diGAP

04/19 Working Paper

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From ‘in the Wild’ into the Wilderness of Field Study Approaches: The Case of the Company Case Study in German Industrial Sociology in Times of Digitalization

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Bundesministerium für Bildung und Forschung

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Karlsruher Institut für Technologie

ESF Europäischer Sozialfonds für Deutschland

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Förderschwerpunkt Arbeit in der digitalisierten Welt

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Abstract: The question of the consequences of digitalization and agility cannot be answered by looking only at the employment statistics. Those who wish to understand the scale and dynamics, gauge the risks and utilize the design possibilities need an empirical insight into companies, for this is where decisions are made about the deployment and forms of new digital technologies. The company as the object of empirical case studies has a long tradition in German labour and industrial sociology. The company case study, action research and subject-oriented labour research are regarded as ideal methodological approaches within sociological labour research in Germany, even though they have different degrees of relevance and are not always clearly delimitable. This contribution presents the methodological traditions in the discipline of the study of labour within companies, and critically discusses these from the perspective of fields of research in the context of CSCW. The contribution will then go on to show that in recent decades the company case stud, as well as the sociology of labour itself, have gradually lost their perspective on technology in both empirical and conceptual terms. This too is critically interrogated from the perspective of ethnographic research traditions focused on technology. There will then be a concluding discussion of further methodological challenges to the empirical investigation of the current digital transformation of labour, and at the same time it is precisely this methodological mix of CSCW and the company case study that creates the opportunity to make visible what is increasingly becoming invisible.

Keywords: action research; case study; digitalization; informatization; sociology of labour; technological change; visual sociology; agility

1 The Case Study in German Industrial Sociology: Introduction[1]

Currently, barely anything in Germany is being debated as extensively as the transformation of labour in the context of Industry 4.0 and other processes of digitalization (Matuschek 2016; Pfeiffer 2017a). Here, both scientific and public discourse often extend far beyond the here and now. Very different forecasts are made on the basis of more or less sound data, and these largely convey two theories: firstly, that digitalization "happens" inevitably, and secondly, that it has predominantly negative consequences for employment (for Germany, e.g. Dengler and Matthes, 2015; arguably most prominently Frey and Osborne, 2017). Here, experts like to quickly extrapolate from vague estimates of potential automation or replacement in individual occupations, and forecast which jobs and careers will disappear over the next few years and decades. The gloomier the forecasts, the higher the impact within science and media, it seems. The question of the consequences of digitalization on the labour of tomorrow cannot, however, be answered by only looking at the employment statistics with yesterday's data.

On the one hand, there have been attempts to predict the effects of the current digital transformation on labour using statistical data and focusing on the labour market. This inevitably means the materiality of technology and the specificity of concrete labour are neglected. On the other hand, there is a multitude of research fields with a more ethnographic, qualitative and participatory slant which consider concrete labour and technology together, often with a focus on the form of the transformation. This primarily includes the interdisciplinary approach of computer supported cooperative work (CSCW), workplace studies – part of the tradition of social and technology studies (STS) –, technography, as well as more recent strands such as human data interaction (HDI). German-language labour research, on the other hand, is not usually, in essence, concerned with the concrete interplay between technology and work practices; instead, its strengths are in the analysis of organizational dynamics, which are pivotal in deciding which concrete forms of labour and technology design are ultimately implemented within the company.

Those who want to understand the asynchronicity and dynamics of the digital transformation must dig deeper, in empirical terms, and proceed differently. Those who want to gauge the risks of the digital transformation, identify the limits of creativity but also utilize the creative possibilities need an empirical insight into the concrete reality of labour today. Despite many tendencies towards erosion and new forms of dissolution, labour still has a prominent place: within the company. The company is the place where current digitalization becomes concrete (or does not become concrete); here, technology and labour are shaped and altered together; the limits and possibilities of the new are demonstrated here. Here, the new proves its worth or fails when it has to be integrated into existing processes, legislative frameworks

[1] The conceptual studies for this article came out of the joint project "Gute agile Projektarbeit in der digitalisierten Welt (diGAP)" (Good Agile Project Work in the Digitalized World, own translation). This research and development project is funded by the German Federal Ministry of Education, Science and Research and the European Social Fund as part of the funding programmes "Zukunft der Arbeit" (The Future of Work, own translation) and "Innovationen für die Produktion, Dienstleistung und Arbeit von morgen" (Innovations for the Production, Services and Work of Tomorrow, own translation) and supervised by Projektträger Karlsruhe.

and factual necessities. Here, technology and labour concretize in the context of commercial interests and power structures. Here, the 4.0 debate is used in a micro-political and partisan way, feeding into new and old myths of rationality. All this determines, to a least the same degree as technology itself, which aspects of digitalization will change which kinds of labour, in what ways and with what consequences. The company is the site of all these dynamic and contradictory processes. The company is not only the stage for this performance but also its director – yet at the same time, it follows a script set by others.

To examine these processes as they arise (and not merely from the point of view of their presumed outcome), and above all to comprehend them, the chosen empirical method is the company case study. The company as the object of empirical case studies has a long tradition within German labour and industrial sociology (H. J. Pongratz and Trinczek 2010; H. Pongratz and Trinczek 2010). However, workplace observation and the recognition of the role of technical artefacts has played a declining role in this since the 1980s.

The CCS, action research (AR) and subject-oriented labour research (SOLR) are regarded as ideal methodological approaches within sociological labour research in Germany. However, there are no clear distinctions between any of the three approaches; in terms of their methodology, they are neither clearly defined nor clear-cut in their approach, and they certainly have considerably different degrees of relevance. We present these three key methodological approaches within company-focused labour research in *section 2* of this contribution. The actual CCS in its three different variants plays a key role here. We briefly summarize the changes it has undergone over the past few years (*2.1*) – in particular in relation to its object – before presenting the other two approaches: action research and subject-oriented labour research (*2.2*). This German-language sociological research tradition is critically discussed in the context of other methodological orientations focused on labour and technology (*2.3*). The aim of this overview and comparison is to present the prevailing methodological approaches within research on German-language labour sociology. These draw on, and have points of contact with, other research traditions which are connected with labour and also refer to the interaction with technology – but they also have their own potential. This contribution discusses the labour sociology CCS, which is different from the labour psychology approach of action regulation theory (Hacker, 1985; Hacker and Melzer, 2009; Volpert et al., 1989) and interdisciplinary CSCW research (Boulus-Rødje et al., 2015; Schmidt and Simone, 1996).

Whereas in the beginning the CCS focused on the technological transformation in particular – with an emphasis on production work – *section 3* plots the trajectory of how this focus gradually changed over time up to the present day: just as, first of all, labour and industrial sociology significantly changed its conceptual understanding of technology and then lost it altogether, there is also a decreasing focus on technical artefacts in the sociological CCS, and an increasing focus on organizational changes.

This loss of a conceptual and empirical relation to technology takes place – astonishingly – in reciprocal relation to the increasing significance of technology within the labour process: from the microelectronics of the 1970s and early 1980s, to the triumph of the PC, to the digitalization of today, the history of mechanization is characterized by a rapid shift away from the production sector, and the increasing influence of technology in the workplace (3.1). The second section (3.2) goes on to critically discuss the disappearance of technology from labour

sociology analysis from the perspective of methodological approaches which focus on technology and its materiality. The aim of this second comparison is to demonstrate how both the company and technology are dimensions that are relevant in the study of the transformation of labour. Approaches from within the fields of workplace studies (Luff et al. 2000a; Orlikowski 2007; Bruni et al. 2016a), technography (Kien, 2008; Rammert, 2011), boundary objects (Star and Griesemer, 1989; Subrahmanian et al.) and human data interaction (Boulus-Rødje et al., 2015; Crabtree and Mortier, 2015) are compared here with the labour sociology case study.

The approaches compared respectively in the second and third section of the CCS are by no means complete, nor does the distribution of approaches across chapters represent a clean separation between them. The CCS approach within German-language labour sociology has proved its worth 'in the wild', but it urgently needs – and this is the central thesis of this article – new ideas from the ethnographic research traditions concerned with the concrete interaction between humans and technology. Here too we encounter a confused 'wilderness' of approaches. These approaches are largely driven by the same engagement and qualitative impetus, but since the 1980s they have sparked lively discussions on methodologies and concepts, leading to numerous ramifications, classifications and references which, as varied as they are, cannot be presented in detail here. The cross-section chosen here – which is inevitably selective – of what can generally be classified as CSCW is focused on the central research objective of this article: to demonstrate that a mutually productive synthesis of CCS and methods within the tradition of CSCW are necessary and meaningful in the face of the current digital transformation of labour.

A vacuum has arisen here which, considering the possible dynamics of change inherent in digitalization, cannot be filled anywhere near rapidly enough. A simple "back to basics" is just not sufficient. The current wave of digital technology requires empirical methods other than physical observation if their effect on labour is to become visible. In this regard we then go on in *section 4* to present a methodological extension of the company case study which takes precisely this as its starting point: the activating visualization method makes it possible to the abstract comprehensible. We use four different examples to show what this might mean in the qualitative survey situation in concrete terms.

