“Trying to predict the future”: Third-generation activity theory’s codesign orientation

Abstract

In the 1980s, Yrjö Engeström took up Leontiev’s activity theory, extending and modifying it extensively to apply it to learning in organizations. Whereas the work of Vygotsky and Leontiev represented a cultural psychology, this “third-generation” activity theory (3GAT) was arguably closer to an organizational sociology. This organizational sociology is specifically oriented to interventionist research: i.e., the consensus-driven codesign of systems of collective action. This underdiscussed orientation explains 3GAT's descriptive organizational modeling and triangle heuristic. Understanding this orientation is crucial for understanding how 2GAT was translated into 3GAT, as well as how a 4GAT might emerge in turn.

Keywords

Cultural-historical activity theory, 3GAT, 4GAT, participatory design, interventionist research, codesign

"Trying to predict the future": Third-generation activity theory's codesign orientation

Activity theory is a term applied to a collection of sometimes discohesive sociocultural understandings of human psychological development. Rooted in Vygotsky's sociocultural understanding of cognition, it was named and developed by Vygotsky's colleague Leontiev[1], then taken up by a number of Leontiev's students and colleagues. Eventually it was also taken up outside the Soviet Union in several variations.

Perhaps the most influential uptake has been by Yrjö Engeström, who extended and modified activity theory extensively to apply it to learning in organizations. Engeström has characterized activity theory as developing in three generations: the first generation was Vygotsky's foundational work, the second generation was based on Leontiev's contributions, and the third generation involved the Western extension of activity theory into organizations (Engeström 1996). The result is often called "third-generation" activity theory (3GAT) or cultural-historical activity theory (CHAT).

Yet in its uptake, 3GAT has changed considerably. In his 2009 article "Reflections on Activity Theory," David Bakhurst charges that 3GAT has strayed from "a fundamental explanatory strategy" to "a method for modelling activity systems with a view to facilitating not just understanding, but practice. Activity theory in [this] sense is, among other things, a way of modelling organizational change" (p.205). And "What we have is a model or a schema that has minimal predictive power" (p.206). That is, 3GAT is *descriptive and diagnostic* rather than

[1] For consistency, I use "Leontiev" in the text, although the name is sometimes transliterated differently in different sources.

predictive. That's in sharp contrast with 1GAT and 2GAT, which treated "the concept of activity as a fundamental explanatory category that is the key to understanding the nature and possibility of mind" (p.205).

Others have made similar criticisms of 3GAT's divergence from 1GAT and 2GAT, claiming that Engeström's version of activity theory breaks theoretically and methodologically from its progenitors and that Engeström has appropriated parts from theoretically divergent areas (e.g., Avis, 2009; Martin & Peim, 2009; Miller, 2011; Peim, 2009; Witte, 2005). As Bakhurst suggests, these criticisms generally center around the 3GAT shift from a focus on individuals-in-society toward organizations. Whereas 1GAT and 2GAT both represented a cultural psychology, 3GAT has more or less become an organizational sociology (Spinuzzi 2018).

But—as the title of this paper suggests—the organizational sociology of 3GAT is specifically oriented to interventionist research: i.e., the consensus-driven codesign of systems of collective action (cf. Sannino 2011). I believe that this underdiscussed orientation explains the descriptive organizational modeling that Bakhurst notes, as well as other features of 3GAT. Understanding this orientation, I argue, is crucial for understanding how 3GAT developed.

By *codesign*, I do not mean the stepwise, linear design experiments that Engeström has recently contrasted with formative interventions (Engeström 2011). Rather, I mean the interventionist research approach in which researchers and participants deliberate about current, unsatisfactory conditions, then collaborate to develop intentional solutions that address those conditions by transforming the activity. This codesign work, as we will see, encompasses the mediators of the activity system: the tools, rules, and division of labor. In intentionally redesigning such mediators, the participants and researchers iterate the activity, collectively identifying and addressing (though not necessarily eliminating) the contradictions,

discoordinations, and breakdowns that participants encounter in it. This approach contrasts with 1GAT and 2GAT, which were deployed in settings such as education and rehabilitation institutes. In these earlier approaches, the primary focus was transforming the actors themselves (their education, development, and rehabilitation), a process that secondarily involves transforming institutions and society. But in 3GAT, the primary focus is on transforming institutions themselves (via codesigning their mediators), a process that may secondarily involve transforming the actors.

In the rest of this paper, I discuss (1) how 3GAT acquired this codesign orientation, largely in its positioning as an alternative to the then-dominant information-processing cognitive psychology; (2) how this codesign orientation affected the uptake of 3GAT in the West, and (3) what implications this orientation has for development toward a 4GAT.

How 3GAT acquired its codesign orientation

As Engeström (1992) notes, Westerners such as Cole, Wertsch, and Bødker became interested in second-generation activity theory as a way to tackle sociocultural issues. Most salient to this paper's argument is how two particular individuals applied activity theory to interventionist research. These two strands rapidly merged into the version of activity theory most often seen in studies of human-computer interaction (HCI) and expertise: 3GAT.

In studies of *HCI*, Bødker (1987) took up activity theory as a framework for underpinning her work in participatory design (see Bødker 2009 for a retrospective; see Spinuzzi 2002, 2005a for a history). In this approach, computer scientists and workers collaborated in developing new computer systems to better support the workers' labor (e.g., Bødker et al. 1987). This strand was taken up broadly among qualitative researchers in HCI (e.g., Nardi 1996).

Meanwhile, Engeström (1987/2014[2], 1992, 1996) took up activity theory as a way to study *expertise*, yielding the Developmental Work Research (DWR) approach and the interventionist research processes called Change Laboratory (Engeström 1999) and Boundary Crossing Laboratory (Engeström 2001). In this approach, workers and management collaborated in developing new mediators (rules, tools, divisions of labor) to better support work.

These two strands of activity theory were later synthesized (e.g., Nardi, 1996; Kaptelinin & Nardi, 2006). To understand the depth of this shift from 2GAT to 3GAT, let's briefly review the historical development of activity theory.

Three generations of activity theory

Engeström (1996) characterizes activity theory as developing in three "generations." In the first generation (1GAT), Soviet psychologist Lev Vygotsky developed the idea of mediation (Vygotsky 1978; cf. Engeström 1996, p.132), in which an individual could control her own actions using physical or psychological tools. In 1GAT, "the unit of analysis remained individually focused. This was overcome by [2GAT, in which] Leont'ev explicated the crucial difference between an individual action and a collective activity" (Engeström 1996, p.132). In 2GAT, Leontiev shifted his unit of analysis from Vygotsky's *word meaning* (and, more broadly, semiotic tools that mediate joint activity; cf. Blunden 2010) to *object-oriented labor activity* (Leontiev 2005; van der Veer and Valsiner 1991). In 3GAT, Engeström says, "questions of diversity and dialogue between different traditions or perspectives became increasingly serious challenges," and thus "The third generation of activity theory needs to develop conceptual tools in order to understand dialogue, multiple perspectives, and networks of interacting activity

[2] Engeström's *Learning by Expanding* appeared in 1987. Here and throughout, I cite his second edition (2014), whose argument is identical to the 1987 edition.

systems." For 3GAT, "the basic model is expanded to include minimally two interacting activity systems" (Engeström 1996, pp.132-133).

