The concept of 'practice': What's the point?

Kjeld Schmidt
Copenhagen Business School, Denmark & University of Siegen, Germany

Abstract. The purpose of the present article is to argue that the point of using the concept of 'practice' in the context of CSCW and related research areas is to overcome the categorial separation of 'thinking' and 'acting' that is part and parcel of the received discourse about 'work' and thus to be able to focus sharply on and express the *unity* of the activities of work. The article shows that received concept of 'practice' has been developed in the course of centuries precisely as a way to focus on normatively regulated contingent activities.

In the course of the history of Computer-Supported Cooperative Work (CSCW), the concept of 'practice' has become a key concept and, indeed, arguably a concept defining of the field.[1] An indication of this development — albeit, admittedly, a very rough one — is that while the term 'practice' in the mid-1980s only occurred in about 25 percent of papers in which the acronym CSCW also occurred, the frequency of use has increased steadily from year to year to the current level of about 75%.[2] This indicator is of course crude but, still, the shift is significant enough: It has become common in CSCW to conceive of problems, observations, and findings in terms of 'practices' (cf., e.g., Luff et al. 2000; Kuutti 2013; Schmidt and Bannon 2013). As Volker Wulf et al. have argued recently: 'CSCW was the first research community in applied computer science which stressed the importance of an in-depth understanding of practices when designing ICT artefacts. From our point of view, this is the key achievement of the research field' (2011, p. 505).

There are sound reasons for this shift. When in operation, coordination technologies intervene, in some cases radically, in the cooperative effort by interposing mechanical regulation of workers' interactions. The design of such interventionist technologies can not be based merely on a model of the application domain in the form of some idealized representation of prescribed or normal procedures; rather, the design must also account for the actual practice in which the system in question is to be integrated, its contingencies, variations, local circumstances. In the words of Lucy Suchman, 'some amount of appropriation into local circumstances will always be required. The question is not whether that work will need to be done, but with what ease or difficulty' (2002, p. 139). Indeed, in the case of coordination technologies, system rigidity may complicate coordination work unbearably and cause breakdowns. This insight is fundamental for CSCW. This then, in turn, raises the crucial question: How

[1] The article draws on arguments sketched and elaborated in different contexts in earlier publications (Schmidt 2011a, b, 2012b, a, 2014) as well as in lectures delivered at the University of Oslo, Norway, 16 May 2013 and at the University of Siegen, Germany, 18 June 2013. The research has been supported by the Velux-Villum Foundations under the 'Computational Artifacts' project.

[2] The calculation is based searches of the co-occurrence of the terms 'CSCW' and 'practice' in documents on Google Scholar from 1983 to 2012 (5-year intervals).

COOP 2014: Proceedings of the 11th International Conference on the Design of Cooperative Systems, 27-30 May 2014, Nice, France, Springer, London, 2014.

do we conceptualize the 'circumstances' into which the technology is to be integrated? Indeed, how do we compare 'circumstances'? That is, how do we compare findings from one setting with those from another or even from one day to the next? How do we determine which observed activities are instances of the same kind? In short, what is our *unit of analysis*? In response to this methodological conundrum, a prevalent approach — a version of the stark mentalism dominating social psychology — has been to introduce intractable constructs such as 'shared goal' as criteria of similarity. However, this move is obviously self-defeating, for it leads nowhere but to circular argumentation: How do we observe the presence of a 'shared goal' if not by observing that activities unfold in a coordinated manner? If so, does deficient coordination then indicate that lack of need of coordination? Does it even make sense to ascribe a shared goal to a collaborative effort characterized by division of labor? (cf., e.g., Schmidt 2012a).

The concept of 'practice' is being used in CSCW as a way out of such muddles. However, another muddle is threatening. In the course of recent decades, the concept of 'practice' has moved center-stage in social theory. The motivation for much of this orientation towards practice (or 'Practice Turn', the title of Schatzki et al. 2001) is that 'practice' is seen as a means for providing social theorizing with an 'ontological' (or transcendental) foundation, i.e., a foundation prior to building a framework bottom up from actual empirical studies. So far, without luck, for the concept of 'practice' is notoriously unfit for doing *that* kind of work. As a result, the term 'practice' is being used in confusing and confused ways: as another word for 'activity', 'culture', 'tradition', 'paradigm', 'embodied action', 'knowing how', and so forth. (For overviews of 'practice theory', cf. Reckwitz 2002; Nicolini 2012)..

In CSCW the concept of 'practice' has moved center stage, not in an effort to build 'theories of practice that substitute magic and just-so stories for hard work' (Stern 2003, p. 201) but, rather, because researchers, in a distributed process of learning from experience, find that this concept, somehow, helps them express their research problems and empirical findings better than concepts such as 'shared goal', 'situation awareness', 'use situation', 'context', 'task', 'activity', 'work', 'tacit knowledge', 'actor network', 'articulation work', 'situated action', and so on. However, the term 'practice' has so far been used quite informally in CSCW. But since it is now assuming the role of a cornerstone concept for CSCW, in that it is now increasingly deployed to define CSCW's research problem, our lack of conceptual clarity is not tenable. Worse, the general confusion about 'practice' in social theorizing is likely to seep through and cause havoc in CSCW as well. Since nothing is gained by substituting one muddle for another, a systematic discussion of the concept of 'practice', from a CSCW point of view, is surely called for. The question is, then, what is it that the concept of 'practice' does for us? What is the point of that concept for CSCW?

Now, concepts are institutions. In the words of the British philosopher John Austin, 'Our common stock of words embodies all the distinctions men have found worth drawing, and the connexions they have found worth marking, in the life-times of many generations' (1961, p. 130). The concept of 'practice' is no exception: it comes with a suite of connotations and references that we can only ignore at our peril, for if we do so we would not know what we are in fact saying. As Austin adduces, our conceptual scheme — what Gilbert Ryle called 'the logical geography of our concepts' — is the outcome of process of selection, typically evolutionary. Concepts, as institu-

tions, have a history. Thus, in order to better grasp the concept of 'practice' it is helpful to realize that it evolved over several centuries and was sharpened precisely in order to be able to express the unity of the activities of work for the purpose of intervening in work practices and their organization.

