



The organization is a repair shop

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abstract

This paper looks at organization from the perspective of ‘broken world thinking’ (Jackson, 2014: 221). This means to appreciate the way organizational processes, structures and behaviours are subject to fragility, disintegration and breakdown and how, in response, they are incessantly held up, restored and fixed. I take repair as an analytical lens to look at the case of Company N., a mid-sized metal-working business. Going through the process of implementing a new Enterprise Resource Planning (ERP) system, it finds itself in an exceptional situation entailing a lot of repair work. However, it turns out that repair is never completed. Rather, both before and after the system switch, Company N. is imbued with the need of constant fixing. Thus, even though the company counts as a manufacturing business, it is basically a repair shop. Concentrating on the company’s practices of repair – in all its variations – points to the way organization is locally and precariously accomplished. It also shows how struggles over power and resources are situated within the never-ending business of repair.

Introduction: The perspective of repair

The stability of organization, its inertia and the inexorable iron cage it constitutes have occupied many scholars in organization studies and elsewhere (e.g. Weber, 1930; Hannan/Freeman, 1977; DiMaggio and Powell, 1983; Barker, 1993; Dale, 2005). The recurrent discussions about the difficulty of *changing* organizational structures and behaviours are related to this assumption of stability (e.g. Kaufman, 1995; Douglas and Wykowski, 1999; McNulty and Ferlie, 2004; McMillan, 2013). However, over the past decades quite an opposite way of thinking about organization has emerged. It considers organization not as a stable entity, but as the temporary product of practices of organizing. This stream of research is marked by integrating process philosophy, pragmatism, linguistics,

ethnomethodology and practice theory into the study of organization (e.g. Weick, 1995; Feldman, 2000; Cooren, 2001; Tsoukas and Chia, 2002; Czarniawska and Hernes, 2005; Hernes, 2008; Ribes et al., 2013; Langley and Tsoukas, 2017). In a short text on ‘Organizing as a mode of existence’, Bruno Latour condensed many of these arguments acknowledging ‘the mass of work’ that has been done in organization studies in order to complicate and re-describe notions of organization (Latour, 2013: 47). One of the crucial points is that ‘there is no inertia at all in an organization. But if you stop carrying it along: it drops dead.’ (Latour, 2013: 41) Carrying out an organization means translating it, hence taking it from one moment to the next. Thus, attention should be focused on the ‘tiny transcendence’ (Latour, 2013: 50) which also leads to ‘the precise *tools* that allow the organization to shift from one sequence ... to the next’ (Latour, 2013: 47, emphasis in original).

Adding to this stream of research, I would like to suggest ‘broken world thinking’ as Steven J. Jackson has proposed with regard to a technologically saturated world (Jackson, 2014: 221). Instead of stability and rigidity, broken world thinking assumes ‘an always-almost-falling-apart world’ (*ibid.*: 222). It implies that technologies and their material as well as social infrastructures or ‘complex sociotechnical systems’ (*ibid.*: 223) are fragile goods, always about to disintegrate. What keeps them from dissolving is the incessant work of maintenance and repair. Broken world thinking is about asking ‘what happens when we take erosion, breakdown, and decay, [...], as our starting points’ (*ibid.*: 221). Directing attention towards the many spots where dissolution and breakdown set in, it develops ‘a deep wonder and appreciation for the ongoing activities by which stability (such as it is) is maintained’ (*ibid.*: 222).¹ Applying this view to the study of organization means considering organized-ness not only as a local and constant accomplishment, but also as a precarious one. Organization does not exist in a self-evident and stable way, but it demands to be enacted. Enactment means assembling human and material resources and it is this delicate assemblage that seems to be crucially related to the work of repair.

In this text, I adopt the perspective of breakdown and repair and use it as a filter to look at organized action.² The specimen of organized action that I will work

1 Alongside Jackson, articles on repair in cultural studies, media studies and STS that guide my exploration are de Laet and Mol (2000), Larkin (2004), Graham and Thrift (2007), Irani (2015), Russell and Vinsel (2016), Graziano and Trogal (2017), Houston (2017), as well as the conferences *The maintainers* in 2016 and 2017 [<http://themaintainers.org>].