Although these three generations are sometimes portrayed as linear expansions, they can be better understood as *qualitative transformations* (to use Engeström's language) or perhaps as *translations* (to use Latour's; see Latour, 1999). That is, as the theory was taken up and deployed under different conditions, it was also transformed to address those conditions. In these translations, the unit of analysis changes (from 1GAT's mediated action to 2GAT's activity system to 3GAT's activity networks) to address different cases (Engeström 2009). That is, each generation does not advance or supplant the previous one, but instead is a variation meant to address different problems in different fields. Table 1 briefly overviews some of these translations as Vygotsky's theory was taken up by Leontiev and then by Engeström, Bødker, and others in the West.

For the present argument, three aspects of the translation to 3GAT are key. First, the research focus shifts from *basic* psychological research (or as Bakhurst says, "a fundamental explanatory strategy") to *applied, practical* research in organizations (or as Bakhurst says, "a method for modelling activity systems with a view to facilitating not just understanding, but practice"; 2009, p.205). Second and related, the empirical focus shifts from individuals-in-society to groups and organizations (see Kaptelinin & Nardi 2006). Third, the location of development or change shifts from the individual's capabilities to the organization's.

[Table 1 near here]

These translations were necessary, not just for application, but for redressing problems with the leading psychological theory in the US, a theory that had similarly attempted to make

the transition from basic research to applied, practical research: Information-processing cognitive psychology (IPCP).

IPCP

IPCP developed from the experimental tradition and posits that cognitive development is best understood in terms of processing information about the environment (as opposed to reacting to stimuli). In this tradition, the brain is metaphorically understood as a computer that processes information from the environment. As the then-dominant psychological theory in the US, and as a theory often understood via the metaphor of mind-as-computer metaphor, IPCP seemed like a natural fit for application in realms such as artificial intelligence, human-computer interaction (HCI), and expertise. Yet some researchers who applied IPCP became discontented with its performance in these realms. As John M. Carroll argued in a retrospective, IPCP had been tested in HCI via application—and found wanting:

> The psychology of the 1970s had focused on arenas of skill and experience involving little domain-specific knowledge. Such domains were particularly amenable to information processing description by small production systems. But these theories lacked the scope and richness required for application in HCI. For example, they had little capability for modeling error or error recovery, no serious notion of cognitive development or of expertise, and they modeled human goals as unanalyzed primitives drawn from a checklist. (1991, p.5)

Consequently, Carroll said, these theories could not be applied predictively, and "could only be applied to modeling fairly limited phenomena" (1991, p.5). Nevertheless, these efforts continued into the 1980s, as "many cognitive psychologists began entering the HCI field, who

sought to apply psychological theory (and not merely the scientific method)" (p.5). But by the mid-1980s, the limitations of IPCP in such applications had become obvious in a variety of applications. Here, I review just two—HCI and studies of expertise—and note how these limitations drove applied researchers to take up activity theory.

HCI

Challenges to IPCP

By the mid-1980s, researchers in HCI had begun to level sharp critiques of IPCP's ability to adequately underpin applied research. In 1986, philosopher Hubert Dreyfus and his brother, RAND researcher and programmer Stuart Dreyfus, published *Mind Over Machine*, in which they critiqued artificial intelligence research for its IPCP-based focus on "knowing-that" rather than "knowing-how"—that is, for attempting to formally and explicitly model knowledge in machines rather than recognizing that human expertise is often tacit and contextual. The same year, Terry Winograd and Fernando Flores (1986) critiqued IPCP's overly rationalist, structuralist, and formalist understanding of cognition, drawing on the hermeneutics of Heidegger and the biological research of Maturana and Varela to argue that IPCP presented an inadequate approach to artificial intelligence. (Winograd, an AI researcher, was influenced by his conversations with Dreyfus.)

The next year, Lucy Suchman published *Plans and Situated Actions* (1987), a dissertation-turned-book that changed HCI by demonstrating that the then-dominant IPCP view, in which an abstract mind engaged in cognition-as-computation, could not adequately account for how people engaged with machines. When working with machines, humans did not use *plans* (in the sense of stepwise series of abstract actions) so much as *situated actions* (in the sense of

local, sensed alternatives at each moment). In her ethnomethodological studies at Xerox PARC, Suchman demonstrated that photocopiers' help systems were built for plans, but their users worked through situated actions, resulting in mismatches and rendering the help systems unhelpful.

Other socially oriented approaches followed in the US, such as Shoshanna Zuboff's 1988 book *In the Age of the Smart Machine*, an ethnographic study of the computerization of work.

Participatory design

Importantly, a parallel strand of HCI research had been developing in Scandinavia and Denmark throughout the 1970s and 1980s: participatory design. In this approach, technical specialists and unions cooperatively explored how "the use of new information technology could affect [union members'] working conditions and how its introduction can affect their interests" as well as to "encourage unions to develop and implement their own technology control activities and policies" (Clement & Van den Besselar, 1993, p.30). Participatory design was explicitly approached as political, as a way to empower union members to codesign information systems that worked with their own tacit knowledge. Like ethnomethodological and ethnographic studies, participatory design studies recognized the social nature of computing work and the tacit expertise of the workers; unlike those other studies, participatory design involved those workers as codesigners—codesigners who sought to "influence technological and organizational changes in the workplace" (Clement & Van den Besselar, 1993, p.30).

Many participatory design projects were undertaken during the 1970s and 1980s, but the best known was Denmark's UTOPIA project, begun in 1981 (Ehn et al., 1983; Bødker et al., 1987; see Spinuzzi, 2005a for an overview). In this project, computer scientists and a typesetting union attempted to give the typesetters some control over the design of new computer technology

being developed for their workplace, a newspaper. This workplace was framed by the Marxist academics as a site for the struggle between capital and labor, a struggle over who could define and control work. Backed by the workers' union, the academics sought to provide a proactive way for workers to help develop systems that supported industrial democracy in their workplace. To achieve this aim, the computer scientists had to understand the work, and workers had to understand the possibilities of technology—something that required "language games," or collaborative design techniques such as mockups, prototypes, organizational games and toolkits, and future workshops (Spinuzzi, 2005b). This work resulted in several publications (e.g., Ehn et al., 1983; Bjerknes et al., 1987; Ehn, 1989; Greenbaum & Kyng, 1991) and its collaborative design techniques were taken up by many other approaches (Spinuzzi 2005a).