The aim of the present article is to show just that.[3] The point of using the concept of 'practice' in the context of CSCW (but also partly in HCI, STS, Knowledge Management, Organization Theory, etc.) is to overcome the categorial separation of 'thinking' and 'acting' that is part and parcel of the received discourse about 'work'. That is, the point is that work, when conceived of as *a practice*, is not reduced to *mere activity*, more or less regular sequences of operation, but is taken to also encompass the ways in which workers competently handle contingencies and variations, ensure orderly alignment of their distributed activities, as well as sundry intellectual activities such as envisioning the outcome, devising methods and plans, identifying tasks, preparing and allocating tasks, etc.

The original 'practice turn'

It is a remarkable paradox that the concept-pair 'theory' / 'practice' was originally formed by ancient Greeks philosophers as a way to express and justify the categorial *separation* of the two concepts. Both Plato and Aristotle made a distinction between *theoria* (contemplative activity), *poesis* (making, producing), and *praxis* (mere activity). Thus, in his *Nicomachean Ethics* Aristotle stated that the concepts of 'making [*poesis*] and acting [*praxis*] are different', pointing out that different kinds of reasoning are involved: 'the reasoned state of capacity to act is different from the reasoned state of capacity to make'. He was also careful to point out that '*praxis*' is not subsumed under '*poesis*'; they are of different kinds (*Nic. Ethics*, 1140a). As for the reasoning involved in '*praxis*', Aristotle left nothing to guesswork: 'manual workers are like certain lifeless things which act indeed, but act without knowing what they do, as fire burns, – but while the lifeless things perform each of their functions by a natural tendency, the labourers perform them through habit' (*Metaphysics*, 981a-b).

Aristotle thus conceived of the manual worker as an agency akin to a disciplined natural force: the worker accomplishes things, sure, but so does a fire; the point of the analogy being that workers, like fire, 'act without knowing what they do'. This is the crux of the aristocratic notion of '*praxis*' as conceived by Aristotle: 'The slave is the minister of practice' (*Politics*, 1254a).

The contemporary concept of 'practice', as it is ordinarily used, is categorially distinct from that of the Ancients'; it is used *in contradiction to* the categorial separation we find in Aristotle; indeed, that is the point of it! It was developed in what could be seen as the original 'practice turn' — a movement that unfolded for centuries beginning with the early Modern Era (from the 15th century). We therefore call our ordinary concept of 'practice' the Modern concept.

[3] I was originally inspired to investigate the history of the concept of 'practice' by an article by Alfred Schmidt (1974).

The story is roughly like the following. With the early developments of a capitalist economy based on craft work ('mechanical arts') from about 1400, the classical notion of 'practice' as mindless activity was increasingly seen as problematic. As the historian Paolo Rossi puts it in his *Philosophy, Technology, and the Arts in the Early Modern Era* (1962), between 1400 and 1700,

> 'A new view of labor, of the function of technical knowledge, and of the significance of artificial processes through which nature was altered and transformed clearly makes its way into the work of artists and experimentalists of the fifteenth century and into the treatises of engineers and technicians of the sixteenth century. […] The men who toiled in the workshops, in the arsenals, and in the studios, or those who had dropped their disdain of practice, considered the operations conducted on these premises a form of cognition.' (Rossi 1962, pp. ix f.).

Thus, the literature of the period is 'extraordinarily rich in treatises of a technical character, which at times were real manuals, and at times disconnected reflections on [the authors'] own work or procedures employed in the various arts.' (*ibid*., p. 15). In order to develop the emerging (eventually capitalist) economy, mastery of the theories of mathematics, physics, etc. was deemed quite insufficient; it became crucial for merchants, mechanists, and scholars to understand the actual role of practical reason and practical experience vis-à-vis the role of mathematics, physics, astronomy, etc. As Rossi puts it: 'The actual union between "discourse" and "practice," "speculation" and "manufacture," in reality presented serious problems' (*ibid*., p. 61). To exemplify this observation, Rossi quotes the Italian military engineer Bonaiuto Lorini who, in a treatise on fortifications (1596), addressed the problem of the relation between the work of the 'purely speculative mathematician' and that of the 'practical mechanic':

> 'The demonstrations and proportions found by the mathematician "between surface lines and imaginary bodies and separated from matter do not respond so perfectly when applied to material things", because the concepts with which the mathematician works "are not subject to those impediments which by nature are always conjoined to the matter that is worked on by the mechanic." The mechanic's judgment and ability consists in knowing how to foresee the difficulties deriving from the diversity of the materials with which he must work, and this is all the more difficult in that no such rules can be offered for "such accidental impediments".' (Rossi 1962, pp. 61 f.).

Lorini continued:

> 'Indeed, the material itself could present a very great impediment, as would be the case when material wheels have to be moved around their axes, which can be impeded by their own unequal weight, even more so when the wheels are sustained over such axes or poles that are not properly centered, all of which can tend to make motion difficult. The pure mathematician, however, imagines them as weightless and tied around invisible lines and points.' (Lorini 1596, Libro V; Rossi 1962, pp. 62).

In short, mathematical theory, for all its conceptual power, cannot encompass the multiplicity of the material world with which the mechanic has to cope. This is insight was revolutionary.

Over time, systematic studies of work practices of this kind developed into a great scientific research tradition, for which Agricola's study of work practices in the Bohemian metal trades (1556) is exemplary. This tradition culminated in the large-scale project launched by the French Academy of Science in 1675, undertaken at the government's request and with the express purpose of producing systematic descriptions

of the work practices and techniques of the about 200 crafts and trades (‘*arts et métiers*’) then in existence in France, from bakeries to pin manufactures: ‘The king wished the Academy to work unceasingly upon a treatise on mechanics, in which theory and practice should be explained in clear manner that could be grasped by everyone’ (Académie Royale des Sciences 1729-34, p. 131). As expressed in the Academy’s own *mémoire* from 1699, it had undertaken the task of ‘describing the crafts in their present condition’, knowing full well that the task was ‘dry, thorny, and not at all dazzling’. The eventual *Descriptions* were to ‘penetrate to the ultimate details, although it would often prove very difficult to acquire them from artisans or to explain them’, but as a result ‘an infinity of practices, full of spirit and inventiveness, but generally unknown, will be drawn from their shadows’. The crafts would thereby be preserved for posterity, but in addition ‘able men’ who lacked the leisure to visit the artisans’ workshops would be able to ‘work on the perfection’ of these practices, just as the Academy itself would not fail to remark if something might usefully be amended (Académie Royale des Sciences 1702, pp. 117 f).