2 This begs the question of whether such a focus on breakdown and repair relates to an actual increase in fragility and drift of organizations and institutions. According to Jackson, ‘the twenty-first century world’ can indeed be considered as being marked

with is Company N., a mid-sized metalworking business located in the south of Germany.³ I will report on and marvel⁴ at the activities of repair that I found there. Hence, in this text, repair is not used as a metaphor, but it refers to concrete practices of coming to terms with the fact that ‘unexpected things can happen and things go wrong’ (Wynne, 1988: 162). The practices of repair that I encountered at Company N. can be separated into two groups. On the one hand, there is exceptional and transitional repair, on the other there is daily and never finished repair. Or, put differently, what drew me to Company N. in the first place was an exceptional period likely to come with a lot of repair work. Concretely, this is the implementation of a new encompassing enterprise software (ERP system).⁵ However, this exceptional period then turned into the background, with the realization that repair never seems to be completed. Rather, great parts of Company N. are marked by a continual need to repair. Hence my claim: Company N. would commonly be categorised as a manufacturing business, but it is actually also a repair shop.

The text consists of four parts. Following this brief introduction to the perspective of repair and the set-up of the study, I will introduce Company N., the case the text at hand is dealing with. This part provides some context for the scenes of repair that are the main focus of the following section. Corresponding to the basic insight stated above, it is divided into an account of exceptional repair and an account of constant repair. The text closes with a discussion further

by ‘risk and uncertainty, growth and decay, and fragmentation, dissolution, and breakdown’ (Jackson, 2014: 221; also Giddens, 1990; Beck, 1992). Maybe these are genuinely novel hallmarks of organization in the new millennium. However, within process organization studies they would be considered as having always been present in organization, however covered and maybe also stabilised by powerful imaginaries of firmness, immutability and determination.

- 3 Fieldwork was carried out between 2012 and 2015. It consisted of 30 days in total of following processes at Company N., conducting interviews, attending meetings, taking photographs, spending time there.
- 4 I borrow this position from Marianne de Laet and Annemarie Mol’s investigation of the Zimbabwe Bush Pump, in which they foster an appreciation and admiration of both the people and structures studied. ‘For we happen to like, no, even better, to *love* the Zimbabwe Bush Pump in all of its many variants.’ (de Laet and Mol, 2000: 225) They advocate the role of the researcher to perceive and describe the accomplishments and successes of their object of research, allowing yourself ‘to be *moved by it*’ (ibid.: 253).
- 5 ERP stands for Enterprise Resource Planning. These business software packages are usually divided into modules according to the standard functional areas, such as sales, planning, production, quality control, stock, procurement, shipping, accounting, and staff. Each department is working within their respective module, but every entry is made into the common database. Hence, they turn into the informational basis of all the other modules in real-time (cf. Pollock and Williams, 2009).

developing three aspects of repair in the context of organization that the case of Company N. is pointing to. These are: the ubiquity of repair; repair as integration of labour and the (in)visibility of repair.

The organization

Company N. is a mid-sized metalworking business established in the 1950s. It has about 115 employees, most of whom work in production. The production facilities consist of seven assembly lines and even though it is a ‘fully-automated’⁶ production, every step of assembly is assisted by workers integrating the machine and the product-in-the-making. Each line ranges from raw material (coin-shaped aluminium platelets) through to the final product: printed cans, mostly intended for hygiene products such as deodorant and shaving foam. At the end of assembly, the printed cans are packaged and subsequently sent off to bottling (which is not done by Company N., but by its customers or their suppliers).

The production lines are the central element of the company. All the other units are arranged around the lines, serving and sustaining them in different ways (fig. 1). The activities at Company N. can be sorted according to a) the preparation of production, b) support during production and c) processing after production (fig. 1). This is roughly the way Company N. operates:

- a) Preparation of production: sales and production planning deal with setting up and coordinating production orders as well as signalling them to other departments related to production. The printing department develops the prints that go on the cans (in consultation with the client) and it prepares the printing template. The stock department provides the raw material needed in the first step of production.
- b) Support during production: the shift supervisor oversees and coordinates the production, which consists of three main steps: ‘pressing’, ‘printing’, and ‘pulling in’. Quality control checks the production in terms of quality measures. It makes sure that erroneous productions are filtered out. The electricians workshop and the tool workshop are ‘auxiliaries’. Their work is directed towards maintaining and repairing the machines making up the assembly lines. Together with the shift supervisor and the production manager, they provide spare parts, emergency interventions, updates, but also long-term improvements of the machinery.