Finally, the *fifth section* discusses the methodological challenges faced by empirical research into the transformation of labour in the context of current processes of digitalization. New dimensions in the 'invisibility' of technology are discussed, and from this perspective it is argued that the effects of the transformation of labour require a more engaged and productive exchange between different methodological traditions. The labour sociology perspective on the company and the CCS method have a helpful contribution to make here, but this is urgently in need of a more ethnographic perspective on the interaction with technology in work practices. Research 'in the wild' in the increasingly digital world of work must venture into the wilderness of different research approaches.

2 Field Research Within the Company: Methodological Traditions in German Industrial Sociology

In the tradition of German labour sociology, the study of the transformation of labour has always been inseparable from research within companies. At first, two methodological approaches prevailed in the 1950s and 1960s: on the one hand the physical observation of individual workplaces, including a description of the visible operations and the technical framework, and on the other hand the attempt to capture the socio-theoretical consciousness of the workers via interviews. Research into workers' consciousness predominated into the 1970s; the focus here was on empirically tracing the direct relationship between the concrete working conditions and the attitude of the workers – including in its Marxist form of class consciousness (e.g. Popitz et al., 1957). This research, too, was carried out predominantly within companies. However, the study on industrial labour and workers' consciousness by Horst Kern and Michael Schumann (1970) is usually seen as the starting point for empirical research based on company case studies. This study already employs various empirical methods, combining, for example, secondary analyses with expert interviews, workplace observations and qualitative interviews with workers.

In German labour research it is only later that we see a crystallization of the theoretical foundation for the concept of the company as the place and object of research and as a case that is representative of something greater, with far-reaching structural dimensions. Long before socio-organizational perspectives became more dominant in German sociology, a theoretical basis for the concept of the company had already emerged in the 1970s as a research focus within the sociology of labour: this was the so-called "Betriebsansatz" (enterprise approach, own translation) (Altmann and Bechtle 1971; Altmann et al. 1978; Bechtle 1980). This conceives the company as a unit that acts autonomously, thereby breaking through previously dominant perspectives of technical and economic determinacy from which the individual company can barely escape. The enterprise approach conceives the company as a place where the decisions and actions of the management lead to autonomous, independent strategies. These are, however, not of an arbitrary nature; the company remains a place where capital commercial interests must be directed into organized control and repeatedly brought back into harmony with the contingence of external market and environmental conditions. The use of technology and the design of work systems are seen, from this point onwards, as configurable elements of such company strategies, elements with different applications. They are no longer regarded as determined by technical progress.

That which today, considering the variety of socio-organizational approaches available, seems barely worth mentioning, was a theoretically pre-emptive step with clear empirical consequences for the debate within German labour and industrial sociology at that time. It made it possible to conduct theoretically-based empirical research. The aim of this was to plot the trajectory of how the structural requirements of the environment were translated into autonomous enterprise strategies and implemented practically within companies. In this sense, the study of concrete labour within individual technical-organizational work systems was the expression and result of enterprise strategies, but it did not cause a technologically induced transformation of labour. In fact, this enterprise approach, which was developed at the Institut für

Sozialwissenschaftliche Forschung (Institute for Social Science Research) in Munich (ISF München), never served as a frame of reference for all research into the sociology of labour; on the contrary – it in fact also came under criticism within the discipline.

This brief historical outline of the case study in German labour sociology shows that workplace observation and the recognition of the role of technical artefacts have played an increasingly secondary role since the 1980s; by contrast, the perspective and involvement of different company actors has become, and is still today becoming, more central. Based on a fundamentally critical perspective, the company case study is traditionally regarded as the ideal methodological approach within sociological labour research in Germany, even though it has considerably different degrees of prevalence and relevance.

2.1 The Company Case Study: Still the Ideal Methodological Approach Today

For many decades, the case study was successfully employed within labour and industrial sociology, and indeed in very different forms; often, however, the respective studies hardly ever described the methodological steps in detail. Still today, there is barely any energetic methodological discourse within the discipline, and even in the methodological discourses within German sociology in general, we rarely hear voices from labour and industrial sociology. The history, methodological traditions and development trajectories of the case study within labour and industrial sociology were first treated as an object of research in a project undertaken by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) between 2007 and 2009 (cf. H. J. Pongratz and Trinczek, 2010). Here, for the first time, the company case study was subjected to a systematic analysis. In this context, Pflüger et al. (2010a, 6), with reference to Yin (2008), emphasize that case studies should not be understood as an individual method but as a research strategy which combines very different empirical methods. They argue that the strategy concept is appropriate because the content focus and the question, as well as the analytical and conceptual framework, are indeed established at the beginning of the research, but the methodological details only emerge over the course of the research process. As a typical methodological mix for the case study within labour and industrial sociology, the authors identify qualitative and expert interviews, document analyses and observations – although these are not defined any more specifically – as well as open-analysis methods (Pflüger et al. 2010a, 6–7). The company case study is characterized by its reference to context, multiperspectivity, combination of methods, and openness (Pflüger et al. 2010b, 31). Here, four types of case study are differentiated, less in terms of the choice of methods and more in terms of the relevance of the individual case and the scope of the intended findings (Pflüger et al. 2010b, 44 ff.):

- *Intervention-oriented case study research*, in which the research process is systematically connected with a design intention (here, to a certain extent, we find the same authors and approaches that are presented further below as action research).
- *In-depth case study research*, which aims to analyse prominent individual cases in detail and therefore also draws, to a certain extent, on methods such as participatory observation or hermeneutic methods of analysis.

- *Comparative case study research*, on the other hand, is more focused on capturing the diversity and breadth of a whole spectrum of characteristics. This objective usually involves a higher number of cases as well as methodological approaches which make it possible to compare the cases. The dominant methodology here is expert interviews with selected groups of actors within the company.
- *Socio-diagnostic case study research* generalizes its findings, with the aim of linking general developments in the transformation of the working world to social development prognosis.

In order to comprehend the labour sociology case study's contribution to scientific and public discourse, we must also consider the method from the point of view of its product; this is – as well as the representation of detailed qualitative analyses – ultimately the formulation of *empirically-based, pointed theories* (Pfeiffer, (Pfeiffer 2015)2015). The theory that is most central here, and one which is repeatedly re-told, is that of the transformation of labour. Such theories are compacted from a multifaceted and early – almost intuitive – perception of the most diverse empirical phenomena. This perception only begins to crystallize in the process of conducting several case studies, and is often only mentionable in comparison with the results of case studies from an earlier period when these phenomena were not yet visible. Such a seismographic diagnostic capability within the discipline – notwithstanding the fact that in its early stages it did not fully meet the quality criteria of a positivist concept of science – makes it possible to represent what is not (yet) fully investigatable. The empirically-based, pointed theory is therefore an element of scientific/practice-based discourse with long-term effects, but is largely undervalued as such within and beyond the discipline.

In this way, the industrial sociology case study – indeed, primarily in its subject-oriented variant (cf. section 2.2) – has, for a long time, been making visible the phenomena of the *subjectivization* of work (Kleemann et al., 2002; Moldaschl and Voß, 2002), or the *dissolution of the boundaries* of work (Kratzer, Nick, 2003; Minssen, Heiner, 2006). In addition, with concepts such as subjectivization and the dissolution of boundaries, it has summarized these phenomena in a formula that is also effective outside science – and it did so long before the quantitative data from the German health insurance companies started regularly providing evidence of the constant increase in work-related psychological stress.

At the same time, the case study reveals – more than purely subject-oriented labour research – the extent to which these subject-bound phenomena are the expression and result of, as well as the complement to, enterprise structures. Processes that are going through an acute transformation cannot often, or for long, be captured empirically and comprehensively in their qualitative depth and quantitative significance. Precisely because they take the form of a pointed theory, such diagnoses provided by labour and industrial sociology, and sustained by a multifaceted empiricism, enable a *mutual discourse of interpretation* with regard to the transformation of labour within both science *and* practice. Science and practice can both thereby refer explicitly to the phenomenon – summarized in narrative – establish further narratives of practice and science, and align their respective actions with these.

As much as the sociology of labour and industry contributes to the social discourse on labour with its findings from the case study, it is just as often also uncritically ensnared in this discourse, unable to free itself from the respective socially dominant "standard narrative on

the history of labour" (Kocka 2000). For example, from the 1950s to the mid-1980s in particular, the predominant narrative within the sociology of labour and industry was focused on skilled, male production work within a standard employment relationship in large industrial firms. On the margins and in the shadow of this narrative, however, researchers lost sight of more diverse narratives: e.g. the work of a part-time secretary in a small technical company, or the cashier in precarious employment, but also the public-service engineer or the laboratory assistant in the dairy. When, in the 1990s, the discourse began to link the end of the *labour* society and the *industrial* society with the professed dawn of the information, knowledge and/or service society, labour and industrial sociology altered its perspective too – to a large extent uncritically. Male production work – which had previously occupied the empirical centre – was replaced by (often, again, male) software developers, web designers, creatives. Many of those who had formerly been omitted from case studies came into the empirical light; the former "stars" of the company case study, such as production work, but also the underbelly of the trendy Web 2.0 world, remained in the dark for a long time. On the one hand, the company case study itself set, and still sets, the boundaries between what has and has not been investigated (gender, standard employment relationship, sector); on the other hand, these boundaries are the result of the necessary empirical access to the company: without access to the company, there is no company case study. For this reason too, the world found out much too late – and in fact not through the empiricism of the sociology of labour but through investigative journalism – about the precarious working conditions of unpaid order pickers and package deliverers working for Amazon or Zalando. Due to, among other things, these systematically blind spots in the case study, their story cannot be told without likewise taking into consideration the other relevant methodological traditions in German labour sociology.