With hundreds of ‘arts and trades’ to investigate and describe, the task undertaken by the Academy was of course enormous, as it involved extensive fieldwork in different lines of trade in different parts of the country. What is more, a systematic approach to the description of practices and representations of techniques (processes, implements, tools) was required and had to be developed. By 1757 only a few pieces of the accumulated analyses had been made publicly available. The reason for the obvious lack of visible progress — apart from the enormity of the task, of course — seems to have been dissatisfaction with the quality of the initial analytical work, which was seen as not sufficiently systematic and accurate. However, the Academy eventually succeeded in getting the publication process organized and from 1761 to 1788 altogether 81 treatises (about 100 volumes) were published under the title *Descriptions des arts et métiers*.[4]

The aim of all this, as stated in the Academy’s preamble to the *Descriptions*, was not merely to ‘examine and describe in turn all operations of the mechanical arts’ but also and equally ‘to contribute to their progress’. The Academy expected that ‘new degrees of perfection of the arts’ would be achieved when scholars undertake the effort of investigating and developing the ‘often ingenious operations performed by the artisan in his workshop; when they see by themselves the needs of the art, its limitations, the difficulties that prevent it from going further, the assistance that one could transfer from one art to another and which the worker is rarely expected to know.’ Subjecting work practices, which had slowly evolved from ‘obscurity’, to systematic study, rationalizing them, would show competent workers a way to ‘overcome the obstacles that they have been unable to cross’, a way to ‘invent new tools’, etc. The point was, as it was proudly put, ‘*éclairer la pratique*’ — that is, to explain and enlighten practice (Académie Royale des Sciences 1761, pp. xvi f.).

The ‘dry, thorny, and not at all dazzling’ effort had huge impact: ‘there can be no doubt’ that contemporaneously these scientific descriptions of arts and handicrafts ‘exerted a potent influence in western Europe’ (Cole and Watts 1952, p. 1). Furthermore, the *Descriptions* provided a model for scholars that received practices were

[4] The *Descriptions* are available from http://gallica.bnf.fr.

accessible to scholarly analysis and might be much improved by application of the insights, methods, etc. of the physical, chemical, mechanical, etc. sciences.

Now, this great tradition of scholarly studies of mundane work practices and techniques ended at just this point. The 'practice turn' that was inaugurated in the 15th century fizzled out as the Industrial Revolution picked up speed (*circa* 1780-1830). But the reasons for the eclipse of practice studies are an important part of the history of the concept of 'practice': it sharpens its point.

Practice studies eclipsed

With the Industrial Revolution the drive to transform work practices continued unabated, but in a very different form. The focal interest of employers and engineers shifted to the seemingly infinite productivity potential of machine technology. New machine technologies and their incremental improvement were seen as decisive. Employers and their engineers could thus afford to conceive of the organization of work and work practices as trivial (Hobsbawm 1964; Montgomery 1979; Nelson 1995). Machinery had the primacy and work practices were expected to somehow adapt. Work practices were not of concern to employers and even less so for academia. Thus, the great tradition of scholarly studies of mundane practices and techniques vanished from the agenda with the Industrial Revolution.

However, by the end of 19th century employers and their agents could no longer afford not to pay attention to the *organization of work*. Industrial workers had 'learned the game', as the historian Erik Hobsbawm puts it: they had experienced that the intensity of the working day was not determined by the traditional norms of 'a fair day's work' characteristic of pre-industrial society and had moreover realized that they, if organized, could influence the quantity of output significantly. Consequently, the issue of how to understand and deal with systematic output restriction became a primary concern of industrialists (Hobsbawm 1964). But the issue of understanding *work practices* for the purpose of their productive transformation remained off the agenda. Frederick W. Taylor's effort to transform the work of skilled machinists, for example, was not motivated by an interest in their practices with a view to the development of these but was rather an attempt to *eradicate* these practices — a utopian attempt to eliminate the sources of contingency and variation in the interest of managerial control. Thus, one will not find *any* description of the work practices of skilled machinists in Taylor's writings (e.g., Taylor 1903, 1907, 1911).

Similarly, one will have to look long and hard to find more than rudimentary descriptions of work practices in the entire literature of industrial sociology and sociology of work. The focus of interest of these disciplines was firmly centered on issues of social and managerial control (from 'industrial fatigue' to 'informal organization' to 'work climate' to 'wildcat strikes' to 'human resource management'). The difference with respect to Taylor's work is merely that where Taylor strove — in utopian rage — to eradicate practice, management doctrine and associated schools of industrial sociology, from the Hawthorne 'experiments' and on, interpreted and handled workers' organized control over the level of production as an expression of collective 'neuroses' and 'non-logical sentiments' and saw the 'informal organization' as a vehicle

for those remnants from pre-industrial society (Mayo 1933; Barnard 1938; Roethlisberger and Dickson 1939). Actual work practice was not an issue that could generate serious interest (cf. Gillespie 1991).

Industrial and work sociology has of course for decades subjected the organization of work and changing demands on worker qualifications to systematic studies. This applies to, for example, studies of the relationship between the nature of production technology and the degree of workers' autonomy in their work, not only in the British 'socio-technical' tradition but also, and far more systematically, in the German tradition from Popitz and Bahrdt (1957) to Kern and Schumann (1970). But these and similar traditions consistently conceive of work and the work situation as the resultant in an equation of multiple causal factors, primarily encompassing the technical systems of production. Machinery retained its conceptual primacy while practice was considered sociologically uninteresting.

Two centuries after the onslaught of Industrial Revolution, actual work practices remained managerially and academically uninteresting. Thus, in 1985, Anselm Strauss and his colleagues could observe that

> 'remarkably little writing in the sociology of work begins with work itself (except descriptively, not analytically) but rather focuses on the division of labor, on work roles, role relationships, careers, and the like' (Strauss et al. 1985, p. xi). 'Not incidentally, of course, there are descriptions and analyses of work done by members of professions, occupations, and by organizational members, but intense focus on the work itself — its task sequences, its organization, its many variants and their conditions and consequences, its articulation, its evaluative processes — is far less usual.' (*ibid*., p. 289). (For a similar assessment, cf. Sharrock and Anderson 1986, p. 85 f.)

What *did* survive the Industrial Revolution and its aftermath of ceaseless upheavals was the Modern concept of 'practice'. In fact, the perhaps most important outcome of the tradition of scholarly studies of work practices is the Modern concept of 'practice' itself. To explore the concept of 'practice' as we have received it and apply it more systematically, let us first revisit the original 'practice turn'.