6 Single quotation marks that are not followed by a reference indicate terms and statements originating from the field.

- c) Processing after production: the finished and packaged goods move on to the shipping department taking care of the delivery to customers. The accounting and finance department registers and processes the turnover. Management attends to the overall figures and their implications as well as long-term projects. The works council also attends to the overall situation, but with special attention to the quality and stability of the employments.

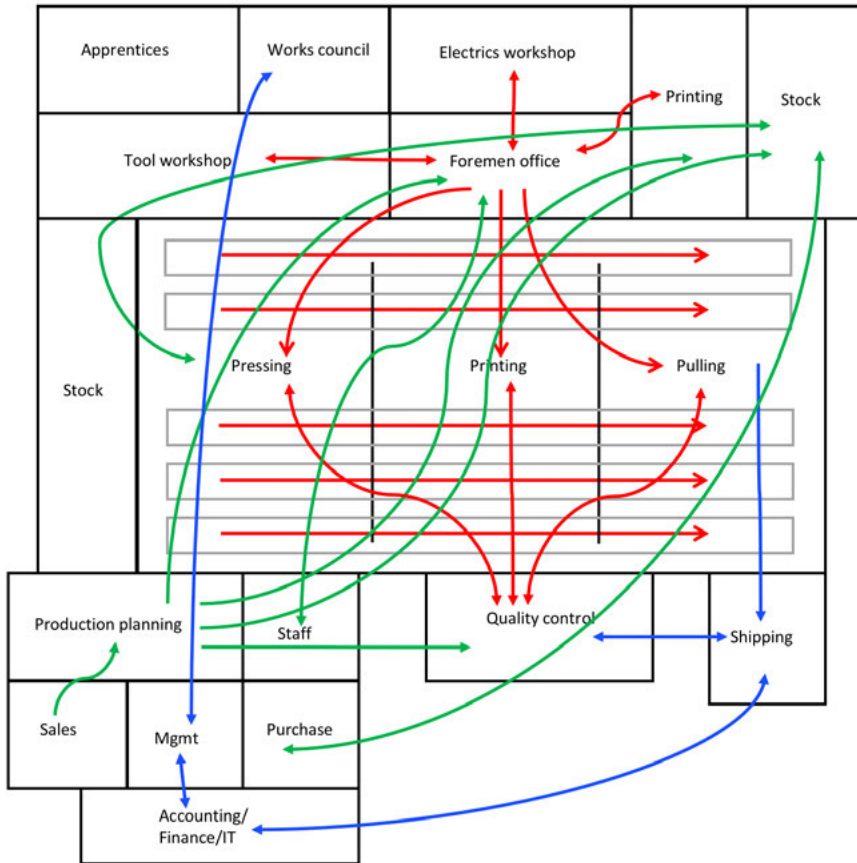


Image 1: The spatial and organizational structure of Company N., 2015: Green arrows – activities related to the preparation of production; red arrows – principal production activities; blue arrows – processing, clearing and evaluation of production activities. Drawing: author.

The coordination between the different steps of value creation is accomplished with the help of a series of tools and technologies, or ‘artefacts that organize’ (Ribes et al., 2013). The company uses an ERP system, but also a rather sophisticated analogue planning table which constitutes an important

communication node. There is also a well-established system of circulating papers in different colours. The employees further invoke 'leg work' and doing things 'on call' as ways of coordinating amongst each other.

Repair

As mentioned above, being in a phase of exception and change was one of the characteristics of Company N. making it a promising case for research. What I am calling 'a phase of exception and change' relates to the introduction of a new ERP system, commonly perceived as a complex process going hand in hand with significant measures of restructuring (e.g. Ciborra, 2000; Westelius, 2006; Pollock and Williams, 2009). At Company N., the process of introducing a new ERP system formally started in early 2012 and was completed in the middle of 2013 (according to management). The preparation of implementation as well as the implementation itself ('cut-over') caused numerous occasions for repair work: repairing the old database so that it could be migrated, for instance, or linking the new system to processes that were not compatible with it. However, next to this exceptional phase of repair, it turns out that Company N. can be considered as imbued with repair work. A lot of constant, daily repair work can be found there, even two years after the implementation of the new ERP system. The need to repair is intertwined with many, if not most of its processes and workflows – also beyond interventions and transformations out of the ordinary.