2.2 Other Methodological Approaches – Within and Beyond the Company

In addition to the case study approaches – which may, from a non-labour-sociology point of view, appear to be less clearly differentiated than they are within the discourse of the discipline, as set out above – we will briefly outline the other methodological approaches that were, and increasingly are, likewise of great importance in labour research. On the one hand, there is action research. This too is focused on the company – however, less as a research case than as a framework for, and object of, changing design. On the other hand, there is subject-oriented labour research, which becomes increasingly important at the point where the company erodes. Generally, neither orientation sees itself either as a methodological antithesis or as a complement to classical case study approaches. They too derive their significance from the fact that they always refer closely to the company as a "case", even at the point where they distance themselves from it. In neither of these methodological orientations is this distancing a methodology-based criticism of case study research. Instead, they are methodological foci which inevitably arise in conjunction with the changing working world and the new questions associated with it, and which are often not systematically explained.

Whereas the classical methods of labour research in the sense of social science methodology primarily endeavour to comprehend and explain, action research focuses on ensuring researchers also take action to change reality. The aim of action research is to combine (originally socio-psychological) research and social intervention, and this is wholly in line with the thinking of its founder, Kurt Lewin, for whom research was not merely about writing books (Lewin

1951, 280). The fundamental impetus behind action research was to establish practice-based hypotheses and drive meaningful social change on the basis of these hypotheses. Lewin presents the following steps as a guideline for action: (1) finding a general idea ("What do we aim to achieve?"), (2) planning ("How can we achieve this?"), (3) intervention in the social field, and (4) subsequent reflection on the results of the intervention (ibid.)

Werner Fricke, who is an active and persistent advocate of action research as an approach relevant to labour research, emphasizes the difference between research and research-driven change within companies more clearly: he argues that whereas applied social science mobilizes precisely as much knowledge as is necessary in order to change an organization, action research changes an organization in order to generate theoretical and practical knowledge (Fricke 2013, 3). What is distinct about this action research approach – and at the same time it is precisely this that inhibits its recognition in the academic world – is its professed value orientation: action research does not see itself as value-free research – it wants to achieve something. The "litmus test" of successful action research, argues Fricke, is nothing less than whether it has successfully helped to develop democratic structures, dismantle hierarchies, and practise and promote democratic modes of behaviour among participants (Fricke 2013, 4). This objective does not, however, release it from its obligation to meet the quality criteria for the method. On the contrary, collective, methodologically generated reflection as well as contextuality and critical disclosure of the influence exerted by the researchers ensure, more than in many other approaches, that change-oriented research within companies has a high level of validity (Fricke 2013, 11–12). Action research has established one method in particular for use within companies, and this has been employed repeatedly and successfully, primarily in Scandinavia – hardly, however, in German labour research. This method is dialogue conferences (Gustavsen, 2017; Pålshaugen, 2002), whereby various actors from a company participate in the development of implementation plans. The participants analyse the situation in three steps, set common goals, and then agree on concrete action points. This means diverse groups of employees from across the hierarchy come together in both homogeneous and heterogeneous combinations. The researchers chair the dialogue, repeatedly introduce research questions and results into the dialogue, and promote reflective processes within the procedure. The whole procedure is governed by the rules of democratic dialogue. These include, primarily: work experience counts more than position, and differences of opinion must be permitted.

So, the case study approach has dominated labour sociology research since the 1980s at the latest. At the same time, so-called consciousness studies have been replaced by a subject-oriented empirical perspective which takes into account the reciprocal constitutional relationship between human and society, thereby attempting to break with the concept of closer determinacy (Bolte, 1983).

This not only opens up the option of also increasingly taking into account the interplay between work and home environments, and furthermore making gainful employment outside the company accessible to an empiricism based in labour sociology. This *subject-oriented labour research*, which has developed since the 1980s in its critical approach to research into workers' consciousness (Voß 1984; Langfeldt 2009), has been gaining in significance in German labour research since then. Precisely because it is not necessarily bound to the company context as a

"case", it has proven to be particularly applicable to new forms of labour beyond gainful employment within a company. In German labour research, these new forms of labour are theoretically connoted with the term "Arbeitskraftunternehmer" (labour entrepreneur, own translation) (Voß and Pongratz 1998) and are empirically analysed as freelancing, solo-self-employment, or crowdworking (Kawalec and Menz, 2013; Papsdorf, 2009).

With the arrival of both the case study focused on the company as an organizational context and subject-oriented labour research, observational studies related to the individual workplace, as well as the detailed representation of the respective technical artefacts and conditions of work, became much less significant within labour sociology research from the 1980s onwards. Still today, these tend to play a role only in adjacent disciplines, such as in ethnographic labour research (Koch and Warneken 2012) or within ergonomics in the tradition of Hacker's occupational analysis (1995). Although, with the process of increasing computerization, technological components have been gaining in importance in more and more workplaces since the 1990s at the latest, for a long time this has only been subject to theoretical and empirical investigation in niche areas within labour sociology research under the keyword "Informatisierung" (informatization) (Boes and Pfeiffer 2005; Pfeiffer 2010; Pfeiffer 2014), so it has thus far not led to any reflection or even revision of the research methodology across the whole scope of the discipline; even the workplace studies approach (Knoblauch and Heath 1999) has not made any notable ingress into case study research within German labour sociology, although Germany has certainly been receptive to it.

This brief historical outline of the case study in German labour sociology and other methodological approaches within sociological labour research demonstrates that workplace observation and the recognition of the role of technical artefacts have played an increasingly subordinate role since the 1980s, and that by contrast, the perspective and involvement of different company actors – and ultimately the subject – have by now become much more central. Based on a fundamentally critical perspective, the company case study and action research have been traditionally regarded as ideal methodological approaches within sociological labour research in Germany, even though they have considerably different degrees of prevalence and relevance. What they all have in common, however, is that they have, to a large extent, lost their relation to technology and the technological transformation. This has less to do with methodology and more to do with their perspective on technology within labour sociology. Here too, there has been a change in perspective over the decades: in each of the past few decades labour sociology would have offered a very different answer to the question of whether the case study should be the chosen empirical method even in times of major technological change. This is due neither to changes in the object nor to changes in the method, rather to the concept of technology within labour and industrial sociology. The following section will explore the historical course of this changing perspective.

2.3 Into the Wilderness 1: Critical Discussion from the Perspective of CSCW and Action Regulation Theory

The focus of labour sociology research is therefore ultimately always the company context – even where this framework is consciously exceeded. This is precisely where we also see differences between the qualitative approaches of labour sociology and other approaches which

focus more strongly on the level of activity or communication. Here we find, in each case, both differences from and points of contact with other research traditions. We will briefly discuss these here:

Let us begin this comparison with action regulation theory (Hacker and Melzer, 2009; Volpert et al., 1989). At first glance, this has three aspects in common with the CCS: 1. A materialist position originating from the critique of capitalism, i.e. a Marxist position; ultimately, the conceptual origins of action regulation theory go back to materialist psychology, originally developed in the Soviet Union by Leontiev and Vygotsky (cf. the current discussion and rehabilitation of the two authors by Tuleski, 2015). For a long time, German-language sociology of labour and industry, too, has explicitly presented itself as critical of capitalism, and it frequently employs Marxist concepts. In particular, the company is so important to it as an analytical framework because the company is the site where the collision of interests between capital and labour becomes concrete and must be negotiated in concrete terms. 2. Labour sociology, too, takes into consideration (if not in its entirety) the level of work practices. The perspective on human work practices is central to Hacker's approach (1985) as well as to the approach further differentiated by Volpert (1989). Human work practices are understood as targeted objective activity and are separated into different levels of regulation (sensorimotor, perceptual-conceptual, and intellectual). However, in the emphasis on tactically and cognitively driven practices there is a pronounced difference from labour sociology. It is at least true to say that in labour sociology research other practices – informal and emotional practices, practices connected with the body, and above all practices that are not tactical and cognitive – have proved to be particularly significant where these are employed in dealing with the technical (and increasingly digitally networked) and complex reality within the company (Böhle, 1994; Böhle et al., 2016; Pfeiffer, 2014).