The heritage: The Modern concept of 'practice'

At an early stage in the course of the original 'practice turn', around 1600, Frances Bacon articulated the conceptual implication of this entire tradition of work and called for a reversal of the relationship between 'theory' and 'practice'. Bacon rejected the notion, received from 'the Ancients', that anything useful at all could be accomplished when men, in 'mad effort and useless combination of forces', 'endeavor by logic (which may be considered as a kind of athletic art) to strengthen the sinews of the understanding' (Bacon 1620, Preface). Thus, in explicit contradiction of Plato and Aristotle, Bacon argued that theory and practice are *equals*, so to speak, and he was thereby able to even conceive of *theorizing proved wrong in practice*: 'sciences fair perhaps in theory, but in practice inefficient' (*ibid*., § II:xlv):

> 'Although the roads to human power and to human knowledge lie close together and are nearly the same, nevertheless, on account of the pernicious and inveterate habit of dwelling on abstractions it is safer to begin and raise the sciences from those foundations which have

relation to practice, and to let the active part itself be as the seal which prints and determines the contemplative counterpart.' (Bacon 1620, §II:iv)

On this revolutionary view, ordinary working practices and practical knowledge were no longer categorially separated from and inferior to scientific knowledge and philosophy. It was conceivable to 'begin and raise the sciences from those foundations which have relation to practice'. However, Bacon's 'practice turn' was of course largely programmatic. Production at the time was craft-based and science immature: Galilei had just started his career when Bacon published his *Novum Organon* in 1620.

However, a century or so later, when Denis Diderot, together with Jean d'Alembert, edited the famous *Encyclopédie* (1751-66), the original 'practice turn' was completed, and the new conception of science as grounded in practical experience that Bacon had vaguely sensed and promulgated could now become articulated most pointedly. Diderot thus wrote an article on 'Arts', i.e., the *practical* crafts, arts, techniques, and sciences, for the first volume of the *Encyclopédie* in which he, following Bacon, flatly observed that 'It is man's work [*l'industrie de l'homme*] applied to the products of nature', his effort to satisfy 'his needs', 'that has given birth to the sciences and the arts' (Diderot 1751, pp. 265 f.). He then went on to describe the relation between 'theory' and 'practice' as a reciprocal one:

> 'every art has its speculation and its practice: the speculation is nothing but the idle knowledge of the rules of the art, the practical aspect is the habitual and unreflective application of the same rules. It is difficult, if not impossible, to develop the practice without speculation, and, reciprocally, to have a solid grasp of the speculation without the practice. There are in every art — with respect to the material, the instruments, and the operation — a multitude of circumstances which can only be learned in practice [*usage*]. It is for practice to present difficulties and pose phenomena, while it is for speculation to explain the phenomena and dissolve the difficulties; from which follows that hardly any but an artisan who masters reasoning that can talk well about his art.' (*ibid*, p. 266, emphases deleted).

To illustrate his argument, Diderot discussed the relationship between academic geometry and the practical geometry as exercised in workshops:

> 'Everyone will readily agree that there are few artists who can dispense with the elements of mathematics. However, a paradox, the truth of which is not immediately obvious, is that, in many situations, these elements would actually harm them if the precepts were not corrected in practice by knowledge of a multitude of physical circumstances: knowledge of location, position, irregular forms, materials and their properties, elasticity, rigidity, friction, texture, durability, as well as the effects of air, water, cold, heat, dryness, etc.' (*ibid*., p. 271).

For instance, Diderot argued, no levers exist 'for which one could calculate all conditions'. Among these conditions are a large number that are very important in practice:

> 'From this follows that a man who knows only intellectual [academic] geometry is usually rather incompetent and that an artist who knows only experimental geometry is very limited as a worker. But, in my opinion, experience shows us that it is easier for an artist to dispense with intellectual geometry than for any man to dispense with some experimental geometry. In spite of the calculus, the entire issue of friction has remained a matter for experimental and handicraft mathematics. […] How many awful machines are not proposed daily by men who have deluded themselves that levers, wheels, pulleys, and cables perform in a machine as they do on paper and who have never taken part in manual work, and thus

who never have known the difference in effect of one and the same machine in reality and as a plan?.' (*ibid*.).

In other words, following Bacon, Diderot completely reversed the internal relationship of Aristotelian concept-pair '*theoria* / *praxis*'. When we talk of 'practice' we no longer conceive of it as mere regular activity devoid of 'reasoning' and 'deliberation'. The categorial separation of '*praxis*' and '*poesis*' has been dissolved, and both the 'capacity of make' and the 'capacity to act' have been united in the Modern concept of 'practice' — united but not conflated. The Modern concept of 'practice' expresses and is used for emphasizing the complex dialectics of general precepts and action.

A generation later, Immanuel Kant, with admirable precision, summarized the Modern concept of 'practice' as it had been developed in the course of four centuries:

> 'One calls a conceptualization of rules, even of practical rules, a theory when these rules, as principles, are thought of in a certain generality and thus have been abstracted from a multitude of conditions that nonetheless necessarily influence their application. On the other hand, one does not call just any operation a praxis; rather, only such a purposive endeavor is considered a praxis that is taken to be attained by following certain generally accepted principles of procedure.' (Kant 1793, p. 127).

Let us unpack this, admittedly, rather compact proposition. The theory of, say, making bread, as expressed in cooking books and handed-down recipes, summarizes the experience of generations in the form of general rules and principles. But in formulating rules and principles, one abstracts from a plethora of more or less accidental conditions and circumstances such as, for instance, the quality and age of the flour, the humidity and temperature of the air, and so on, which are nevertheless to be taken into account by the baker in action. On the other hand, not everything the baker does can be ascribed to the practices of baking bread. That he perhaps drinks a cold beer while the dough is rising or surreptitiously kisses the maid while the bread is in the oven are not elements of this practice, however important they may be for his quality of life. The two concepts — 'theory' and 'practice' — are mutually constitutive.

This concept of 'practice' is the Modern one. This concept is the same we find when, for instance, Ludwig Wittgenstein says that 'To establish a practice, rules are not enough; one also needs examples. Our rules leave back doors open, and the practice must speak for itself' (Wittgenstein 1949-51, §139. My translation). It is the same we find in Peter Winch (1958), and in Pierre Bourdieu (Bourdieu 1980). That is, in the Modern concept of 'practice', as summarized by Kant, we use the term 'practice' to designate activities that are governed by a 'theory', i.e., 'a conceptualization of rules' that have been 'abstracted from a multitude of conditions' and thus are 'applied' as 'general principles'. Now, and this is the important point, when applying these 'general principles' the 'circumstances', that were elided in abstracting the rules, again have to be faced and dealt with. In other words, the point of the Modern concept of 'practice' is to focus on the ways in which the competent actor in his or her action is taking the particular conditions into account while committed to and guided by the appropriate general principles ('theory', 'rules'). When studying a practice we are focusing on how the practitioners determine the nature of situation, how they select effective and efficient techniques (materials, implements, bodily postures, methods, etc.), determine deviations from what has been assumed in the rule formulations, deal with routine troubles, recover from breakdowns, etc.