Exceptional repair

The decision to switch to a new ERP system is in itself an act of repair. It is occasioned by the concern that the existing ERP system is prone to work erroneously due to capacity problems. The story goes that the volume of data is too large and that it starts to overwrite old data sets. It is said to be 'extremely dangerous to continue working with this system'. According to managing director B., it could stop working reliably any minute and then 'no one knows what to do anymore'. The timing for a system change is far from convenient, but it is the 'necessary timing'. Introducing a new ERP system presents itself as 'bare necessity': 'we had no other choice.' It is an urgent act of repair occasioned by the perception of an emergency situation.⁷

7 But this story is amended by remarks which point in another direction, that is: maybe the timing is convenient after all. For a couple of years ago, Company N. has been bought up and it now forms one out of four different locations. Networking these four locations is said to be another idea behind purchasing a new and more elaborate ERP system.

After having agreed on this necessity, the next step consists of deciding on a specific software package and its provider to make a contract with. The management's main criterion for choosing a new system is its degree of dissemination. Company N. does not want to run a 'niche solution'. Hence, they decide on the ERP system dominating their sector: R/3 by SAP. It is the industry's standard. Managing director G. – one of the main advocates of the decision – has a lot of experience with the software. Its prevalence also makes it more likely to find people that are familiar with the system and with the process of transition. One of these people is F. who joins Company N. in June 2012 in order to support the process.

F. is placed within the production planning department which constitutes, if you will, the company's 'centre of coordination' (Suchman, 1993: 114).⁸ In the planning department, F. first of all gets to know the extant ERP system as well as the extant way of production planning with the help of an analogue planning table (fig. 2). In parallel, he is involved in the preparation of the system switch. This encompasses the migration of the existing database ('master data') to the new system. A 'data takeover' has to take place between the old and the new system. According to F., this is difficult in and of itself. A couple of adaptations of the master data are necessary in order to use it with SAP. In reality, the data migration is even more difficult because the master data is 'not a hundred percent well maintained'. 'It's just mistakes that happened or a lack of knowledge for whatever reason, it doesn't matter. I don't want to say it is topsy-turvy, but in a way, it is...' The lack of maintenance results from mistakes in minor details, for instance entering the postal code into the same field as the name of the city instead of entering it into the designated field. One of F.'s tedious tasks is to find and repair these kinds of mistakes in the master data so that it can be migrated.

The day of implementation, the 'cut-over', has to be postponed from December 2012 to March 2013. F. and the other employees involved in the system switch are not only struggling with the data migration, but also with the customization of the new system. This is a common procedure of tuning. ERP providers like SAP, Microsoft, Oracle, and Infor offer basic, generic programmes that are then customized according to the specifics of the sector.⁹ The process of customization is double-edged: on the one hand, the system should be adapted to local, well entrenched structures resulting from the concrete product and the

8 Suchman describes centres of coordination as a work setting that is 'dedicated to the ongoing management of distributed activities in which one set of participants is charged with the timely provision of services to another' (Suchman, 1993: 114).

9 This is often done by third-party suppliers who also provide industry specific add-on software (Pollock and Williams, 2009: 43).

company's concrete situation. On the other hand, adapting the software to local practices should not go too far. Changing the generic software makes it more prone to mistakes. Also, future software updates become more complicated (and more expensive). It is said that in order to make most use of the possibilities an ERP system has to offer, an organisational rearrangement is necessary. This way the system is more likely to unfold its potential for rationalisation and automation (Pollock and Williams, 2009).



Image 2: The analogue planning table, 2015. Photo: author

In this phase of customisation at Company N., there is a lot of varying information about who will get to work with the new system and to what degree. This leads to uncertainty about who will need what kind of SAP training. Also, F. has doubts about the quality of information they have provided as a basis for customization: 'We were servicing, we provided the information. Depending on how good our information was, this is how good SAP will be in the end.' Yet, the day of putting the new system into operation is approaching. This is how F. envisions it: 'It will be a hammer coming down on top and then someone has to sweep up the pieces. You can be prepared for a lot of things and then in the end it will probably hit somewhere else.' He and his fellow colleagues don't feel they can plan for the cut-over. Rather they will just have to face the situation.