The UTOPIA project was also the main vector by which activity theory came to Western HCI.

Activity theory comes to participatory design: Bødker's Through the Interface

In her search for a Marxist framework to underpin this participatory design work, Susanne Bødker—a graduate student in computer science who was working on the UTOPIA project—picked up and applied Leontiev's activity theory to the problem of designing interfaces. The resulting dissertation, *Through the Interface* (1987), was published in slightly altered form as an influential book (1991).

In the dissertation, Bødker cited Winograd and Flores (1986) and Dreyfus and Dreyfus (1986) to support the argument that HCI's basis in cognitive science was inadequate for understanding design: "Some of the promoters of this tradition have come to the conclusion that the tradition is at present at a point, where a shift is needed from a quantitative analysis approach to a qualitative design approach: *design is where the action is in the user interface*" (1987, p.2,

her emphasis). She argued that "*Design is a process of learning*" (p.45, her emphasis), and to better understand it, she sought a theory of human sociocognitive development: Leontiev's activity theory.

Bødker's empirical cases, theorized using 2GAT as a starting point, are interesting from a designer's point of view: inventive, often low-tech, driven to encourage participation. For instance, she discusses mockups developed with paper and colored slides, which were designed both to educate her users about computer interfaces (most had never seen one) and to encourage their full participation (they could modify the paper mockups easily).

Bødker developed three aspects of activity theory to adapt it to design work—aspects that became crucial in 3GAT.

First, Bødker adopted Leontiev's *levels of activity*[3] to characterize collective activities, goal-directed actions, and unconscious operations (Bødker, 1987, p.28). The goal was emphatically *not* to develop individual workers to conform to a new regime; rather, representative participants contributed their considerable expertise to the design of new software tools, tools that could fit into the participants' existing workflows, conceptual schemes, and expertise (that is, their social relations), supporting the population and allowing them to accomplish their work more effectively. Specifically, goal-directed actions and unconscious operations were well-positioned to describe Bødker's close studies of how people interacted with design artifacts, and articulating these levels also allowed her to identify and track disruptions in users' operations. The level of activity provided her with a more fine-grained language for describing how actions and operations integrated to pursue larger objectives. Levels of activity became crucial in later HCI research as well as research in related areas (e.g., Bødker &

[3] The levels of activity had previously been mentioned by cultural psychologists working in the Vygotskian tradition, such as Lave et al. (1984) and Wertsch (1985), but Bødker made them central to her empirical analysis.

Andersen 2005; Gonzalez et al. 2009; Kaptelinin & Nardi 2006, 2012; Kuutti 1996; Spinuzzi 2003).

Second, she took up Leontiev's notion of *crystallization*, in which mediators were seen as material instantiations of cognitive operations, a cultural inheritance that could instantiate best practices (Leontyev 2009, p.102). But in Bødker's implementation, mediators were not simply evolved and inherited—they themselves became the objects of design activity, consciously and collectively designed to solve problems in an ongoing activity. This new relationship to mediators meant that the role of human actors changed as well: Rather than mastering a defined object through defined mediators, human actors developed and crystalized expertise as they directed their activity toward an emergent object. Whereas Vygotsky and Leontiev emphasized transforming *individuals*, Bødker emphasized transforming *mediators* through dialogic negotiation by collective subjects to produce new collective designs and interventions, consequently reforming adjacent activities.

Third, without using the term[4], Bødker described *activity networks*: i.e., constellations of interconnected, not necessarily hierarchically related activities in which one activity's object could function as another activity's mediator. The concept was necessary for analyzing design within interconnected systems of expertise. Consider a writer, who labors to produce her *object* (a script). The script is then given to a television announcer, who uses the script as a *tool* in a second activity (Bødker, 1987, p.40). This concept of activity networks was critical for describing workplace development in activity theoretical terms for HCI, since HCI by definition involved applying computer expertise to domains that had not yet been computerized—that is, it involved making contact between two or more heretofore separate activities.

[4] As we'll see, Engeström coined the term "activity network" and theorized the concept that same year (Engeström, 1987/2014).

These three innovations responded to the challenge of adapting activity theory to the challenge of design. In so doing, they also responded to the limitations of IPCP.

Bannon & Bødker (1991) elaborate further on why this approach was needed. They had both become concerned about the gap between cognitive science methods and "concrete design in real-life situations" (p.227). In cognitive science, "the study of human thinking and problem solving is commonly regarded as being concerned with representations in the head and the processes that run over them" (p.228) and human and artificial processes are understood as essentially similar (p.229). "The importance of actual practice is not recognized, the individual is still set up against the social, much cognition is still regarded as 'in the head,' and the laboratory is still seen as the appropriate place to learn about how people understand and act in the world" (p.230). Such studies "tend to analyze individuals without reference to their community, or their history, performing on a task designed by the experimenter, not the subject, who is then expected to perform in certain ways" (p.230). Dryly, they suggest that "To the extent that mainstream theory does not give an adequate account of how people think and act in the everyday world, basing the design of artifacts on such limited research studies may not be the most fruitful approach to adopt" (p.231). In Bødker's activity theory approach, "Design of artifacts in this framework can be viewed as a process in which we determine and create the conditions that turn an object into an artifact of use. The future use situation is the origin for design, and we design with this in mind. Use, as a process of learning, is a prerequisite to design" (pp.245-246). That is, "Design is a process of learning, when viewed both as a collective process and as an individual process for the participants." They conclude that "*Design is trying to predict the future, without ever being able to fully predict it*." (p.246, my emphasis) and that it entails "new conditions for

collective activity (e.g., a new division of labor), and new ways of coordination, control, and communication." (p.247).

In this extended critique, the authors approvingly cite Jean Lave's 1988 book *Cognition in Practice* as a critique of IPCP. Lave's work did not directly relate to HCI, but it had a relevant focus: expertise.

Expertise

Challenges to IPCP

The nature of human expertise, as Dreyfus & Dreyfus (1986) argued, was inadequately served by models built on explicit, codified knowledge—models assumed by IPCP. IPCP, as the name suggests, emphasized *information processing* rather than *meaning construction* and used the computer as a metaphor for the mind (see Bruner, 1990, p.4). This metaphor, Dreyfus & Dreyfus charged, led early AI researchers such as Simon and Newell to emphasize explicit rules and rational comparisons rather than tacit knowledge and intuition (in the sense of translating experience into action; see Klein, 2003). Yet, Dreyfus & Dreyfus argued, explicit rules and rational comparisons were hallmarks of *novices* rather than experts. Rather, they argued, the more expert a person is, the less the person tends to use explicit knowledge: experts tend not to be rational so much as "arational," taking actions rather than making decisions (p.36). (This line of thinking was reflected in later studies of naturalistic decision-making; see Klein et al., 1993; Zsambok & Klein, 2009). Like Dreyfus and Dreyfus, other researchers in the 1980s began to realize that it was simply not possible to make all knowledge explicit (e.g., Carroll, 1990).