At first glance, the CCS does not appear to differ methodologically from other multimedia approaches employed within organizations. Questions are put – predominantly in individual interviews – to various employees and decision-makers from a company, often supported with several group discussions, a number of quantitative surveys, as well as an analysis of company documents. From the perspective of CSCW research, therefore, what is different about, or what is particular to, the CCS is not yet visible purely on the methodological level. The research paradigm and research position within the CCS are indeed very similar to those within CSCW research. However, the considerable differences between the CCS and CSCW are not methodological, rather they exist on three other levels: the intention, the object and the product of the research.

- The *intention* of the CCS is not so much to make design changes but to understand the use of digital technology in the company context. For example, a CCS analyses why particular digital technologies are used in the company and others are not, and which company decision and negotiation processes have led to particular constellations of technical artefacts and the ways in which they are used. Similarly, a CCS examines the consequences – e.g. increased stress, downgrading of jobs, reduction in employment – of the technologies that have been introduced. Here too, the focus is less on which IT design could change these consequences

and more on how various actors within the company evaluate and deal with these consequences.

- The *object* of the CCS within labour sociology is the company. It is true that information is gathered about subjects and their subjective perspectives, and that these are traced analytically; the focus of interest here, however, is not actually the respondent, rather the respondent as the representative of an activity (e.g. the plant operator, the maintenance staff member, the development engineer), of a role (e.g. marketing team leader, production department manager, person responsible for healthcare management), or of institutionalized interests (board of human resources, works council). What is crucial to the labour sociology CCS is therefore the company as a case and not the use of a particular technology in a particular task or team setting. The company is conceptualized here as a site of social determination where capital and work converge in concrete contradiction, a contradiction which must be negotiated on a daily basis. This leads to specific technical and organizational solutions. The company is therefore the framework and the context of the research. It is not, however, about tracing a particular company as a case in its entirety, rather about examining the implementation of digital technologies within different companies and trying to understand the different ways in which these are negotiated. Sampling strategies therefore always refer, on the one hand, to the company (which companies, what size of company, in which industries and with which constellations of interest groups), and on the other hand – depending on the question – to areas within the company (which groups of employees, which level of hierarchy – but always the works council and the management).
- To understand the contribution of the CCS, we have to consider the method from the point of view of its *product*, which is – apart from the representation of detailed qualitative analyses – ultimately the formulation of *empirically based*, *pointed theories*. Of all of these, the main theory – which is perpetually re-articulated – is the transformation of labour. Such theories are developed out of a varied and timely, almost intuitive perception of diverse empirical phenomena, which only emerges once several case studies have been conducted, and is often only identifiable in comparison with the results of previous case studies in which these phenomena were not yet apparent. This seismographic diagnostic ability – which nonetheless, in its early stages, inevitably never meets the quality criteria of a positivist notion of science in its entirety – makes it possible to represent something that is not (yet) entirely investigable. The empirically-based, pointed theory is therefore an element of scientific/practice discourse which has long-term effects but is largely underestimated as such both within and beyond the discipline.

With its specific intention, its central object and its theoretically pointed product, the industrial sociology CCS – although primarily in its subject-oriented variant (cf. section 2.2) – has, for a long time, been rendering visible phenomena associated with the *subjectification* of labour (Kleemann et al., 2002; Moldaschl and Voß, 2002) or the *dissolution of the boundaries* of labour (Kratzer, 2003). In addition, it has been using precisely such concepts as subjectivization and the dissolution of boundaries to summarize these phenomena in a formula that is also

effective outside science – and it has been doing so since long before the quantitative data from the German health insurance companies started regularly providing evidence of the constant increase in work-related psychological stress.

At the same time, the CCS reveals – more than purely SOLR – the extent to which these subject-bound phenomena are the expression and result of, as well as the complement to, company structures. Processes that are going through an acute transformation cannot often, or for long, be captured empirically and comprehensively in their qualitative depth and quantitative significance. Precisely because they take the form of a pointed theory, such diagnoses provided by labour and industrial sociology, and sustained by a multifaceted empiricism, enable, early on, a *mutual discourse of interpretation* with regard to the transformation of labour within both science *and* practice. Science and practice can both thereby refer explicitly to the phenomenon – summarized, in terms of narrative, under a single concept –, establish further narratives of practice and science, and align their respective actions with these.

In comparison with action regulation theory, the computer supported cooperative work (CSCW) approach in the context of the digital transformation – if only due to its name – seems to offer more points of contact with the labour sociology CCS. One obvious aspect they have in common is a strong collective perspective: the focus is not on the individual person and their individual work but on cooperation and joint action – primarily understood as communication. One particular added value of CSCW – especially in a period of dynamic transformation – is its interdisciplinarity; by contrast, labour sociology is a comparatively monogamous research tradition. CSCW research always focuses on how IT systems can improve cooperation and the associated communication between employees. Increasing productivity and efficiency also often have a role to play in this. The intention here is to reduce complexity as far as possible: 'A major research issue in CSCW is to understand how computer systems can be instrumental in reducing the complexity of coordinating cooperative activities […]' (Schmidt and Simone, 1996, p. 155).

'Much of CSCW is devoted to the support of group work […]' (Star and Strauss, 1999, 377). At first glance, this statement seems to fit – but only just – with the research within agile development teams that is outlined above. Labour sociology within the company takes as its starting point interests that are inherently different from one another and therefore typically asks in its analysis which company realities enable or encumber cooperation at team level, which make it easier to control, and which make it more stressful. The IT equipment available is seen here, at best, as an aspect of the case under study, and complexity is usually seen as an unavoidable fact of company activity – a requirement of human action and therefore more of a design requirement in the area of competence development and qualification than in the area of technological engineering. The CCS is therefore concerned with the question of what *exists* – the results of the study can only indirectly influence the design of what is already there. Here, action research, with its strong impetus towards participation and design, would be much closer to CSCW research than the CCS – both are, after all, rooted in a Scandinavian and democratically oriented research tradition.

On the other hand, a productive parallelism between CSCW and labour sociology emerges particularly in the current debate regarding the replaceability of human labour with digitalization: whereas statistical labour market studies ascribe a high degree of routine to many activities

and see this as the crucial criterion for technical replaceability (cf. on this the critical study by Pfeiffer 2017b), qualitative labour sociology endeavours – as does CSCW – to render visible non-routine processes where they are often barely even perceived within the company. When, for example, Suchmann suggests '[…] that simple oppositions of knowledge and routine work are more ideological than descriptive, and act rather to obscure work's actual demands than to clarify them' (2000, p. 44), most experts in German-language labour sociology would agree. The labour sociology CCS is therefore conceptual, and in its methodological perspective it is much closer to CSCW or even to the socio-informatics approach (Wulf et al., 2018) than to more strongly formal approaches such as human computer interaction (Weyers et al., 2017). There is a broad spectrum within these approaches, ranging from strong reference to qualitative perspectives such as grounded theory, to praxeological theories (Stevens et al., 2018), through to formal methods of interactive IT system engineering in terms of 'computer science modelling and verification techniques' (Oliviera et al., 2017, p. 4). HCI was certainly initially strongly characterized by cognitive psychology and therefore strongly geared towards laboratory experiments; it was only once experts began to critically discuss, inter alia, the 'work context gaps' arising from this that HCI also turned towards more strongly participatory and qualitative field methods (cf. Bannon, 2000, p. 235). IS (information systems) research and IS design research, too, have focused for a while now on a strongly qualitative strand explicitly based in grounded theory (see Rohde et al., 2017).

The CCS therefore demonstrates similarities with, as well as differences from, both action regulation theory and the CSCW approach. In the face of the digital transformation of labour, a systematic connection between the labour sociology CCS and CSCW in particular seems to be productive. On the one hand, both CSCW and action regulation theory underestimate the significance of constellations of company interests for the implementation of digital transformation, and could benefit methodologically here from the labour sociology CCS. On the other hand, the CCS lacks any systematic reference to the recognition of technical artefacts and their materiality as significant for the analysis. Here, the CCS needs to draw inspiration from CSCW research. We will discuss this further in the next section.

3 Technology: (Not) an Object of Labour Research

Technology was a key issue for German labour and industrial sociology from the beginning. Its focus was essentially the potential of technology to transform labour. The mechanization of labour was interpreted from the perspective of Marxist forces of production and therefore as a historical process that was the expression of social interests. In this understanding, the process of mechanization, i.e. the strategically motivated use of technology within a company, was therefore an objectified expression of the respective prevailing relations of production. From this perspective, labour and industrial sociology examines the effects of technological transformation on labour and focuses this on three key functions of the mechanization of labour: reducing workload, increasing effectiveness, and process control. The focus is on both the social prerequisites for the genesis and design of (production) technology and the intentions behind its utilization and deployment within the company. This applies in particular to the consequences for living labour and human capital. As well as the changes in qualification

requirements, it also encompasses the question of the potential for emancipation and the hazards of alienation associated with technological transformation. Here, technology, like the work organization of labour, is regarded as a medium through which to deal with the problem of transformation – i.e. the question of how to guarantee the subject's participation and willingness to apply his human capital within the company's operations if his contract of employment is structurally inchoate. We will now show, first of all, how technology, in its materiality, is gradually disappearing from labour sociology research. We will then go on to critically discuss and compare this in the context of, and in debate with, technosociological research.