As expected, the day of implementation comes with a lot of repair work. I'm witnessing the situation in the planning department, where four people have teamed up to manage the day of the cut-over (fig. 3). These people have attended extensive trainings prior this day. In the old system, they have prepared production orders for the next two weeks to come. They are printed out several times (fig. 4) and the orders – represented by small handwritten cardboard cards – are properly arranged within the analogue planning table. Now, on the day of cut-over, the aim is to turn these prearranged orders into orders within the SAP system and its electronic planning table (fig. 5). The old system is about to be 'closed' by the IT department (this, too, takes more time and effort than anticipated). The new system is running on the computers. Starting to interact with it now – beyond the context of training and simulation – seems to be rather nerve-racking. F. and his colleagues are struggling with the new system's obstinacies and the way it behaves (e.g. automatically deleting entries if they have not been manipulated for more than a minute). They discover mistakes in the master data, wrong item numbers for instance, presumably ensuing from 'copy/paste-mistakes' and 'interface problems'. So, they resort to lists printed out from the old system, with the help of which they start double-checking the new system's outputs. The confusion within the master data was dreaded, but also somehow expected. A more unexpected smash eventually comes from missing labels needed for shipping. The shipping department does not know which labels and which kinds of numbers to use. Finished goods pile up from the warehouse, until the problem is resolved the next day.



Image 3: Note about cut-over in the planning table, 2013. Photo: author.

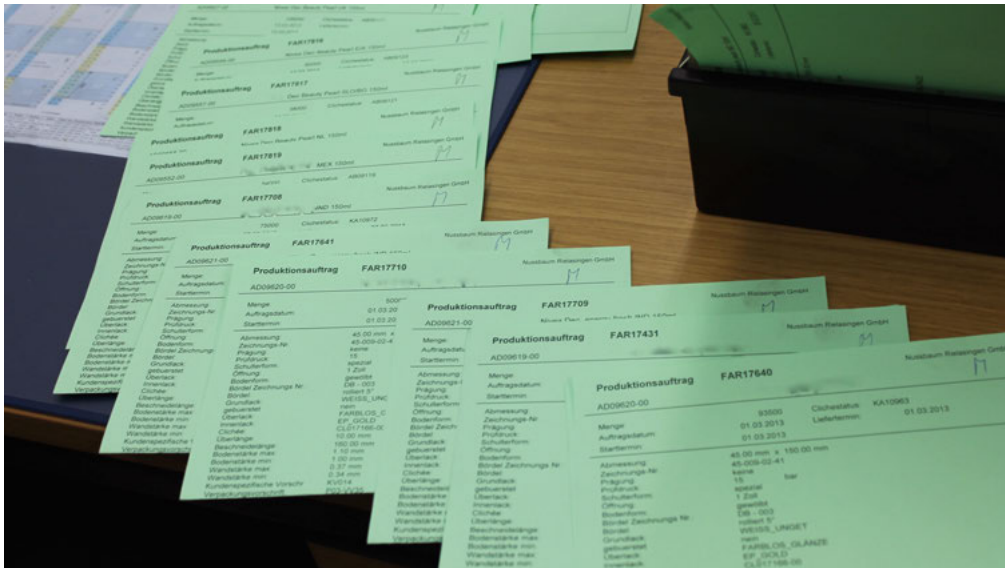


Image 4: Preparation for the cut-over, 2013. Photo: author.

ArbPlatz		Kurzbezeichnung	Anzahl	KW 10			KW 11			KW 12		
				05.03.2015	07.03.2015	09.03.2015	11.03.2015	13.03.2015	15.03.2015	17.03.2015	19.03.2015	
LINIE4	Linie 4		1	0	0	0	0	0	0	0	0	

				Auf								
Auftrag	A	Zeich.Num.	Läng	KW 10			KW 11			KW 12		
				05.03.2015	07.03.2015	09.03.2015	11.03.2015	13.03.2015	15.03.2015	17.03.2015	19.03.2015	
1015351	A	45-002-03-93	193	1								
1015227	A	45-002-03-93	193		1							
1015736	A	45-002-03-93	193			1						
1015357	A	45-002-03-93	193				1					
1015354	A	45-002-03-93	193					1				
1012386	A	45-002-03-91	158						1			
1015203	A	45-002-03-91	158							1		
1015230	A	45-002-03-91	158								1	
1015862	A	45-002-03-91	158								1	
1015367	A	45-002-03-91	158								1	
1015361	A	45-002-03-91	158								1	
1015360	A	45-002-03-91	158								1	
1015151	A	45-002-03-91	158								1	
1015366	A	45-002-03-91	158								1	
1015364	A	45-002-03-91	158								1	
1015365	A	45-002-03-91	158								1	

Image 5: SAP's electronic planning table, 2015.

