I'm done and I don't give a damn about what the others are doing.

Right now it seems that it's becoming a problem, which is in a way also a good thing, namely the increase of advertisement mail.

This internal flexibility, it would mean that the work measurement would be adjustable within our own office. So that when the amounts of mail fluctuate, the real shirty day wouldn't fall on one guy alone, while the others just giggle about it....

There are these so called pipelines [referring to special delivery services and other separate branches of the Postal Services], we do a terrible amount of overlapping work. So for example the special deliveries comes from five kilometers to fetch from us a packet which goes to the house next to us, and takes it there. So that really doesn't make any sense.

The tentative and uncertain tone in the characterization of the contradictions in the Change Laboratories reflected the fact that the Postal Service had had a total monopoly in their field for a long time. There were lots of historically built-in buffers that slowed down and softened the impact of the contradictions experienced in daily work practice.

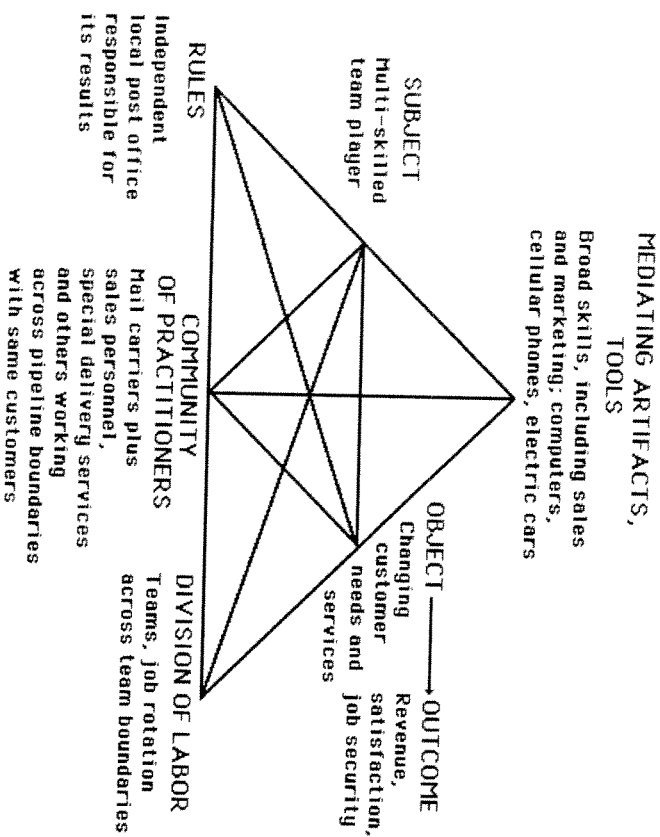


FIGURE 14.4. Summary of the model for delivery work in the year 2000 designed by the workers.

In the second phase of the process, the pilots designed visions for delivery work as it should be organized in the year 2000. The results of this phase are summarized in Figure 14.4.

Figure 14.4 is obviously an idealistic vision. However, the core idea of independent post offices responsible for their own results became a sound guiding principle for the transformation envisioned. While crafting the vision, each pilot also designed a set of first-step solutions and tools to be implemented as local experiments within the next months. These local experiments had different emphases in the different pilots. Three of the five designed experiments aimed both at introducing teams and also at creating new products and services. Two of the five experiments concentrated on new products and services only.

In the third phase of the process, the experimental solutions were implemented and their impact on revenues, performance, customer satisfaction, and workers' well-being was monitored. Two examples of the new products and services, both pioneered by the Turku 52 pilot office, may be mentioned.

Example 1: The Turku 52 pilot group decided to start selling stamps to the customers at their door, thus saving them the trip to the post

office. This had not been the practice in Finnish Postal Service. To put the idea into practice, a pilot group needed to design a brochure advertising the new service to the customers, and an order form for stamps. The pilot group also needed to design and order belt bags for carrying money. They needed to make sure the mail bags were appropriate for carrying stamps. For this concrete solution, the post office had to become a virtual design office for a while. A new set of instruments were created—a step was taken toward a qualitatively new type of instrumentality which involves direct business discussions between the mail carrier and the customers.

Example 2: In the pilot office of Turku 52, the mail carriers designed an entirely new "safety service" for old people living alone in their apartments. The mail carrier would not only drop the mail, he or she would also ring the doorbell and check that everything is all right with the elderly customer. There was rapidly growing need for this type of service due to demographic change in the country. The social services department of the City of Turku quickly endorsed the idea, seeing potential savings in it. The new service was experimentally implemented in the area for which the pilot office was responsible. The experiment attracted nationwide attention in mass media.

These two examples clarify the difference between the process elicited by the Change Laboratory and management consulting approaches such as business process reengineering (BPR). The famous launching slogan of BPR was "Don't automate, obliterate!" (Hammer, 1990), implying that the idea is to radically wipe out unnecessary and wasteful processes. An appropriate slogan for the *Delivery 2000* project would have been: "Don't obliterate, expand!" This implies that new products and new business (e.g., selling stamps, delivering safety services) are built, taking advantage of the existing basic work processes (delivering mail). Such an expansive approach is possible only when instead of mapping and rationalizing the existing processes, one starts by questioning historically the *object of work*: What are we producing and why? (Engeström, Puonti, & Seppänen, 2003).

In each phase of the Change Laboratory process, there was back-and-forth movement between the problems or the first stimuli presented on the *mirror surface* and the conceptual models or the second stimuli worked out on the *model/vision surface* (see Figure 14.1). When a vision for the future organization of work was constructed, the participants were asked to identify practical problems and difficulties that the new model would generate. These were worked out in more detail when the practitioners actually implemented and tested their solutions in practice.