Critiques of IPCP-based understandings of expertise thus began to mount in the 1970s and 1980s. One strand of critique came from the direction of cultural psychology, specifically scholars working in the Vygotskian tradition.

Vygotsky's work was available in a limited sense to US psychologists beginning in 1962, when *Thought and Language* was published in English in abbreviated form. But it became much more popular with 1978's *Mind in Society*, a collection of Vygotsky writings sometimes described as a "greatest hits" collection (e.g., Smagorinsky 2018, p.71). Two editors of this collection—Michael Cole[5] and Sylvia Scribner—used Vygotskian theory as a basis for their approach to cultural psychology (Cole & Scribner, 1974), studies of literacy (Scribner & Cole, 1981), and studies of expertise at work (Scribner, 1984). Others such as Barbara Rogoff and Jean Lave studied situated cognition, editing an influential collection (Rogoff & Lave, 1984) with the rationale that "our ability to control and orchestrate cognitive skills is not an abstract context-free competence … but consists rather of cognitive activity tied specifically to context" (Rogoff, 1984, p.3). Situated cognition-based studies in this collection (e.g., Lave et al., 1984; Scribner, 1984) and elsewhere (e.g., Lave, 1988) provided an alternate account of expertise through the 1980s.

These studies and others were cited by Yrjö Engeström in his early work on activity theory, specifically *Learning by Expanding* (1987/2014) and *Interactive Expertise* (1992).

[5] Later, Cole began drawing on Engeström's work and Developmental Work Research. See, e.g., Cole & Engeström 1993; Cole 1995, 1999.

Activity theory comes to expertise: Engeström's Learning by Expanding *and* Interactive Expertise

Whereas Bødker applied activity theory to HCI, Engeström applied it to adult workplace learning in Finland, and specifically to designing organizational innovations to leverage and improve expertise.

Engeström found IPCP to be too confining and decontextualized to serve as a basis for understanding expertise. Inspired by Sylvia Scribner's work with adult learning, he undertook his first activity theory-based study in 1982, examining how janitorial work "requires complex thinking, problem solving, and learning" (Engeström & Glaveanu, 2012, p.515). This research study, Engeström says, was the first developmental work research study (Engeström & Glaveanu, 2012, p.515). Engeström later wrote *Training for Change* (1994), a guidebook published by the International Labor Office and meant for human resources development, personnel training, and other instances in which adults are being trained. Later in the 1990s, Engeström and collaborators developed a consensus-based change process for organizations called Change Laboratory (Engeström 1999). In all of these cases, Engeström's focus was on providing processes to support researchers and participants in codesigning systems of collective action.

Engeström developed these ideas in many publications, but we'll look at two early ones in particular: *Learning by Expanding* (1987/2014) and *Interactive Expertise* (1992).

In *Learning by Expanding* (1987/2014), Engeström proposed developmental work research (DWR) as a way to both explore and codesign systems of collective action (p.xvi). To carry on DWR, he proposed extensions to Leontiev's 2GAT.

First, Engeström provided a graphical heuristic (the now-famous triangle) for picturing Leontiev's activity system. This heuristic, which has been derided by some critics (e.g., Miller, 2011), was meant not only as an analytical device for researchers but (critically) also as a way to communicate with—and codesign work with—research participants (e.g., Engeström, 1999; Engeström & Sannino 2010). That is, it served as an interventionist "language game" (Ehn 1989) similar to the prototypes and organizational games that Bødker and other participatory designers used to leverage the tacit expertise of participants. This point has been overlooked by those who have critiqued the triangle heuristic as an oversimplified theoretical tool. (See Sannino 2011 for further elaboration of this point, and see Engeström 2018, pp.23 and 78 for other representations Engeström has developed for local stakeholders.)

Second, Engeström integrated Ilyenkov's (1982) theorization of contradictions, making them crucial to 3GAT analysis. Contradictions provided an account of change that went beyond linear development, an account that became crucial for deploying 3GAT in codesign since it allowed researchers and participants to articulate conflicts across parts of work, conflicts that were often grounded in differences in work roles and expertise.

Third, Engeström expanded the analysis to activity networks, that is, two or more interacting activity systems. Whereas Bødker described such networks in brief, Engeström coined the term "activity network" and theorized the concept. This innovation was necessary for understanding interactions and quaternary contradictions in workplaces.

Fourth, Engeström applied analyses of historical changes to work organization and work forms, drawing from Westerners such as Powell, Zuboff, and Castells to understand how organizations and expertise had developed.

Fifth and finally, Engeström supplemented the dialectical base with the dialogism of Bakhtin (1981). While dialectics was a sufficient base for understanding learning and development in hierarchical contexts such as classrooms, dialogism was necessary in contexts in which participants of equal stature had to share perspectives and deliberate on solutions—such as in codesign work. Whereas 2GAT provided a managerial view of activity, 3GAT drew on dialogism to facilitate multiperspectival analysis and design of work.

Engeström continued this line of thought in *Interactive Expertise* (1992), identifying two perspectives on expertise—the algorithmic account, which sees expertise as residing in individuals' heads, and the enculturational account, which sees expertise and thinking as embedded in social situations, practices, and cultures (pp.3-5). (To illustrate the latter, he quoted Dreyfus & Dreyfus, 1986.) Although these schools were typically presented as rivals, Engeström asserted that they share three propositions:

- "Expertise is universal and homogeneous"
- "Expertise consists of superior and stable individual mastery of discrete tasks and skills"
- "Expertise is acquired through internalization of experience" (p.5)

These propositions, Engeström argued, are Cartesian. Engeström further argued that expertise is located in activity systems rather than individuals (p.11). "Expertise," he argued, "is learning what is not yet there" (p.14). More broadly, "Expertise is here seen as an interactive accomplishment, constructed in encounters and exchanges between people and their mediating artifacts" (p.iii).

Based on this understanding, Engeström offered two innovations in *Interactive Expertise*. First, he described a developmental cycle of expert activity, which

> begins with almost exclusive emphasis on internalization, on socializing and training the novices to become competent members of the activity as it is routinely carried out. Creative externalization occurs first in the form of discrete individual deviations and innovations. As the disruptions and contradictions of the activity become more demanding, internalization takes increasingly the form of critical self-reflection, and externalization, search for novel solutions, increases.
>
> Externalization reaches its peak when a new model for the activity is envisioned, designed and implemented. As the new model becomes consolidated, internalization of its inherent ways and means again becomes the dominant form of learning and development. (p.16)

Engeström characterized the developmental cycle as the collective equivalent of Vygotsky's zone of proximal development (p.16). This cycle was the kernel of the Developmental Work Research approach.