3.1 The Curious Case of Vanishing Technology from German Labour Sociology

Over the past few decades, sociological labour research has changed the concept of technology: gradually, technology has changed from a central object, defining other aspects of labour, into one aspect on the periphery of the disciplinary focus (Böhle, 2001). Here, it is possible to trace a trajectory of development in terms of content and chronology from an evolutionary faith in technology and advancement in the 1950s, to the technological determinism debate of the 1980s, through to the labour and industrial sociology of today, which is, to a large extent, free from the concept of technology.

Characteristic of the first phase was the assumption of a rising development trajectory from skilled crafts and trades via mechanization through to automation, with the respective corresponding working subjects. This concept of technology was closely connected with the general prevailing sociological interpretation of the industrial revolution, which – apart from theoretical differences – interpreted the social transformation, to a large extent, as the consequence of technological progress. This perspective was consistent with the tradition of the history of ideas, which saw in technological development the opportunity for liberation from the (burden of) labour and from traditional forms of government. These assumptions began to falter from the late 1970s onwards (Böhle, 1998).

While from the late 1970s onwards it became increasingly clear, in empirical terms, that Taylorist forms of the division of labour were becoming less efficient, the previously deterministic concept of technology within the discipline also began to falter and was replaced by other concepts: the interdependency concept emphasized the social effects of technological innovation and viewed technological development itself as a social process (Lutz 1987), whereas the convergence concept (vgl. Pries et al. 1990, pp. 7–9) increasingly applied key ideas on the transformation of labour to various fields (e.g. sales strategy, labour and company organization as well as personnel system). Both concepts thereby opened up new spheres for empirical surveys within CCS research. For the enterprise approach mentioned above, technology is predominantly a means of implementing autonomous enterprise strategies in order to increase labour productivity and to rationalize, and it is therefore analytically significant in its purpose and consequences. None of these concepts places empirical value on technical artefacts in and of themselves or in terms of their intrinsic material logic – quite the contrary. Neither does this change substantially in mainstream labour and industrial sociology when, from the 1980s onwards, information technology becomes increasingly significant.

Whereas in the 1960s the focus was initially on the Taylorization of mental labour, studies on the introduction of microelectronics in the 1980s showed that the use of the PC was also compatible with very different forms of labour and did not necessarily lead to Taylorization and deskilling (Weltz and Lullies 1983). The theorem of informatization (Schmiede 2006) conceptually picked up on this development. This concept stands for the process of the generation and utilization of information – a process which has a long history – in terms of how it functions as a mechanism of enforcing and reproducing a capitalist exploitation logic. This rediscovery of technology within labour and industrial sociology has no methodological implications for empirical CCS research, and, moreover, it tends to be peripheral to, rather than central to, the disciplinary debate.

The empirical results on the relationship between labour and technology reflect the respective underlying concepts of technology within the discipline and how these have changed over time. The automation debate from the end of the 1950s onwards was therefore characterized by the perspective of technology's causal effect on labour. Later on, empirical findings in CCS research demonstrated the relationship between technological rationalization and the replacement of human work (vgl. Kern and Schumann 1984).

From the 1980s onwards, a paradoxical development became more and more apparent. The increasing mechanization of production was accompanied by quantitative and qualitative problems which could not be brought under control through further mechanization. The 'CIM ruins' (Brödner 2007) and the 'Toyota shock' (Womack et al. 1991), which permanently compromised the technological-organizational hegemony of the German automotive industry, led to critical destabilization – not only among the creators and users of technology but also in mainstream industrial sociology. Technology was no longer unambiguous in its effect on labour; instead, it was causing unexpected polarization: the flip-side of the newly available opportunities for qualification and participation for the winners of rationalization was fewer opportunities for the silent sufferers of rationalization, workers in sectors that were in crisis, and/or the unemployed (Kern and Schumann 1984).

At the same time, the challenge of close technological determinism brought with it the possibility of shaping technology around social and human-oriented considerations, and this was reflected in the research programme entitled 'Humanisierung der Arbeit' (The Humanization of Labour, own translation). This programme ran from 1974 to 1998, over the course of which numerous CCS research projects were conducted.

Within this support programme – the largest and longest support programme in German labour research to date – the design focus of the individual projects was, in empirical terms, geared more towards the organization of labour than towards technology. Technology design, on the other hand, became the focus of some projects concerned with 'computergestützte erfahrungsgeleitete Arbeit' (CeA) (computer-supported experienced-based labour, own translation) between 1988 and 1998 (Martin, 1996). The research policy and labour policy activities connected with the initiative 'Gute Arbeit' (decent work)[1] since the end of the first decade of the 21st century have in turn, to a large extent, abandoned the goal of shaping technology, and are even demanding that the traditional technological orientation of early humanization research be 'replaced' by a labour and organizational process orientation (Pfeiffer 2017c). In labour sociology research too, then, technology has ultimately effectively become a 'curious case of

[.] vanishing technology' (Button, 1993). Labour sociology has ultimately taken a social-constructivist step with barely any critical reflection. We therefore agree with Horlick-Jones (2007) that labour sociology has thereby indeed overcome 'narrow technocratic reductionism', however this is at the cost of what the author calls the 'signature of the technology': 'the specific ways in which it is articulated in practical reasoning and discourse within real-world settings' (2007, 41). It is only because of the support programmes resulting from the concept of Industry 4.0 – which has been at the forefront of the debate in Germany since 2011 – that technology has once again become the object of current CCS. However, the debate around the conceptual understanding of technology within labour and industrial sociology has only just tentatively begun. Furthermore, the transformation of technology as the object not only implies the need for conceptual re-thinking but also gives rise to new methodological questions. For these, research traditions which have always taken technology seriously as an object of study, offer useful ideas for the CCS. We will now explain what both approaches can possibly learn from one another.

3.2 Into the Wilderness 2: Critical Discussions from the Perspective of Workplace Studies, Boundary Objects and Technography

Technology, labour and organization are indeed 'three main pillars of contemporary societies', however they are often considered separately (Bruni et al. 2016b, p. 1). The authors focus their investigation on '(…) invisible work required from users in order to make a new technology or design "usable" (and useful) […], as well as an invisible work made by technologies in order to incorporate user's needs and requirements' (2016b, p. 6). They therefore render visible not only further dimensions of invisible labour (for more detail on this, cf. section 4), but also a level of what Rammert addresses with the term 'distributed agency'; with a focus on autonomous systems in particular, he argues for a 'pragmatic turn' (2011, 1): 'It is neither the individual nor the collective human actor, neither the technical artefact alone nor the combined technical system as such. It is the mixed constellation composed of the elements on both sides of the divide […]. This collective agency is constituted by the distributed activities of the heterogeneous units […]' (Rammert, 2011, pp. 16).

It is this techno-sociological focus on the interplay between technology and human which is, on the one hand, neglected within labour sociology and yet, on the other, is all the more necessary when it comes to technology that operates autonomously. However, simply switching from labour sociology to technosociology is not enough. This is because the company as an interest-led site is the environment in which both decisions on the deployment and design of technology and the position of the employee and the tasks s/he must perform are the expression of a specific and systematically asymmetrical constellation of interests. This level is always involved, so to speak, as a third actor – an insight, incidentally, which is integrated into the Scandinavian orientation of CSCW as a matter of course; this is apparent, for example, when the experts explicitly address the role of the trade unions (Floyd et al., 1989, p. 341). It is therefore necessary to systematically combine the respective strengths of the analytical lenses of technosociology and labour sociology. IS research, which is orientated towards grounded

theory, also integrates the organizational level more strongly, proving itself in this sense particularly conducive to connection with labour sociology. Ultimately, this is not only about dividing agency between human and technology within an organization; it also emphasizes that technological artefacts 'must be co-designed, appropriated and enacted for effective use together with other formal structural or procedural resources (integrated organization and technology development)' (Rohde et al., 2017, p. 166).

We have not yet given the fullest impression of the 'wilderness' with the approaches we have discussed thus far. Of these, workplace studies (WPS) is undoubtedly of particular importance from the point of view of labour sociology. The assertion that '[e]very workplace setting is unique and this is reflected in the interpretations of formal and informal work practices in various studies' (Plowman and Rogers, Yvonne, 1995, p. 309) shows that the perspectives of the two approaches are very closely aligned.

Schmidt (2000, p. 142) differentiates between two types of WPS within CSCW: it can either be used as a method of requirements analysis, or it can contribute to the conceptual principles of CSCW – according to Schmidt, both have different roles which must be clearly differentiated. Together with Carla Simone, for example, he makes a conceptual contribution with the 'coordination mechanisms', an empirically-based but nonetheless generically applicable approach for analysing 'use of artifacts for the purpose of coordinating cooperative activities in different work domains' (1996, p. 155). Here, the technological artefact is '[…] more than a permanent symbolic construct; it has a specific material format which, in itself, is of importance to its use' (Schmidt and Simone, 1996, p. 179)[2].