In applying the concept of 'practice' we are thus deviating drastically from conventional engineering and sociological approaches that assume that contingencies *can* be eliminated and hence that work *can* be reduced to mindless or mechanical execution of procedures, process descriptions, etc. that have been determined and choreographed in advance. This assumption —shared by Taylor as well as his later detractors (e.g., Braverman 1974) — is closely related to Laplace's idea of an omniscient demon that by virtue of its knowledge of the state of the universe in its entirety at a given moment would be able to predict the future states of the universe with impeccable precision (Laplace 1814). But however elaborate, sophisticated, and tested a plan, procedure, etc. might be, its realization in action is subjected to conditions, circumstances, variation, that may or may not have been anticipated. In the words of Ludvig Holberg: 'For squinting at a seaman's chart / Is not the whole of steering' (1722, act v, sc. 8). This is what is referred to when we speak of 'practice'.

In sum, when conceived of as a practice, work is not reduced to *mere execution* of some given task (i.e., what Aristotle and his modern followers might consider mindless), but is taken to also encompass not only handling variations and contingencies but also what is done to envision outcome; devise methods and plan for probable contingencies; identify tasks to be performed; prepare operations; allocate or assume responsibility, as well as activities of coordinating, aligning, evaluating, instructing, learning, etc. The term 'practice' is in other words used to frame contingent activities as committed to criteria for correct conduct in the form for norms, rules, procedures, plans, etc. The noun 'practice' thus means *normatively regulated contingent activity*.

This much should be clear by now. But the concept of 'practice' can be tricky. Category mistakes abound. It is of course beyond the scope of this article to elaborate on the intricacies of this concept but a few brief remarks will suffice to indicate the issues.

(1) A practice is constituted by the rules and principles adhered to by actors and by virtue of which they are accountable for their doings (Wittgenstein 1945-46, §§ 143-242). The rules and principles to which actors are committed in their contingent activities provide the criterion of similarity that enables them (and observers) to determine not only what is deemed correct conduct but also what is being deemed activities of the same kind. One practice differs from another in so far as the rules and principles differ.

(2) That practices are normatively constituted tends to elude theorists. The snag is our distinction between 'mere regularity' and 'rule-following' (Wittgenstein 1945-46, §§ 143-242; Hacker 1988) or between 'natural regularity' and 'normative regularity' (Williams 2010). When we observe stable patterns or correlations, what we find is *mere regularity*. But when we observe that actors justify their actions and their justifications are accepted (or rejected), or give and receive instructions on how to conduct themselves in a certain line of activity, or correct themselves and accept corrections and sanctions with respect to their conduct, etc., then we are observing something *other* than natural regularity in behavior; we are finding instances of *normative regularity*.

(3) 'Practice' is belongs to the web of the *activity* concepts. A practice is something we perform or engage in; it has a temporal structure. However, 'practice' should not simply be conflated with the concept of 'activity'. An activity has 'genuine duration': it has a starting point and an end-point in time (Wittgenstein 1945-48, §§ 71-

83). Our baker may begin preparing rolls Friday morning at 03:00, place the hot rolls on the shelves in the shop at 05:00, and may then go to bed. At this point this particular sequence of activities ends, but not his practice nor the practice of baking bread. A lawyer does not cease to practice the law when she is fast asleep. When we refer to a specific practice, we are referring to a specific *category* of activity, namely, activities that are related by virtue of being committed to certain rules and principles.

(4) To engage in a practice requires command of a repertoire of techniques (and perhaps technologies), the wielding of which requires concomitant qualifications or skills. But these concepts should not be assimilated. As an activity-concept, the concept of 'practice' is different from concepts of faculties such as 'skill' and 'technique' (or 'knowing-how', cf. Schmidt 2012b). The grammar of 'technique' runs parallel to that of 'qualification' ('competence', 'skill') but only for part of the journey: 'techniques' is a neutral expression of distinct capacities (methods, tools) by means of which a task is doable. Techniques are typically also neutral in as much as one will often find the same technique used across different practices. The technique of, for instance, using a knife for cutting meat may be applied by a surgeon as well as by a butcher or an executioner; but they wield the knife for quite different purposes, with different concerns, by observing different criteria of priority. In short, 'skill' expresses *ability* but 'technique' *capacity*. All in all, the faculties are all acquired, possessed, and applied; they are not *performed*, as are practices.

(5) When engaged in a practice, actors are confronted with the inexorability of action, in as much as avoidance or postponement of action may also have effects, perhaps unwanted. The practitioner does not have the privilege of an observer. He or she cannot afford the general skepticism demonstrated by Descartes when he in his *Philosophical Meditations* describes how he is sitting by the window overlooking a square somewhere in Northern Holland around 1640: 'if I look out of the window and see men crossing the square, which I just happen to have done, I normally say that I see the men themselves […]. Yet do I see more than hats and coats which could conceal automatons?' (1641, p. 21). But unless one is engaged in the alien practice of hunting down replicants, such as Rick Deckard in *Blade Runner*, it would not be sane to wonder whether the spectacle of bipedally locomoting shapes wearing coats and hats are indeed automatons and not humans. In our ordinary working practices, such skepticism is a luxury. In the course of action, the practitioner has to take for granted that things that look normal are in fact normal. Alfred Schütz (1953) dubbed this stance 'the natural attitude'. The practitioner is faced with 'imposed relevances' that he or she has to cope with (Schütz 1947-51; Bittner 1973). Faced with the 'urgencies' of his or her work, the practitioner has to 'economize' any ambition that his effort be consistent, complete, etc. (Bourdieu 1980).