Second, drawing on Bakhtin, he characterized the activity system as a multi-voiced formation (p.17). "Expertise in any given field," he argued, "is an ongoing dialogue or polyphony of multiple competing and complementary viewpoints and their respective 'instrumentalities', repertoires of mediational means. The various voices represent 'social languages' rooted in different societal positions, ideologies and traditions of practice. This multivoicedness is both a resource for collective achievement and a potential source of

fragmentation and conflict" (p.9). And "a developmental cycle is a re-orchestration of those voices, of the different viewpoints and approaches of the various participants" (p.16).

To make this argument, he drew on further work in cultural psychology that was published after *Learning by Expanding*, including Lave's *Cognition in Practice* (1988), Rogoff's *Apprenticeship in Thinking* (1990), Lave & Wegner's *Situated Learning* (1991), and Wertsch's *Voices of the Mind* (1991), as well as adjacent work that emphasizes cultural and historical aspects of expertise, such as Zuboff's *In the Age of the Smart Machine* (1988).

Developmental Work Research and Change Laboratories

Although Engeström sometimes offered descriptive studies—such as his studies of law and medicine in *Interactive Expertise*—these were in service of interventionist work. In a retrospective, Engeström characterized *Learning by Expanding* as taking "the first steps toward constructing *developmental work research* as a methodology for applying activity theory, specifically the theory of expansive learning, in the world of work, technology, and organizations" (2014, p.7, his emphasis). This approach later led to the Change Laboratory approach, in which "practitioners meet regularly [in a dedicated workspace] to go through a cycle of analysis and redesign of their work activity. … Change Laboratory is a setting for expansive visibilization of work, relying heavily on the viewing of videotaped material and on the construction and use of diagrammatic models" (1999, p.70).

These themes are illustrated in Cole and Engeström (1993), which describes a project in which investigators worked with Finnish hospital personnel to design a new division of labor. In the old division of labor, doctors rotated patients: when a doctor became available, she or he would take the next patient in line. In the new one, doctors became responsible for patients in their zones, meaning that they repeatedly saw and formed relationships with specific patients.

This new division of labor yielded a new understanding of the object—patient care (pp.37-39). The redesigned division of labor was a success: "The new model dramatically changed the availability and access of care… there is no longer a shortage of physicians willing to work in the stations" (p.39). Cole and Engeström described this redesign process in terms of Vygotsky's Zone of Proximal Development (ZPD; Vygotsky 1978), but rather than applying the ZPD concept to a dyad, they applied it to an entire collective activity system, yielding an expansive cycle (p.41).

Here and in his other work, Engeström (1987/2014, 1992, 1996) took up Leontiev's activity theory as a way to address the question of developing expertise in organizations. Engeström studied adult, able-bodied participants with the assumption that these participants had already developed their own sets of expertise as fully formed agents, typically in peer- or near-peer power relationships such as medical care; the goal was to understand these encounters, work with representative participants to mutually reconfigure them, and thus improve outcomes for a general population, since expertise is stretched across the activity system, codesigning mediators (tools, rules, division of labor) could yield systemic improvements in expertise. Through these studies, Engeström developed the Developmental Work Research (DWR) approach and the intervention-and-research process called Change Laboratory (Engeström 1999).

Importantly, just as participatory design served as a methodology to codesign computer interfaces, Developmental Work Research and Change Laboratory served as methodologies to codesign organizations and work. Engeström pithily characterized the results of these methodologies as "learning what is not yet there" (2016).

Conclusion

I conclude by summarizing 3GAT's codesign orientation, then discussing its implications.

3GAT's codesign orientation

DWR and PD have many similarities, leading Bødker to draw heavily on Engeström's framework once she found out about it in 1987 (Bødker 2009; Bødker & Grønbaek 1996; Bødker et al. 2017). Yet they have differences as well (Bødker 2009; Bødker & Klokmose 2011). Specifically, Bødker argues that PD tends to analyze artifacts in multiple streams (2009, p.282); reaches beyond communities of work to the "entire life context," not just the "organizational side" (p.283); and involves developing a collaborative vision in situations that lack conditions for a zone of proximal development (p.284).

Still, Bødker and Engeström independently approached codesign along roughly the same lines. First, the researchers facilitated participants' reflection on the current system and its problems. Next, the participants, with the researchers' help, described a potential future, then checked for consensus on the goals and feasibility of proposed iterative changes. Finally, participants and researchers together designed and implemented solutions, solutions that became the focus of the next iteration of the codesign cycle.

Importantly, this approach requires "language games" (Ehn, 1989) that let the researchers and participants describe the existing system and the problems within it. Such language games can include participatory design techniques such as prototyping and organizational games — or Change Lab techniques such as constructing, examining, and discussing activity system diagrams, which serve as a "mediating second stimulus" for the participants (Engeström &

Sannino 2010, p.15). On the basis of such common, consensual descriptions, participants and researchers can then generate and test potential futures.

It is this interventionist codesign orientation that has led 3GAT to gain the most traction in areas that (a) are oriented to design and (b) share an IPCP background. These areas include HCI, CSCW, and workplace studies of technology (e.g., Nardi, 1996; Kaptelinin & Nardi 2006, 2012) and adult education and education beyond traditional classrooms (e.g., Tuomi-Grohn & Engeström 2003; Sannino et al. 2009).

The codesign approach is necessarily *descriptive and deliberative, not predictive*: It assumes that participants have tacit knowledge that must be elicited, and also that they must come to consensus about the systems that they codesign. For Bødker and for Engeström, the shift to 3GAT involved a shift to codesign research—research that is conducted not *on* participants but *with* participants, oriented toward the interests of those participants, and yielding joint emergent knowledge. In the third generation, then, the point was not to provide a "fundamental explanatory strategy" but to model change and facilitate practice, as Bakhurst says; the model perhaps has "minimal predictive power" (2009, p.206), but its descriptive power is what anchors its approach, which *facilitates researcher-participant deliberation*. This deliberation is applied to designing new work organization, new practices, and new tools. As Bannon & Bødker (1991) argued, "Design is trying to predict the future, without ever being able to fully predict it" (p.246). Or, to quote Marx (1845): "Philosophers have hitherto only *interpreted* the world in various ways; the point is to *change* it."

Yet, as 3GAT has become more broadly applied and applied to broader domains, its limitations have become clearer. In the final subsection, I note some of these limitations and suggest a direction for a fourth generation of activity theory.