Luff et al. (2000b) also emphasize that WPS is not only meaningful and useful in the context of requirements analyses; they argue that the emphasis should primarily be on interdisciplinarity: on the one hand there is a 'diversity of approaches which inform workplace studies' (2000b, p. 3) and on the other hand WPS 'offer a contribution to [a diversity of] disciplines' (2000b, p. 13). Three characteristics, however, run continuously through this diversity: an interest in situational interactions with technologies in the workplace, 'overwhelmingly naturalistic, ethnographic studies' as a methodology, and finally the attempt to reflect constantly on theories and concepts in order to understand technology (ibid.).

The HDI (human data interaction) community focuses on the challenges accompanying more recent applications such as big data or autonomous systems. Again, we must not regard these as a discrete strand of research. The aforementioned CSCW approaches (including *articulation work* or *boundary objects*) are a source of considerable inspiration here too. The 'emerging field' of HDI is 'concerned with understanding and developing the underlying technologies required to support human interaction with digital data (algorithms, analytics, visualisations, etc.).' And although the authors emphasize, '[w]hether the data is big or small is not of particular concern here' (Crabtree and Mortier, 2015, p. 4), they recognize the new challenge which has arisen primarily in the context of data handling and which should justify the discrete strand of HDI; this encompasses the levels of *personal data discovery*, *personal data ownership and control*, *personal data legibility*, and *personal data tracking* (Crabtree and Mortier, 2015, p. 19).

The intention of the 'field study approach' in CSCW is 'informing design' (Plowman and Rogers, Yvonne, 1995, p. 309). The intention of the labour sociology CCS, by contrast, is to

comprehend the work practices and the situation of the working person within the interestled environment of a company. Whereas 'requirements analysis presumes a mature and reasonably understood technology […] in order to determine if a given family of technologies might be usefully deployed' (Schmidt, 2000, p. 146), in the CCS the existing technology is, at best, examined in terms of its interaction with other aspects, but within the general approach it is included as a barely relevant dimension of the company environment. It is also for this reason that German-language labour sociology finds it comparatively difficult to describe what is new within the current digital transformation: it lacks the categories to describe the technology – and that is even more true of the description of virtual technology; it is more difficult to comprehend the ways in which this works via observation than it is to comprehend, for example, the way a machine works. The methodological challenge of rendering the invisible visible is not, however, simply limited to the virtuality of software in contrast to the materiality of a machine. We will come back to the much more complex contexts involved here in the conclusion below.

Whereas the technology in early CCS research was material and the mutual actions of technology and human were physically observable, this is no longer true of most current technologies. The more digital the technology, the less material the algorithm; the more generic the software, the less easily technology can be captured as an 'object' of research. It appears abstract in itself, it is discussed in an abstract way in the company context, and the ways in which workers work through it and with it elude external observation.

4 Activating Visualization Within Qualitative Interviews (AVIQ)

Within the methodological canon of the social sciences, visualization tends to be an exception – sociology in particular is regarded as positively hostile towards images (Feldmann 2003). Where sociological research does work with visualization, this is predominantly in the context of the graphic representation of research results and within the framework of the analysis. Tufte (2001), for instance, provides creative examples of the graphic preparation of quantitative data with the aim of improving comprehensibility and communicability. Such methods of representation, which facilitate analysis and communication of results, are used mainly in the context of network analysis (Mayer, 2011). In general, web- and/or IT-supported visualization of data has been a higher-profile issue across a range of scientific disciplines for a few years now (Belussi 2007; Chen et al. 2008). The aim here is to approach the corpus of material within both the analytical process and the representation of results through iterative structuring, to access it intuitively and more holistically, and – by comprehending it and appropriating it – make it more graspable (Tufte, 2006). This involves not only taking into account quantitative material but may also, for instance, take the form of a retrospective quantification of qualitative material, as for example in computer-aided clustering (Grimmer and King 2011). In this sense it is not just a question of the representation of scientific results but also of the digital visualization of e.g. concept maps or search results in Web 2.0 and their utilization in organization development processes (vgl. die Beiträge in Tergan and Keller 2005). Visualizations have

hardly any role to play in labour and industrial sociology; in general, the methods used in case study research projects presented above tend to follow classical methods of social research and are mostly based exclusively on the spoken or written word. By comparison, workplace observation features more rarely, and mostly without a systematic methodological approach. Visualization, however – whether in the survey situation or in the representation of results – has thus far had barely any role to play in the methodological canon of the case study in labour and industrial sociology.

We will subsequently present elements of visualization we first developed in the context of our research as part of a project on innovation processes in mechanical engineering (Wühr et al. 2015); since then, we have successfully applied these numerous times within studies in the context of agile project work, and in the meantime they have become an inherent part of the company case study in our research projects.

Visualizations also, without doubt, have a supportive effect within the process of analysis. In so doing, however, they do not replace the work of content analysis with the transcribed interview, but rather serve as a useful complement to the process of analysis within the depths of the narrative. The actual strength of visualizing elements becomes apparent, though, in the survey situation, when they are used in the survey process itself.

The aim here is not to use the images depicted to provoke only one reaction in the interviewees, but to actively elicit from them further visualizations or prompt them to change the visualizations they have been presented with. There are only a few examples of the use of this methodology of visualization in the social sciences. In visual anthropology, for example, photographs and videos are "(...) employed by a social researcher during the course of an investigation, rather than a focus on the visual for its own sake" (Banks 2001, 9). Furthermore, Canfias and Novak (2006) prove that a learning process is activated as an effect of visualization in the interview. It is therefore more than a method of image interpretation from a media studies or art education point of view (siehe etwa Marotzki and Niesyto 2006). The visualizing elements employed here make it possible to bring into the interview situation phenomenon levels relevant to human capital (Pfeiffer 2014) via the subjectivizing relation to the object of labour and the organization of labour, and to do so more effectively than would be possible within a purely verbal interaction. We will now describe, by means of an example, how we used the visualizing elements we had developed.

4.1 Visualized Object of Labour Undergoing a Process of Innovation

In a study on innovation processes in mechanical engineering, the second interview question in the individual interview was a stimulus for the narration, from a subjective perspective, of an innovation story related to a concrete product. A4-format colour photos of this product were placed between the interviewer and the interviewee and were kept visible throughout the whole interview. This method ensures that the actual object of labour that has undergone the process of innovation – the product that has been developed – can be visualized and therefore experienced in a tangible – at least in a visual – way. The product of the innovation process central to the interview also thereby becomes a mutual object in the interaction between interviewer and interviewee, with each participant being able to alternately and repeatedly refer to it within the conversation. The effect, on the one hand, is to find a quick way into the narration

and to elicit, to a large extent, a vivid, concretized description. On the other hand, it makes it possible to distinguish between general assertions and assertions in relation to the concrete innovation process – this is often actively referred to by the interview partners themselves. It is precisely this reflective stimulus, latent in the image on the table, which often generates particularly informative interview passages, shedding light on the question of to what extent the innovation process described is of an exceptional or exemplary nature in comparison with the innovation culture within the company as a whole. The pictorial representation of the product that had been developed therefore also brought technology into the interview situation as an actor. This meant that it functioned not only as a narrative stimulus and memory prompt over the course of the conversation, but – so to speak – sat at the table too: the interaction between the engineer and the artefact being developed in the actual innovation process was therefore reflected in a tangible way in the interview situation.

4.2 Visualizing Representation of Collaborative Relationships

In the same research project, the initial question was about the proportion of innovation across all departments along the product life cycle. We therefore used a further visualizing element in the interview situation: a depiction of the ideal-typical product life cycle, a depiction created by the German mechanical engineering industrial association (VDMA 2008, 7). The diagram used in the interview corresponds, in terms of content and theme, to the specifications of the industry, but it was reduced enough to allow, at the same time, enough space for the interviewees to write on it and make changes to it. This A3 depiction of the stylized product life cycle was used as a basis throughout the interview. Initially, the depiction was introduced with a request to the interviewees to enter any necessary changes directly onto the sheet in order to ensure that the diagram depicted, as effectively as possible, the actual stations of the innovation process under study from the interviewee's point of view. Some interviewees made detailed changes here (cf. Fig. 1).

The interview passages accompanying this process of re-writing and partially re-sketching initially revealed that the ideal-typical product life cycle is, at certain crucial points, uncharacteristic of the sector. Further questions related directly to the proportion of collaboration and innovation demonstrated by the participants within the innovation process across the product life cycle they had described. The next step was to ask the interviewees to place themselves and their own position within the innovation process under study on the PLC depiction. These dots were often placed between two ideal-typical stations on the PLC diagram, or more than one red dot was stuck onto the sheet – the accompanying reasons given here provided not only a deeper insight into the interviewees' concrete activities and responsibilities (often also those that went beyond their official allocation within the organizational chart) but also shed further light on the actual character of the product life cycle within the respective company.