(6) The concept of 'practice' is located in a rather troubled part of our 'geography of our conceptual scheme'. It is, for instance, adjacent to the concept of 'culture' but its grammar is distinctly different. 'Culture' is not an activity category. One *performs* a practice, but one does not *perform* a culture or a tradition; one belongs to it and one's behavior may exhibit traits typical of that culture or tradition ('customs'). In addition, the term 'culture' is used in bewildering ways, encompassing prevalent patterns of everyday conduct (e.g., dietary preferences, table manners) as well as various 'ideological' phenomena (e.g., notions of virtue and duty, of what amounts to a 'good life'), and even cosmologies. By assimilating 'practice' with 'culture' or 'tradition',

the point of the concept of 'practice' is elided, namely, the point that the 'theory' has a rationale in that it has been abstracted as a body of rules and principles *and* that one, in *applying* the 'theory', is again faced with the 'circumstances' from which the 'theory' has been abstracted. The unity of work is forfeited.

(7) The methodological upshot of all this is, that when we look at an activity as an instance of a practice, we identify it as constituted by a certain body of rules and principles, but *at the very same time* we look at the ways in which these rules and principles and associated skills and techniques (methods, tools) etc. are applied with respect to varying circumstances. A description of a practice will be incomplete if it does not account for the circumstances and their variation, for typical sources of variation, and for typical patterns of variation, just as it will be incomplete if it does not account for practitioners' strategies of handling these variations. Without accounting for the circumstances and the ways in which they are handled, our description would amount to nothing but yet another representation of the 'theory'.

(8) It finally complicates the concept of 'practice' further that what Kant with some reservation refers to as 'theory' is itself a rather manifold phenomenon. There is, crudely put, on one hand official or codified 'theory' in the form of, say, mathematical theorems, 'natural laws', and otherwise established regularities; but the practitioners *also* apply rules and principles they have acquired through experience or emulation. They master a repertoire of strategies, procedures, routines, recipes, etc., just as they, through instruction and training, have developed professional perception (Hanson 1958), that is, the (visual, auditory, tactile) ability to distinguish objects, states, events that are known from experience to be of relevance for their effort (Schütz suggested the term 'typifications' for such distinctions, cf., e.g., Schütz 1953, 1957). Where a novice or an observer perhaps merely notices that the dough now has swollen 'a lot' in the container, the baker may observe that it *now* is quite as it should be. That is, an adequate description of a given practice will also provide a reconstruction of the repertoire of rules and principles that practitioners employ routinely in their day's work, not only the official ('academic') ones, but also the not-yet canonized procedures and distinctions that are passed on through instruction, training, exercise, emulation, typically in an primarily oral culture. Accordingly, an analysis of a practice stands in a recursive relationship to that practice. When the not-yet canonized procedures and distinctions become described and their rationales accounted for, the analysis contributes — potentially — to increasing the validity and scope of the 'theory'. This should not come as a surprise, for the Modern concept of 'practice' was developed for exactly that purpose: as the conceptual underpinning of our intervening in our practices in order to rationalize them: '*éclairer la pratique*' — 'explain' and 'enlighten practice' (Académie Royale des Sciences 1761, pp. xvi f.).

The point?

As demonstrated above, the Modern concept of 'practice' evolved over several centuries, as an intellectual accompaniment to the effort to understand and rationalize received craft practices that, 'born in obscurity', had to be transformed and appropriated into the emerging capitalist production. It was also argued, however, that with the

emergence of machine technology employers and engineers lost interest in something as mundane as work practices. Industrial sociology accepted these mental blinders as demarcating its horizon.

Now, with the contemporary technological revolution, driven by computing technology and especially collaboration technology, the picture has changed completely, not just because of the radical transformations of work and organization afforded by these technologies, but also and especially because the very development of these technologies requires a deep understanding of work practices. This has been the case from the very beginning and is even more so today (Schmidt 2011a, Chapter 11). Hence the renewed importance of the concept of 'practice'.

The development of conventional machine technology had been drastically constrained by the cost of building and modifying control mechanisms. And at the same time, even the most simple mechanical devices often had dramatic productivity effects. Against that background, the issue of adapting machine design to existing work practices could be and was largely, well, an non-issue. Workers rather had to adapt to the idiosyncrasies of the particular machine design. At the most, ergonomists were called in to take care of the design of 'human factors' aspects of the control interface (knobs, dials, and so forth). This was feasible because the design of the machine could be based on scientific theories and engineering models of the processes to be automated (such as those of cutting metal). The engineer could think of himself as possessing, within the confined and controlled domain in which the machine was to operate, powers akin to those of Laplace's demon. Understanding work practices was not considered an issue for engineering as a discipline.

With modern computing technology (i.e., the stored-program digital electronic computer in the form of the mass-produced microprocessor, supported by high-level programming languages, compilers, code libraries) the cost of building and modifying automatic control mechanisms, i.e., software, and hence machines has been reduced by orders of magnitude. And because of the drastically reduced cost of building control mechanisms in the form of software, computing technologies are penetrating work domains heretofore untouched by machine technology. Against that background, the issue of the integration of machinery into work practices has been turned upside-down. Understanding work practices as a basis for systems design has become a practical necessity. Technological research areas such as Human-Computer Interaction, Systems Development, Requirements Engineering, Participatory Design etc. arose to meet these challenges (in different ways).

For CSCW, the challenges are of course the same and yet, radically different. Coordination technologies are fundamentally new technologies in that they are designed and used for the purpose of computational regulation of human interaction. That is, they are computational complements of coordinative practices. Design of such technologies cannot be predicated on an assumption that the designer can anticipate the behavior of the machine in anything approximating the foresight of Laplace's demon.

The point of the concept of 'practice' in the context of CSCW is exactly the same as the point of its original development in the Modern era: to focus on *the unity of action in work*. When we address activities as practices, we are looking at the ways in which the actor's commitment to the 'theory' is upheld in face of contingencies and in which the actor, in the 'fog of war', orients to the criteria provided by the general principles. Thus the concept of 'practice' does work similar to notions such as 'articu-

lation work' (Strauss 1985; Gerson and Star 1986) or 'situated action' (Suchman 1987). It is here noteworthy, however, that while Suchman does emphasize that 'plans are resources for situated actions' and thus insists on the unity of action in work, this insight is all but obliterated when it is stated that situated action is 'essentially ad hoc' (p. ix). In contrast, the Modern concept of 'practice' allows us to maintain a strict focus on the reciprocity of 'theory' and 'practice': *normatively regulated contingent activity*. And finally, by virtue of its focus on the reciprocity of 'theory' and 'practice', the concept of 'practice' provides a unit of analysis one does not find in, for example, the notion of 'articulation work' or in the notion of 'situated actions'. For when we talk about 'a practice' we are talking about an *identifiable category of activity* for which the criteria of similarity are the rules and principles to which actors are committed.