Implications for developing a 4GAT

Various activity theorists have suggested that it might be time to develop a fourth generation of activity theory (4GAT) (e.g., Engeström 2009; Forsgren & Bystrom 2017; Ploettner & Tresseras 2016; Spinuzzi 2012). In part, this need is due to the fact that activity theory continues to expand both theoretically and methodologically (Spinuzzi 2011). But in part, the need has to do with changes in how people co-labor: Engeström has suggested that "we are moving toward increasingly open, amoeba-like communities characterized by multidirectional swarming, weak boundaries, and no stable center," communities in which authority and agency grow from minority influencers from the peripheries (2009, p.317), even though they may involve "bounded hubs of concentrated coordination efforts" (p.310). Examples include open source software and Wikipedia (pp.309-310). In such cases, Engeström argues, a 4GAT may be needed to address "social production and peer production," in which "the boundaries and structures of activity systems seem to fade away" (p. 309).

Engeström and colleagues have addressed these limits by discussing constructs such as knotworking, runaway objects, mycorrhizae, and wildfire activities (Engeström, 2008). Yet these constructs suggest a challenge to 3GAT's interventionist stance. This stance is to a large extent reliant on a stable set of stakeholders—as Engeström says of mycorrhizae, "a relatively durable, stabilized structure" (Engeström 2006, p.1788), but in social and peer production cases, such "boundaries and structures … fade away"; stakeholders fluctuate and take different roles during the activity. In such cases, we can expect interventionist approaches to struggle to succeed for lack of stable intervention partners.

To understand why, we can look at the history of participatory design (PD). PD developed in Scandinavia, based on the principle of codesigning solutions with political

representatives from powerful unions. As PD was taken up in the United States, where unions are far less powerful, such political stakeholders were not available. Instead, US designers turned to functional representatives — "typical" users, who adequately represented the functional concerns of a vast set of potential software users but could not represent the political concerns of any group. This shift meant that although PD techniques survived, they were deployed in different ways, with different results, and were evaluated in different ways. Solutions were not codesigned in the same sense, nor were they responsive to the needs of political stakeholders, even if they were generated through the "same" process (see Spinuzzi 2005a).

PD's interventionist stance assumed a stable set of political stakeholders, stakeholders that could not be found in the environs of US software design. Similarly, 3GAT's interventionist stance assumes a stable set of stakeholders who can serve as codesigners as they engage in a dialectic, juxtaposing contradictory viewpoints or ideas to develop a common settlement. Yet those stable stakeholders are not guaranteed in cases such as social and peer production. For instance, open source projects involve stakeholders who participate intermittently and with various durations and orientations. The same is sometimes true of coworking spaces, subcontractor networks (Spinuzzi 2015), and other types of interprofessional work (Guile 2010, 2012) oriented to projects in which fluid sets of stakeholders participate intermittently, rotate leadership roles, and may define and transform the object in different and conflicting ways.

Granted, 3GAT has addressed the issue of interacting activities through the concept of activity networks, a concept that has typically been applied to participants with well-established roles, objects, and organizational boundaries (e.g., doctors and patients; lawyers, judges, and clients; eldercare workers and the elderly they serve). For networks of a small number of stable activity systems, this approach is manageable. Yet when an object is shared by a network of

activities, as in entrepreneurial pitches, it can be ontologically unstable or multiple (in the sense of Mol 2002): not just understood or perceived differently (i.e., "fragmented"; see Engeström 2009, p.302) but also *enacted* differently by stakeholders positioned in different overlapping activities with different motives and developmental cycles (see Spinuzzi 2017). In such cases, an interventionist approach may struggle to unite different stakeholders or even to identify and stabilize one set of stakeholders in the absence of "boundaries and structures" (Engeström 2009, p. 309). The interventionist codesign orientation of 3GAT, which shaped its approach and theoretical tools, may be untenable in such situations.

To develop, activity theory must address this issue of unstable stakeholders. That is, it must either find a new mechanism for intervention for new work conditions, or confine itself to older (institutional) work conditions, or return to analysis and description. Whichever path it takes, activity theory will require another qualitative transformation, perhaps as momentous as the transformation from 2GAT to 3GAT.

Works Cited

Avis, J. (2009). Transformation or transformism: Engeström's version of activity theory? *Educational Review*, *61*(2), 151–165. https://doi.org/10.1080/00131910902844754

Bakhtin, M. M. (1981). *The dialogic imagination: Four essays*. Austin: University of Texas Press.

Bakhurst, D. (2009). Reflections on activity theory. *Educational Review*, *61*(2), 197–210. https://doi.org/10.1080/00131910902846916

Bannon, L. J., & Bødker, S. (1991). Beyond the interface: Encountering artifacts in use. In *Designing interaction: Psychology at the human-computer interface* (pp. 227–253). New York: Cambridge University Press.

Bjerknes, G., Ehn, P., & Kyng, M. (Eds.). (1987). *Computers and democracy -- A Scandinavian challenge*. Aldershot, England: Avebury.

Blunden, A. (2010). *An Interdisciplinary Theory of Activity*. Boston: Brill.

Bødker, S. (2009). Past experiences and recent challenges in participatory design research. In A. Sannino, H. Daniels, & K. D. Gutierrez (Eds.), *Learning and expanding with activity theory* (pp. 274–285). New York: Cambridge University Press.

Bødker, S. (1987). *Through the Interface: A Human Activity Approach to user Interface Design*. Aarhus Universitet. Retrieved from http://pure.au.dk/portal/files/20861897/Full_text

Bødker, S. (1991). *Through the interface: A human activity approach to user interface design*. Hillsdale, NJ: L. Erlbaum.

Bødker, S., & Andersen, P. B. (2005). Complex mediation. *Human-Computer Interaction*, *20*, 353–402.

Bødker, S., Ehn, P., Kammersgaard, J., Kyng, M., & Sundblad, Y. (1987). A UTOPIAN experience: On design of powerful computer-based tools for skilled graphical workers. In G. Bjerknes, P. Ehn, & M. Kyng (Eds.), *Computers and democracy -- A Scandinavian challenge* (pp. 251–278). Aldershot, England: Avebury.

Bødker, S., Dindler, C., & Iversen, O. S. (2017). Tying Knots: Participatory Infrastructuring at Work. *Computer Supported Cooperative Work (CSCW)*, 1–29. https://doi.org/10.1007/s10606-017-9268-y

Bødker, S., & Grønbaek, K. (1996). Users and designers in mutual activity: An analysis of cooperative activities in systems design. In Y. Engeström & D. Middleton (Eds.),

Cognition and Communication at Work (pp. 130–158). New York: Cambridge University Press.