The crucial question on the product life cycle – always in relation to the chosen concrete object of innovation – concerns the estimated proportion of innovation at each station of the innovation process. The first question was who had made a substantial contribution to the innovation described. The interviewees were asked to mark the respective stations on the PLC diagram with further sticky dots in blue. The subsequent question was which stations should

have been allotted a greater proportion of the innovation process, even if – for whatever reasons – this did not happen at the time. This too was actively visualized by the interviewees by sticking on further dots, this time in green. It was particularly interesting to note here that frequently, before sticking on the dot, long, often very concrete interview passages ensued, in which the interviewees gave detailed reasons as to how they had arrived at a particular decision – visualized by sticking on the dots – weighing this up by talking to themselves. These interview passages persistently proved to be more vivid and less schematic than question-answer situations – which often arise in interviews – usually allow. Again and again, not only did this help to produce longer and more intensive narrative passages, but in particular, the visualized processes of consideration and reflection before deciding where to place the dot allowed insights of a kind rarely found in other qualitative interviews in the context of company case studies.

4.3 Thermometer Metaphor as a Way of Visualizing Feelings of Stress

Stress has become an increasingly hot topic over the past few years, particularly in highly-qualified knowledge work. Whether in engineering or software development, whether in conventional or agile project management, labour research in Germany continually finds evidence of an immense intensification of labour and an increase in psychological pressures in particular (Gerlmaier 2010; Pfeiffer et al. 2014; Carstensen 2015). Often though, the interview partner's own stress is difficult to verbalize, for it is, to a certain extent, individually suppressed, and is barely addressed within the company culture, especially in IT companies with younger employees. A simple visualizing element is particularly effective in capturing this topic in the interview, nonetheless. It helps the employees to describe and name their subjective stress situation. The employees have to actively draw onto this visualization too. It is a schematic representation of a type of fever thermometer with two diametrical values for the two stress situations which, in the interview question, we call, in everyday language, "in the green" versus "at breaking point" (see Fig. 2). The interviewees are asked to mark the current stress situation they are experiencing by spontaneously placing a dash on the scale between these two poles on the picture of the thermometer.

The research experiences with this simple element over the five years it has been used in research across various sectors and companies repeatedly shows that the statements concerning the decision on the position of the dash are usually – and particularly where interviewees feel they are under a lot of pressure – accompanied by highly emotional and deeply reflective interview passages.

By placing the dash, the interviewee has to actively engage with his own stress, and this helps to negotiate a thematic shift in the course of the interview which might be perceived as a disruption – the shift from the innovation process, perceived by the subject as 'external', to the highly subjective issue of stress, which, in the day-to-day operations of the company, can predominantly only be dealt with on an individual basis. The entries are often very hesitant, and in many cases they come very late, after long phases of reflection and noticeably long periods of silence. It is often apparent that the activating visualization – even though it is barely more than a single dash – makes it easier for the interview partners to gradually adopt an attitude of reflection focused more on their inner lives. The sometimes surprisingly personal

interview passages offer deep insights not only into the ongoing stress situation but also, and above all, into the individual's coping strategies. The atmosphere of the interview situation frequently switches here from subjective, yet still focused on the objective, such as the pictures of the product life cycle, to intense, very personal insights into the private life 'behind' the professional subject in a manner otherwise only seen in biographical interviews on deeply emotional issues. On the basis of these experiences, we have used this methodological element (as well as the one presented below) by default ever since, even in projects with wholly different questions, as long as the issue of stress might, or does, have a role to play.

4.4 Blank Pie Chart as a Way of Visualizing Work Content

A third element we present to the interviewees in the interview with the request for visualization is a diagram of an "untouched" pie, i.e. a depiction of a blank circle (cf. Fig. 3). This, as the interviewer explains, symbolizes 100% of the interviewee's actual working hours. The interviewee is then asked to draw in and name slices of pie to represent important proportions of his working hours. In our experience, interviewees predominantly respond to this request with a high level of earnestness and precision. They usually add percentages to their entries without being asked to do so, and they often check whether the final sum adds up to 100% and not a different number by mistake.

This process of active visualization, i.e. the process of labelling work activities and drawing on and numbering the pies, generates dense and highly narrative interview passages. Here, the interviewees often enter into a candid dialogue with themselves. This creates a high degree of openness with regard to the topic under discussion, something rarely achieved by merely conducting a conversation in a qualitative interview. Usually, the process prompts the interviewees to thoroughly, independently, and without being asked to do so, structure the groupings, names and clusters of work content under discussion – which means they turn out differently.

Even more productive is the connected question of which of the marked proportions the interviewees feel are an actual and, so to speak, legitimate part of their own work, and which they feel are disruptive or deviate from their intended job profile. Precisely because this question follows on from the pie chart the interviewees themselves have just created, it gives rise, at this point too, to in-depth, reflective interview passages, which include interviewees talking to themselves. The use of this visualization generates increased and denser narration on concrete job content and the subjective assessments of this; often, the interviewees themselves become aware of the reasons for their stress for the first time through this process: they realize that the increase in their work is due to taking on more and more purely administrative tasks – this was frequently found to be the case in conventional project work.

Overall, the use of the visualizing elements presented here over the course of the interviews proved to be extremely productive, and the interviewees consistently responded well to it. The visualizing elements do generate more intensive and qualitatively more detailed interview passages than are produced by interviews without this support. Moreover, they promote a higher degree of openness with regard to the topic under discussion – ultimately, with their pen or sticky dot, the interviewees have more structuring "power" in the interaction situation than the interviewer does.

5 Company Case Study: Highly Topical *and* a Case for Further Methodological Development

The more digital the technology, the less material the algorithm, the more generic the software: as such, it is all the more difficult to nail down technology as an 'object' of research. In itself it is abstract; in the company context it is discussed in an abstract way; and dealing in it and with it eludes external perception. Whereas the actions of a worker on a machine appear – at least at first glance – as accessible to sociological observation, and at least describable as phenomena, work on the computer initially looks very similar from an external perspective – whether an engineer is designing in CAD, a wages clerk is entering figures into an excel table, or a medical specialist is documenting care methods: pure external observation of what is taking place shows the same thing in each case: a person looking at a screen and using a keyboard and a mouse. We have to come closer if we want to see the menu and opened windows, identify the software being used or the content of the document that is currently open. If we want to understand more, purely looking at the computer is no longer sufficient: we must ask what exactly is being done here, the intention behind it, and what the restrictions and consequences of it are. This final stage in the attempt to comprehend the technology is equally necessary when dealing in and with both material and non-material artefacts. Star and Strauss (1999, p. 377) argue, that '[n]o work is inherently either visible or invisible' and that we always "'see" work through a selection of indicators: straining muscles, finished artifacts, a changed state of affairs. The indicators change with context, and that context becomes a negotiation about the relationship between visible and invisible work. With shifts in industrial practice these negotiations require longer chains of inference and representation, and may become solely abstract' (ibid.).

'As computer use moves from single to group task and communication, the jobs of tuning, adjusting, and monitoring use and users grows in complexity' (Star and Strauss, 1999, p. 10). This kind of work is called articulation work: 'work that gets things back "on track" in the face of the unexpected, and modifies action to accommodate unanticipated contingencies. *The important thing about articulation work is that it is invisible to rationalized models of work*' (Star, 1991, p. 275); 'articulation work manages the consequences of the distributed nature of the work' (Star and Strauss, 1999, p. 10). Star und Simone develop 'elemental categories of articulation work', thereby differentiating, for example, between 'articulation work with respect to the cooperative work arrangement' and articulation work 'with respect to the field of work' on the one hand, and 'nominal and actual articulation work' on the other (1996, p. 190); both are 'qualitatively different': a nominal 'task is expressed in terms of what, an activity in terms of how.' It is through this precise differentiation, which barely features in the methods of the labour sociology CCS, that CSCW research is able to bring the invisible to light.

Other authors, too, have dealt empirically or conceptually with non-visible, or less visible, forms of work. Nardi and Engeström (Nardi and Engeström, 1999, p. 1) address four variants of invisible work: (1) highly-qualified work at invisible 'behind the scenes' locations; (2) manual and apparently routine work, of which the relevant aspects of knowledge and problem-solving ability remain invisible; (3) domestic and cleaning work performed by people who have been

rendered invisible; and finally (4) informal work which is not advertised in the job description but is of great factual and functional significance.

Star and Strauss argue along very similarly lines, however they define three dimensions of invisible work: '*Creating a non-person*' (invisibility of the person, e.g. domestic and service work); '*Disembedding background work*' (invisibility of relevant aspects of work, e.g. nurses' work 'embedded under a general rubric of "care", and usually taken-for-granted'; "*Abstracting and manipulation of indicators*", especially '[f]ormal and quantitative indicators of work [.] abstracted away from the work setting' – a process which is seen both within the company (key figures) and in the statistics (1999, pp. 16–23).