In sum, the concept of 'practice', as developed over four centuries in studies of ordinary work, does not lead to the mystifications inherent in notions like 'shared goal' or to the infinite regress of rule-skepticism as exemplified by, say, 'situated action'. Cooperative work practices are as observable as electromagnetic fields. We can observe and determine the normative make-up of a practice ('rules' and 'principles') when actors, for example, from time to time make excuses for particular actions ('Sorry, my mistake!'), justify their actions ('Well, I had to do it this way because that part there was defective'), sanction the actions of colleagues ('You were supposed to deliver this part at my workstation by lunch'), instruct novices ('Be careful with this!'), or ask for guidance ('Where do I put this draft when I'm done?'). It's a researchable program; it not only works in theory but also in practice.

References

Académie Royale des Sciences (1702). *Histoire de l'Académie royale des sciences, M.DC.XCIX [1699], avec les mémoires de mathématique & de physique, tirez des registres de cette Académie*, vol. 1. Paris: Boudot. – Paris: Gabriel Martin etc., 1732.

Académie Royale des Sciences (1729-34). *Histoire de l'Académie royale des sciences depuis son etablissement en 1666 jusqu'en 1699*, vol. 1-13. Paris: Compagnie des libraires. – Paris: Gabriel Martin, etc., 1732.

Académie Royale des Sciences (1761). Avertisement de l'Academie des Sciences de Paris (1761). In Académie Royale des Sciences: *Descriptions des arts et métiers, faites ou approuvées par Messieurs de l'Académie royale des sciences de Paris*. Neuchatel: Société typographique, 1771, vol. 1, pp. xvi-xix. (2nd ed.).

Agricola, G. (1556). *De Re Metallica* (Basel, 1556). London: The Mining Magazine, 1912. – Dover Publications, New York, 1950.

Aristotle (*c*. 334-322 BCE-a). *Politics*. In *The Complete Works of Aristotle*. Princeton, New Jersey: Princeton University Press, 1984, vol. 2, pp. 1986-2129.

Aristotle (*c*. 334-322 BCE-b). *Metaphysics*. In *The Complete Works of Aristotle*. Princeton, New Jersey: Princeton University Press, 1984, vol. 2, pp. 1552-1728.

Aristotle (*c*. 334-322 BCE-c). *Nicomachean Ethics*. In *The Complete Works of Aristotle*. Princeton, New Jersey: Princeton University Press, 1984, vol. 2, pp. 1729-1867.

Austin, J. L. (1961). *Philosophical Papers*. Oxford: Oxford University Press. (3rd ed., 1979).

Bacon, F. (1620). *The New Organon: Or True Directions Concerning the Interpretation of Nature* (1620). In *The Works*. Boston: Taggard and Thompson, 1863.

Barnard, C. I. (1938). *The Functions of the Executive*. Cambridge, Mass.: Harvard University Press.

Bittner, E. (1973). Objectivity and realism in sociology. In G. Psathas (ed.): *Phenomenological Sociology: Issues and Applications*. New York, etc.: John Wiley & Sons, pp. 109-125.

Bourdieu, P. (1980). *Le sens pratique*. Paris: Les Éditions de Minuit.

Braverman, H. (1974). *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*. New York and London: Monthly Review Press.

Cole, A. H.; and G. B. Watts (1952). *The Handicrafts of France as Recorded in the Descriptions des Arts et Métiers, 1761-1788*. Boston: Baker Library, Harvard Graduate School of Business Administration.

Descartes, R. (1641). *Meditations on First Philosophy* (Paris, 1641). In R. Descartes: *The Philosophical Writings of Descartes*. Cambridge: Cambridge University Press, 1984, vol. 2, pp. 1-62.

Diderot, D. (1751). Art (*Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, Paris, 1751). In *Œeuvres*. Paris: Robert Laffont, 1994, vol. 1 (*Philosophie*), pp. 265-276.

Gerson, E. M.; and S. L. Star (1986). Analyzing due process in the workplace. *ACM Transactions on Office Information Systems*, vol. 4, no. 3, July 1986, pp. 257-270.

Gillespie, R. (1991). *Manufacturing Knowledge: A History of the Hawthorne Experiments*. Cambridge: Cambridge University Press. (Paperback ed., 1993).

Hacker, P. M. S. (1988). Language, rules and pseudo-rules. *Language & Communication*, vol. 8, no. 2, 1988, pp. 159-172.

Hanson, N. R. (1958). *Patterns of Discovery: An Inquiry into the Conceptual Foundations of Science*. Cambridge: Cambridge University Press.

Hobsbawm, E. J. (1964). *Laboring Men: Studies in the History of Labour*. London: Weidenfeld & Nicolson.

Holberg, L. (1722). *Den politiske Kandstøber: Comædie*. København. – In *Comedies by Holberg* (translated by O. J. Campbell and F. Schenck), New York, 1914.

Kant, I. (1793). Über den Gemeinspruch: Das mag in der Theorie richtig sein, taugt aber nicht für die Praxis (*Berlinische Monatsschrift*, September 1793). In *Werke in zwölf Bänden*. Frankfurt a. M.: Suhrkamp Verlag, 1964, vol. XI, pp. 125-172.

Kern, H.; and M. Schumann (1970). *Industriearbeit und Arbeiterbewußtsein: Eine empirische Untersuchung über den Einfluß der aktuellen technischen Entwicklung auf die industrielle Arbeit und das Arbeiterbewußtsein*, vol. 1-2. Frankfurt am Main: Europäische Verlagsanstalt.

Kuutti, K. (2013). "Practice turn" and CSCW identity. In M. Korn, *et al*. (eds.): *ECSCW 2013 Adjunct Proceedings: The 13th European Conference on Computer Supported Cooperative Work, 21-25 September 2013, Paphos, Cyprus*. Aarhus, Denmark: Department of Computer Science, Aarhus University, pp. 39-44. (DAIMI PB - 596).

Laplace, P.-S. (1814). *Essai philosophique sur les probabilités*. Paris: Courcier.

Lorini, B. (1596). *Delle fortificationi di Buonaiuto Lorini, libri cinque: ne'quali si mostra con le piu facili regole la scienza con la pratica, di fortificare le città, & altri luoghi sopra diuersi siti […]*. Venetia: Gio. Antonio Rampazetta.

Luff, P., et al. (eds.) (2000). *Workplace Studies: Recovering Work Practices and Informing System Design*. Cambridge: Cambridge University Press.

Mayo, E. (1933). *The Human Problems of an Industrial Civilization*. New York: Macmillan, 1933. – London and New York: Routledge, 2003.