Bødker, S., & Klokmose, C. N. (2011). The Human-Artifact Model: An Activity Theoretical Approach to Artifact Ecologies. *Human–Computer Interaction*, *26*(4), 315–371. https://doi.org/10.1080/07370024.2011.626709

Bruner, J. S. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.

Carroll, J. M. (1990). *The Nurnberg funnel: Designing minimalist instruction for practical computer skill*. Cambridge, MA: MIT Press.

Carroll, J. M. (1991). Introduction: The Kittle House manifesto. In John M. Carroll (Ed.), *Designing Interaction: Psychology at the Human-Computer Interface* (pp. 1–16). New York: Cambridge University Press.

Clement, A., & Van den Besselaar, P. (1993). A retrospective look at PD projects. *Communications of the ACM*, *36*(4), 29–37.

Cole, M. (1995). Socio-cultural-historical psychology: Some general remarks and a proposal for a new kind of cultural-genetic methodology. In J. V Wertsch, P. del Rio, & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 187–214). New York: Cambridge University Press.

Cole, M. (1999). Cultural psychology: Some general principles and a concrete example. In Y. Engeström, R. Miettinen, & R.-L. Punamaki (Eds.), *Perspectives on activity theory* (pp. 87–106). New York: Cambridge University Press.

Cole, M., & Engeström, Y. (1993). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed Cognitions: Psychological and Educational Considerations* (pp. 1–46). New York: Cambridge University Press.

Cole, M., & Scribner, S. (1974). *Culture and thought: a psychological introduction*. New York: Wiley.

Dreyfus, H., & Dreyfus, S. E. (1986). *Mind over Machine: The power of human intuition and expertise in the age of the computer*. New York: Free Press.

Ehn, P. (1989). *Work-oriented design of computer artifacts*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Ehn, P., Kyng, M., & Sundblad, Y. (1983). The UTOPIA Project. In *Systems Design for With and by the Users: Proceedings of the Ifip Wg 9.1 Working Conference*. North-Holland.

Engeström, Y. (1992). *Interactive expertise: Studies in distributed working intelligence*. Helsinki: University of Helsinki.

Engeström, Y. (1994). *Training for change: New approach to instruction and learning in working life*. Geneva: International Labour Office.

Engeström, Y. (1996). Developmental work research as educational research: Looking ten years back and into the zone of proximal development. *Nordisk Pedagogik*, *16*, 131–143.

Engeström, Y. (1999). Expansive visibilization of work: An activity-theoretical perspective. *Computer Supported Cooperative Work*, *8*, 63–93.

Engeström, Y. (2001). Expansive Learning at Work: toward an activity theoretical reconceptualization. *Journal of Education and Work*, *14*(1), 133–156. https://doi.org/10.1080/13639080020028747

Engeström, Y. (2006). From Well-Bounded Ethnographies to Intervening in Mycorrhizae Activities. *Organization Studies*, *27*(12), 1783–1793. https://doi.org/10.1177/0170840606071898

Engeström, Y. (2008). *From Teams to Knots: Studies of Collaboration and Learning at Work*. New York: Cambridge University Press.

Engeström, Y. (2009). The future of activity theory: A rough draft. In A. Sannino, H. Daniels, & K. Gutierrez (Eds.), *Learning and expanding with activity theory* (pp. 303–328). New York: Cambridge.

Engeström, Y. (2011). From design experiments to formative interventions. *Theory & Psychology, 21*(5), 598-628.

Engeström, Y. (2014). *Learning by Expanding*. New York: Cambridge University Press.

Engeström, Y. (2016). *Studies in Expansive Learning: Learning What Is Not Yet There*. New York: Cambridge University Press.

Engeström, Y. (2018). *Expertise in Transition: Expansive Learning in Medical Work*. New York: Cambridge University Press.

Engeström, Y., & Glăveanu, V. (2012). On Third Generation Activity Theory: Interview with Yrjö Engeström. *Europe's Journal of Psychology*, *8*(4), 515–518. https://doi.org/10.5964/ejop.v8i4.555

Engeström, Y., & Sannino, A. (2010). Studies of expansive learning: Foundations, findings and future challenges. *Educational Research Review*, *5*(1), 1–24. https://doi.org/10.1016/j.edurev.2009.12.002

Forsgren, E., & Byström, K. (2017). Multiple social media in the workplace: Contradictions and congruencies. *Information Systems Journal*, (July), 1–23. https://doi.org/10.1111/isj.12156

González, V. M., Nardi, B., & Mark, G. (2009). Ensembles: Understanding the instantiation of activities. *Information Technology and People*, *22*(2), 109–131. https://doi.org/10.1108/09593840910962195

Greenbaum, J., & Kyng, M. (Eds.). (1991). *Design at work: Cooperative design of computer systems*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Guile, D. (2010). *The Learning Challenge of the Knowledge Economy*. Boston: Sense Publishers.

Guile, D. (2012). Inter-professional working and learning: 'Recontextualising ' lessons from 'project work' for programmes of initial professional formation. *Journal of Education and Work*, *25*(1), 79–99.

Ilyenkov, E. V. (1982). *The dialectics of the abstract and the concrete in Marx's Capital*. Moscow: Progress.

Kaptelinin, V., & Nardi, B. (2012). *Activity Theory in HCI: Fundamentals and Reflections*. *Synthesis Lectures on Human-Centered Informatics* (Vol. 5). Morgan & Claypool. https://doi.org/10.2200/S00413ED1V01Y201203HCI013

Kaptelinin, V., & Nardi, B. A. (2006). *Acting with technology: Activity theory and interaction design*. Cambridge, MA: MIT Press.

Klein, G. (2003). *The Power of Intuition: How to Use Your Gut Feelings to Make Better Decisions at Work*. New York: Doubleday.

Klein, G. A., Orasanu, J., Caldenwood, R., & Zsambok, C. E. (Eds.). (1993). *Decision Making in Action: Models and Methods*. Norwood, NJ: Ablex.

Kuutti, K. (1996). Activity theory as a potential framework for human-computer interaction research. In B. A. Nardi (Ed.), *Context and consciousness: Activity theory and human-computer interaction* (pp. 17–44). Cambridge, MA: MIT Press.

Latour, B. (1999). *Pandora's hope: Essays on the reality of science studies*. Cambridge, MA: Harvard University Press.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life*. New York: Cambridge University Press.

Lave, J., Murtaugh, M., & de la Rocha, O. (1984). The dialectic of arithmetic in grocery shopping. Harvard University Press.

Lave, J., & Wenger, E. (1991). *Situated learning : legitimate peripheral participation*. New York: Cambridge University Press.