They also discuss all three dimensions of invisible work in terms of the technological transformation and CSCW requirements. In the case of the first, technological, and in particular digital, transformation can significantly extend this work – with negative consequences for the structure of the labour market and the social structure; long before the platform economy, the authors had already diagnosed that in 'the creation of large-scale networked systems, this process may cascade' (1999, p. 20). In the case of the second, they emphasize that '[b]ackground work is vulnerable to oversight in the design of CSCW systems' and that, conversely, the 'analyst or systems developer risks violating people's autonomy' (1999, pp. 21–22); in the case of the third, the authors finally touch upon current technologies again: '[…] with the advent of "affective computing," smart badges, and other forms of linking presence, thought and emotion in advanced CSCW applications' it becomes even more relevant for CSCW research too that '[…] the use of abstract indicators must be understood in light of the contexts and relationships of visible and invisible work' (Star and Strauss, 1999, p. 23). Furthermore, the design recommendations from the perspective of invisible work – made explicit elsewhere – only become particularly relevant in the context of the current digitalization, such as when the authors emphasize the importance of privacy or of obtaining access to the overall system (1999, pp. 25–26).

Here too, the labour sociology CCS has a lot in common with the CSCW perspective, particularly in connection with action- and subject-oriented labour research. For example, acquiring autonomy and individual room for manoeuvre in terms of design and action has always been a guiding principle of labour sociology too. In terms of the company, however, whereas labour sociology concentrates on the arena in which the negotiations take place at the intersection between visible and invisible work and attempts to analytically comprehend their organizational representation, CSCW focuses on their design – their technological design in particular. The more not only business processes but also work processes are increasingly shaped by technology – in the form of new digital technologies – and are therefore also influenced by design decisions beyond the company, the more labour sociology can, and ought to, learn from CSCW research. Conversely, however, the more the company as a whole becomes the design object of technical systems by becoming increasingly networked, the more CSCW can, in turn, draw inspiration from the labour sociology CCS.

An increased reciprocal relation between the two research traditions compared here makes particular sense where each has a normative framework. For example, the 'Scandinavic approach' (c.f. Floyd et al., 1989) of CSCW research in particular sees itself as a contribution to 'working life democracy', at the same time seeing the trade unions as a close collaborator

(Bjerknes and Bratteteig, 1995, p. 74). This attitude and practical willingness to cooperate is also present in many areas of labour sociology research.

One of perhaps the most important empirical contributions in terms of making invisible work visible in the workplace is Orr's study on service technicians; she establishes that not only the 'study of work practice is unusual' (1996, p. 8), rather that we all 'rarely talk about what we really do in the doing of the job' (1996, p. 1). In addition, her ethnographic study – more so than any other – gives us an insight into the working world of service technicians in their interaction with the photocopiers in need of servicing, but also with the customers. Ten years later, the author reflects on her study back then and in fact admits that '[…] the organization does not appear significantly in the book' (2006, p. 1805). Orr does justify this, and initially her justification seems to make sense: ultimately, she argues, the focus was not on the Xerox organization but on the 'work of technicians within Xerox […a]part from the intrusions of management through documentation, parts supply, and policy'; because 'the technicians were a relatively self-contained community […] telling the story of the technicians at work did not require a greater part for the organization' (2006, p. 1807).

Here we see a major difference between the labour sociology CCS and workplace studies. From the point of view of labour sociology, precisely this connection would be very productive. The CCS would ask whether service technicians in two differently managed companies operate in the same way with technology and customers; it would ask, for example, whether a trade union interest group can influence the organization and the technological infrastructure; it would try to find out why and how management intrudes, and whether service technicians are able to function as a quasi self-operating unit only under certain conditions. Furthermore, it would try to find out why the technical and organizational conditions of work were designed as they are, and which negotiation processes, industry influences, and path dependencies they are based on.

With increasing globalization, there is a growing demand for locally distributed collaborative work; this also places specific demands on data collection in ethnographically oriented studies. For example, Prikladnicki et al. describe basic difficulties such as 'gaining access to field sites, building trust and documenting distributed and complex work practices in the context of several research projects […], understanding local languages and different cultures, observing synchronous interaction, or dealing with barriers imposed by political conflicts between the sites' (2014, pp. 822–823).

It is precisely where the aforementioned problems arise that the strengths of the labour sociology CCS become apparent. Because they see the company as a case, and because they analyse work practices in the context of this case, the way different cases and the difference between their approaches are dealt with is as normal a methodological challenge as the consideration of various interests. In labour and industrial sociology these are not only seen on the axis of capital and labour – negotiations of interests between functions, levels of hierarchy, locations etc. also play a systematic role.

The CCS thereby continues to prove itself to be a highly current methodological approach to investigating the transformation of labour. It is furthermore an approach that has not only studied the transformation within the company but has also repeatedly reacted to this by

changing its methodology. This is particularly apparent in SOLR: this has opened up the perspective on relationships and developments beyond the company, without in so doing losing sight of the company as an empirical and methodological starting point. In *section 2* we tried to trace the company case study's potential and capacity for transformation as the ideal methodological approach within labour sociology. The transformation of labour is not only connected with technological change, but it is certainly more strongly connected with this than in previous years. This technological change is predominantly – if we forget robotics and 3D printing for a moment – digital and therefore abstract, which means it cannot be empirically observed in the workplace. As a methodological extension, CSCW methods can therefore make a relevant contribution to the conceptual studies which appear to be necessary for a rediscovery (or rather, a new discovery) of technology within labour and industrial sociology. This could be a productive way of compensating for the conceptual deficit in labour and industrial sociology with respect to technology and its role in the field of labour, as described in the *third section*. Currently, one of the most important challenges within research policy therefore should that of relating the largely parallel traditions of technological sociology and its methods to labour sociology and its CCS approach in a conceptual and methodologically more systematic way.

The study of the current digital transformation of labour on the one hand and the methodology of the CCS on the other are both facing further challenges – some new, some heightened – which demand methodological answers. These challenges can be defined heuristically through the *power of discourse* and a *future focus*. We will now briefly outline these and discuss them from a methodological point of view.

For many decades, the concrete technological transformation of labour was predominantly a specialist discourse within the company world, albeit accompanied by a labour policy discourse. Only in the 1980s did the discourse on the technological transformation of labour extend its reach in the face of increasing mass unemployment at the time. The term Industry 4.0 and its associated and deeply interest-led discourse, on the other hand, reached companies not as a consequence of, or reaction to, the technological transformation, but rather as a task, a guideline and a warning, setting out what had to be done and, above all, how quickly it was necessary to act. Qualitative interviews in the context of CCS reflect this discourse like echo chambers. Those conducting the interviews have to work increasingly hard to 'get behind' the discourse, so to speak, in order to find out – instead of abstract platitudes – the company experts' and employees' concrete opinions on their own company, their own present status, and their own work.

The strong future focus of the transformation debate is inspired by this discourse, among other things. Science and media are trying to outdo one another in their forecasting, management consultancies and interest-led think tanks are constantly flooding the public with new studies containing technological visions which often reach far into the future but have little to do with the concrete experience of employees on the one hand and the current potential of new technologies on the other. The dynamics of change encounter – depending on the company, the sector, and the structure of the labour market – highly heterogeneous initial and environmental conditions. We should therefore assume that the digital transformation is proceeding asynchronously and impacting in different ways. This would seem to suggest the need

for differentiation and precise observation, but it seems the temptation to formulate big theories and normalize through trend predictions is too great. Currently, for example, there is a lot of discussion around how a society could finance itself if it were to delegate all gainful employment to robots and algorithms. The discourse around the seemingly more banal design requirements with regard to individual, current and real aspects of the technological transformation in concrete fields of application is comparatively quiet. However, a multitude of such concrete (operational) individual decisions is playing a significant role today in shaping the work of tomorrow and defining what we can take from an algorithm in real terms the day after tomorrow. This challenge can, and must, be answered by overcoming the methodological silence between the qualitative labour sociology CCS on the one hand and the quantitative labour market and occupational statistics on the other. We can only understand the transformation in terms of its dynamics, asynchronicity and intrinsic logic within the operational environment if we study it from within an analytically informed but qualitative paradigm. Here, the CCS is the method of choice. Its findings, however, are barely commensurate with statistical labour market research because they are so dense and differentiated. By contrast, it is the large data sets which can indicate systematic relationships and trends. Statistics, however, always amount to a retrospective representation; the phenomenon they are least able to systematically 'measure' – mainly in periods of radical change – is precisely the measurement that is needed: the new. Both methodological schools have been existing side by side for too long; only a few researchers are actively working on their highly productive peripheries and in their grey areas. To study the digital transformation, we need both.

Endnotes

1. As well as a labour policy design initiative, the title 'Gute Arbeit' also stands for a research approach with historical roots in the qualitative case study research of the aforementioned research program 'Humanisierung der Arbeit', but it is itself of a quantitative nature. The DGB-Index Gute Arbeit is a representative survey conducted annually, since 2007, across the whole of Germany (Holler, 2014). The 2016 survey, with more than 4,000 respondents, included questions on the digitalization of labour (Krüger and Foehrmann 2016).
2. They demonstrate this, for example, not only for IT systems but also for a checklist or the logic of a Kanban system. In the case of the latter, what they describe in terms of propagation steps, and the summary knowledge that is thereby lost to the user, can be transferred almost one-to-one to the mechanisms of back propagation, as is typical of artificial neural networks, which are currently popular.

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