CONCLUSION: LESSONS FOR VYGOTSKIAN STUDIES

In the ten years that have passed after the first Change Laboratory project within the Postal Services, we have conducted dozens of Change Laboratory method intervention studies in various organizations. Variations of the basic Change Laboratory method have been developed, such as *Boundary Crossing Laboratories* between multiple collaborating organizations (e.g., Engeström, Engeström, & Kerosuo, 2003) and *Competence Laboratories* for proactive identification and formation of new competencies on the shopfloor (e.g., Virkkunen & Ahonen, 2004). These studies have generated a very rich database, which, as analyses progress, will yield new insights into the potentials and challenges of expanding Vygotsky's idea of double stimulation to interventionist studies of transformations in work (for some of the analyses, see Engeström, Lompscher, & Rückriem, 2005). At this point, I will take up three such challenges.

The first challenge has to do with the nature of mediation by tools and signs. Previous Vygotskian theorizing and research has mainly focused on a single individual or on two subjects using a single, well-defined mediating tool or artifact. Language as mediator demands a more complex approach – but studies of semiotic mediation have commonly excluded material instruments and tools. In the Change Laboratory, the mediational setup is complex and multilayered both semiotically and instrumentally. Yet the Change Laboratory is temporally and spatially constrained so as to allow the collection of comprehensive fine-grained data by means of videotaping. Analysis of such data forces the researcher to adopt a new view of mediation: instead of using single instruments, tools, or language, one has to analyze a whole interconnected *instrumentality*.

The concept of instrumentality has three implications: (1) The instruments form a system that includes multiple cognitive artifacts and semiotic means used for analysis and design, and straightforward primary tools used in the daily work are brought into the Laboratory for examination, reshaping, and experimentation. (2) In such a dense mediational setting, a set of interconnected new sociocognitive processes are called for and a new mentality is generated. (3) The complexity of the setup means that the instrumentality is constantly evolving; old tools are modified, and new tools are created.

The second challenge stems from the centrality of agency in Vygotsky's theory of double stimulation. If human agency is the central focus, then we need to rethink our standard notions of causality. What kind of interpretive lenses do we need for that? Eskola (1999, p. 111) suggests

Interpretive Layer	In activity the actor	Takes into account, according to this or that logic, that	If x, then y Law, rule
Contradictory Layer	As participant in collective activities	Is driven by contradictory motives	Searching resolution by often unpredictable actions

FIGURE 14.5. Two layers of causality in human action.

of the activity in which the actors are involved, and its meaning to the different actors; (2) the laws and rules that actors take into account in this activity; and (3) the logics used to take part in the activity. Eskola's realistic paradigm focuses on the fact that humans do not merely react as physical objects, they act based on their activities, interpretations, and logics. For the sake of simplicity, I call this the *interpretive layer* of causality.

But there is more to causality in human contexts. Human beings interpret, and they also face contradictions between multiple motives embedded in and engendered by their historically evolving communities and objects. This is the layer that makes humans look irrational and unpredictable (see Engeström, 1989). This adds another layer to human causality. I call it the *contradictory layer* (Figure 14.5).

What is still missing in Figure 14.5 is the human potential for agency, for intentional collective and individual actions aimed at transforming the activity. Thus, I complete the picture by adding an *agentive layer* (Figure 14.6).

Interpretive Layer	In activity the actor	Takes into account, according to this or that logic, that	If x, then y Law, rule
Contradictory Layer	As participant in collective activities	Is driven by contradictory motives	Searching resolution by often unpredictable actions
Agentive Layer	As potential individual and collective agent	Takes intentional transformative actions	Inventing and using artifacts to control the action from the outside

Vygotsky's description of the Lewinian experiment beautifully captures all the three layers of Figure 14.6 in a simplified form. Initially, the subject interpreted the situation as an experiment in which one must follow the rules of the experimenter. When nothing happened, a contradiction emerged between those expected rules and one's quest for meaning; there was a period of confusion, which could lead to unpredictable and "irrational" actions. However, by using an external cultural artifact such as the clock, the subject was able to transform the situation and take agentive action. Notice that agentive action in its rudimentary forms may look like nonaction, or mere resistance – such as leaving the room in the experiment. It is, however, a radically different action from that of, say, passive waiting or "irrational" noisemaking. Translated into the context of collective work activity and the Change Laboratory, the same steps might look like this. Initially, practitioners interpret their work situation as an iron cage where they must do what they are told. As systemic contradictions accumulate in the work activity, repeated dilemmatic problem situations and "impossible tasks" emerge, confusion, stress, and resistance grow, and unpredictable "irrational" actions are likely. By means of external cultural artifacts such as the Change Laboratory instrumentality, a collective effort may be taken to transform the situation by agentive actions. In the Change Laboratory, disturbances and dilemmatic situations, including practitioners' own "irrational" actions engendered by these situations, are reproduced, observed, and reexperienced as "first stimuli." Conceptual models are employed, as "second stimuli" to facilitate specific agentive actions of analysis, design, and implementation.

The third challenge is also related to agency. We have extensive experience of generating agentive actions among competent adult practitioners in various workplaces. But can Change Laboratories be useful with children or with underprivileged, marginalized and silenced groups of people? Or will the method turn into a form of paternalistic manipulation if used with such subjects? It seems clear that to take such subjects as equal interlocutors in interventions, the researchers need to learn new ways to listen to and amplify the voices of the subjects (Porter et al. 2005). For example, in the Culture Laboratory, a variation of the Change Laboratory designed for immigrant students, we found that the students' interests were very often expressed in fragmentary and weakly articulated suggestions, which were easily overlooked if the interventionists did not nurture and support the expansion of such suggestions (Teräs, in press).

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INTRODUCTION

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