Montgomery, D. (1979). *Workers' Control in America: Studies in the History of Work, Technology, and Labor Struggles*. Cambridge: Cambridge University Press. (Paperback ed. 1980).

Nelson, D. (1995). *Managers and Workers: Origins of the Twentieth-Century Factory System in the United States, 1880-1920*. Madison, Wisc.: University of Wisconsin Press. (2nd ed.).

Nicolini, D. (2012). *Practice Theory, Work, and Organization: An Introduction*. Oxford: Oxford University Press.
Popitz, H., et al. (1957). *Technik und Industriearbeit: Soziologische Untersuchungen in der Hüttenindustrie*. Tübingen: J. C. B. Mohr.
Reckwitz, A. (2002). Toward a theory of social practices: A development in culturalist theorizing. *European Journal of Social Theory*, vol. 5, no. 2, 2002, pp. 243–263.
Roethlisberger, F. J.; and W. J. Dickson (1939). *Management and the Worker: An Account of a Research Program Conducted by the Western Electric Company, Hawthorne Works, Chicago*. Cambridge, Mass.: Harvard University Press.
Rossi, P. (1962). *Philosophy, Technology, and the Arts in the Early Modern Era*. New York, etc.: Harper & Row, 1970. Transl. from *I filosofi e le macchine*, Feltrinelli Editiore, Milano, 1962. Transl. by S. Attanasio.
Schatzki, T. R., et al. (eds.) (2001). *The Practice Turn in Contemporary Theory*. London and New York: Routledge.
Schmidt, A. (1974). Praxis. In H.-G. Backhaus, *et al*. (eds.): *Gesellschaft: Beiträge zur Marxschen Theorie*, vol. 2. Frankfurt a. M.: Suhrkamp, pp. 264-308.
Schmidt, K. (2011a). *Cooperative Work and Coordinative Practices: Contributions to the Conceptual Foundations of Computer-Supported Cooperative Work (CSCW)*. London: Springer.
Schmidt, K. (2011b). The concept of "work" in CSCW. *Computer Supported Cooperative Work (CSCW): The Journal of Collaborative Computing*, vol. 20, no. 4-5, October 2011b, pp. 341-401.
Schmidt, K. (2012a) Predicate or subject? Assorted notes on the metaphysical notion of "sharing", in: *Workshop: Do We Really Need to Share to Cooperate?, COOP 2012: 9th International Conference on the Design of Cooperative System, 29 May – 1 June 2012, Marseille*.
Schmidt, K. (2012b). The trouble with "tacit knowledge". *Computer Supported Cooperative Work (CSCW): The Journal of Collaborative Computing and Work Practices*, vol. 21, no. 2-3, June 2012b, pp. 163-225.
Schmidt, K.; and L. J. Bannon (2013). Constructing CSCW: The first quarter century. *Computer Supported Cooperative Work (CSCW): The Journal of Collaborative Computing and Work Practices*, vol. 22, no. 4-6, August-December 2013, pp. 345–372.
Schmidt, K. (2014). Praksisanalyse. In S. Vikkelsø and P. Kjær (eds.): *Klassisk og moderne organisationsteori*. København: Hans Reitzels Forlag, pp. 157-180.
Schütz, A. [A. Schutz] (1947-51). *Reflections on the Problem of Relevance* (Manuscript, 1947-51). In *Collected Papers. Vol. V: Phenomenology and the Social Sciences*. Berlin: Springer-Verlag, 2011.
Schütz, A. [A. Schutz] (1953). Common-sense and scientific interpretations of human action (*Philosophy and Phenomenological Research*, September 1953). In *Collected Papers. Vol. I. The Problem of Social Reality*. The Hague: Martinus Nijhoff, 1962, pp. 3-47.
Schütz, A. [A. Schutz] (1957). Equality and the meaning structure of the social world (1957). In *Collected Papers. Vol. II. Studies in Social Theory*. The Hague: Martinus Nijhoff, 1964, pp. 226-273.
Sharrock, W. W.; and R. J. Anderson (1986). *The Ethnomethodologists*. Chichester: Ellis Horwood Publishers.
Stern, D. G. (2003). The practical turn. In S. P. Turner and P. A. Roth (eds.): *The Blackwell Guide to the Philosophy of the Social Sciences*. Malden, Mass., and Oxford: Blackwell Publishing, pp. 185-206.
Strauss, A. L. (1985). Work and the division of labor. *The Sociological Quarterly*, vol. 26, no. 1, 1985, pp. 1-19.
Strauss, A. L., et al. (1985). *Social Organization of Medical Work*. Chicago and London: University of Chicago Press.

Suchman, L. A. (1987). *Plans and Situated Actions: The Problem of Human-Machine Communication*. Cambridge: Cambridge University Press.
Suchman, L. A. (2002). Practice-based design of information systems: Notes from the hyperdeveloped world *The Information Society*, vol. 18, no. 2, 2002, pp. 139-144.
Taylor, F. W. (1903). *Shop Management*. New York: Harper & Brothers. – New York: Harper & Brothers, 1911.
Taylor, F. W. (1907). *On the Art of Cutting Metals: An Address Made at the Opening of the Annual Meeting in New York, December 1906*. New York: The American Society of Mechanical Engineers.
Taylor, F. W. (1911). *The Principles of Scientific Management*. New York: Harper & Brothers. – New York: W. W. Norton & Co., 1967.
Williams, M. (2010). *Blind Obedience: Paradox and Learning in the Later Wittgenstein*. London and New York: Routledge.
Winch, P. (1958). *The Idea of a Social Science and its Relation to Philosophy*. London: Routledge & Kegan Paul. (2nd ed., 1990).
Wittgenstein, L. (1945-46). *Philosophical Investigations* (Manuscript). Oxford: Blackwell Publishers, 2009. (Revised 4th ed.)..
Wittgenstein, L. (1945-48). *Zettel* (Manuscript). Oxford: Basil Blackwell Publishers, 1981. (2nd ed; 1st ed. 1967).
Wittgenstein, L. (1949-51). *On Certainty* (Manuscript). Oxford: Basil Blackwell Publishers, 1975. (2nd ed.; 1st ed. 1969).
Wulf, V., et al. (2011). Engaging with practices: Design case studies as a research framework in CSCW. In P. J. Hinds, *et al*. (eds.): *CSCW'11: Proceedings of the ACM 2011 Conference on Computer Supported Cooperative Work*. New York: ACM Press, pp. 505-512.