Leontiev, A. N. (2005). Study of the environment in the pedological works of LS Vygotsky: a critical study. *Journal of Russian and East European Psychology*, *43*(4), 8–28. https://doi.org/10.1080/10610405.2005.11059254

Leontyev, A. N. (2009). *The development of mind*. Pacifica, CA: Marxists Internet Archive.

Martin, D., & Peim, N. (2009). Critical perspectives on activity theory. *Educational Review*, *61*(2), 131–138. https://doi.org/10.1080/00131910902844689

Marx, K. (1845). Theses on Feuerbach. Retrieved December 11, 2015, from https://www.marxists.org/archive/marx/works/1845/theses/theses.htm

Miller, R. (2011). *Vygotsky in perspective*. New York: Cambridge.

Mol, A. (2002). *The body multiple: Ontology in medical practice*. Durham: Duke University Press.

Nardi, B. A. (Ed.). (1996). *Context and consciousness: Activity theory and human-computer interaction*. Cambridge, MA: MIT Press.

Peim, N. (2009). Activity theory and ontology. *Educational Review*, *61*(2), 167–180. https://doi.org/10.1080/00131910902846874

Ploettner, J., & Tresseras, E. (2016). An interview with Yrjö Engeström and Annalisa Sannino on activity theory. *Bellaterra Journal of Teaching & Learning Language & Literature*, *9*(4), 87–98. https://doi.org/10.5565/rev/jtl3.709

Rogoff, B. (1984). Introduction: Thinking and Learning in Social Context. In B. Rogoff & J. Lave (Eds.), *Everyday Cognition: Its Development in Social Context* (pp. 1–8). Cambridge, MA: Harvard University Press.

Rogoff, B. (1990). *Apprenticeship in thinking : cognitive development in social context*. New York: Oxford University Press.

Rogoff, B., & Lave, J. (Eds.). (1984). *Everyday cognition : its development in social context*. Cambridge, Mass.: Harvard University Press.

Sannino, A. (2011). Activity theory as an activist and interventionist theory. *Theory & Psychology*, *21*(5), 571–597. https://doi.org/10.1177/0959354311417485

Sannino, A., Daniels, H., & Gutierrez, K. D. (Eds.). (2009). *Learning and Expanding with Activity Theory*. New York: Cambridge University Press.

Scribner, S. (1984). Studying working intelligence. Harvard University Press.

Scribner, S., & Cole, M. (1981). *The psychology of literacy*. Cambridge, Mass.: Harvard University Press.

Smagorinsky, P. (2018). Deconflating the ZPD and instructional scaffolding: Retranslating and reconceiving the zone of proximal development as the zone of next development. *Learning, Culture and Social Interaction*, *16*(September 2017), 70–75. https://doi.org/10.1016/j.lcsi.2017.10.009

Spinuzzi, C. (2002). A Scandinavian challenge, a US response: Methodological assumptions in Scandinavian and US prototyping approaches. In *Proceedings of the 20th annual international conference on Computer documentation* (pp. 208–215). ACM Press. https://doi.org/http://doi.acm.org/10.1145/584955.584986

Spinuzzi, C. (2003). *Tracing genres through organizations: A sociocultural approach to information design*. Cambridge, MA: MIT Press.

Spinuzzi, C. (2005a). Lost in the translation: Shifting claims in the migration of a research technique. *Technical Communication Quarterly*, *14*(4), 411–446.

Spinuzzi, C. (2005b). The methodology of participatory design. *Technical Communication*, *52*(2), 163–174.

Spinuzzi, C. (2011). Losing by Expanding: Corralling the Runaway Object. *Journal of Business and Technical Communication*, *25*(4), 449–486.

Spinuzzi, C. (2012). Working Alone, Together: Coworking as Emergent Collaborative Activity. *Journal of Business And Technical Communication*, *26*(4), 399–441.

Spinuzzi, C. (2017). “I Think You Should Explore the Kinky Market”: How Entrepreneurs Develop Value Propositions as Emergent Objects of Activity Networks. *Mind, Culture, and Activity*, *24*(3). https://doi.org/10.1080/10749039.2017.1294606

Spinuzzi, C. (2018). From superhumans to supermediators: Locating the extraordinary in CHAT. In A. Yasnitsky (Ed.), *Questioning Vygotsky's Legacy: Scientific Psychology or Heroic Cult* (pp. 137–166). New York: Routledge.

Suchman, L. A. (1987). *Plans and situated actions: The problem of human-machine communication*. New York: Cambridge University Press.

Tuomi-Gröhn, T., & Engeström, Y. (Eds.). (2003). *Between school and work: New perspectives on transfer and boundary crossing*. Boston: Pergamon.

Van der Veer, R., & Valsiner, J. (1991). *Understanding Vygotsky: A Quest for Synthesis*. Cambridge, MA: Blackwell Publishers.

Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: MIT Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Wertsch, J. V. (1985). *Vygotsky and the social formation of mind*. Cambridge, Mass.: Harvard University Press.

Wertsch, J. V. (1991). *Voices of the mind: A sociocultural approach to mediated action*. Cambridge, Massachusetts: Harvard University Press.

Winograd, T., & Flores, F. (1986). *Understanding computers and cognition: A new foundation for design*. Reading, MA: Addison-Wesley.

Witte, S. P. (2005). Research in Activity: An Analysis of Speed Bumps as Mediational Means. *Written Communication*, *22*(2), 127–165. https://doi.org/10.1177/0741088305274781

Zsambok, C. E., & Klein, G. (Eds.). (2009). *Naturalistic Decision Making*. New York: Routledge.

Zuboff, S. (1988). *In the age of the smart machine: The future of work and power*. New York: Basic Books.

Table 1. Contrasts across generations of activity theory (based on Spinuzzi 2018, p.154).

	Vygotsky (1GAT)	**Leontiev (2GAT)**	**Contemporary CHAT (3GAT)**
Theory	Grand	Middle-range	Middle-range
Research focus	Basic	Applied, practical	Applied, practical
Disciplinary orientation (research)	Psychology	Psychology, psychophysiology, sociology	Organizational sociology, cultural psychology
Disciplinary orientation (application)	Pedagogy, defectology, rehabilitation, cross-cultural psychology (dyads of more and less culturally advanced practitioners)	Pedagogy, defectology, rehabilitation (dyads of more and less culturally advanced practitioners)	Management (systems of employees and managers); Design (systems of users and symbolic artifacts)
Unit of analysis	Meaning and (later) sense	Labor activity	Organizational activity and activity networks
Empirical focus	Individuals and dyads: individual subjects	Individuals-in-activity and dyads; individual subjects	Groups, organizations, and interconnected social systems; collective subjects
Location of development or change	The individual's capabilities	The individual's capabilities in relation to society	The organization's capabilities (in mediators)
Agent	Self	State	Participants