At Company N., the change of system has always been announced as ‘turning the switch’. But instead of such a one-time switch, a lengthy and fragmented process is taking place. F. says: ‘It is a long switch, a rusty one.’ During the next couple of months, a ‘reciprocal tuning’ between SAP and Company N. occurs (Pickering, 1995: 20). More repair work is necessary. For instance, they collect those software problems emerging in the first months of use and pass them back to the

programmers at SAP to work on them. Also, some rearrangements are done in terms of who has to perform what kinds of inputs to the system. It turns out that the shift supervisors do not manage to service the system in the way it is necessary: they were assigned to register finished productions in the system running on the computer in the shift supervisors' office. However, their actual work – dealing with the heterogeneous and 'buggy' machines making up the assembly lines – was incompatible with the regularity demanded by the system. Taking care of the machines is a job marked by irregularity and urgency. If a machine fails, which is not uncommon at Company N., the shift supervisors are busy getting it back on track. This is their main priority. Hence, in situations like these, registering finished productions remains undone. But in this case, the ERP system does not allow the shipping department to proceed with the goods. This resulted in congestions and delays. In order to repair this situation, the task of registering finished productions has been passed back to the planning department. Either way, people from the planning department walk over to the shift supervisors' office several times a day to deliver papers signalling new production orders. When they walk back they now take a piece of paper with them reporting on finished productions. Back at their computers they transfer this information to the SAP system. Hence, paper and 'leg work' are used as means to fill the gaps left by the system.

The system switch is an exceptional situation causing a lot of exceptional repair work. The cut-over is unknown territory for almost everyone at Company N. There is no rule book to the situation, but rather it has to be faced and explored step by step. It turns out, the implementation demands good nerves and improvisation skills. However, it also turns out that this exceptional situation is just one part of repair work that can be found at Company N. At first, the system switch captured my attention, but it eventually led to the observation that the need to repair also shapes situations and processes rather unrelated to the system switch. Besides, the need to repair the SAP system turns from an exceptional into a constant issue, even two years after the cut-over.

Constant repair

The story of the shift supervisors' trouble to service the SAP system points to another instance of machine-induced workflows. This is the work in production. The rhythm and flow of this working routine emerges from the interaction with an error-prone production facility: every assembly line consists of a range of interconnected electromechanical machines differing in age and stemming from different manufacturers. Failure of certain machines is a regular element of the working day. The shift supervisors' work is oriented towards quickly getting the machines back on track and they do so by resorting to craft skills, experiences,

and the ability to improvise. One manager describes this as a well-trained attitude of ‘firefighting’, as opposed to working systematically and analytically on the prevention of disturbances. ‘Firefighting’ is a central mode of working in the production hall of Company N. There are even auxiliary facilities attuned to this mode: the tool workshop¹⁰ and the electronics workshop are located adjacent to the production hall with its staff always ready to be called to help with certain machine failures. For instance, while I’m interviewing the master electrician, his telephone rings and someone informs him that ‘the compactor is down again’. In a routine way, he packs his tools, walks over to the production hall, finds the respective machine and starts handling the cables and switches.

While the shift supervisors and their helpers are in charge of quickly tackling the daily breakdowns of the machines, the production manager’s job is to overlook the machinery as a whole. This more systematic and analytical way of dealing with the machines (not just ‘firefighting’) is done via the variable of breakdowns, too. The production manager mainly monitors and collects disturbances, their sources and subsequent downtimes. Next to using them for his own work of finding longer lasting solutions to the respective problems, he also turns this data into block diagrams and displays them to the staff in production. Reducing disturbances and downtime is the central aim of production management and hence the central unit to evaluate how well it is doing.

Taking the perspective of repair illustrates how Company N.’s whole sphere of production is imbued with breakdown and the resulting need for repair. This is not unusual or alarming. Rather repair is the ‘cultural mode of existence for technology’ in the production hall (Larkin, 2004: 306) that gets side-lined by default assumptions of stability and order as well as by the actual overall well-being of Company N. Breakdown and repair shape the workdays’ rhythm. The continued need for repair is also the workers’ source of perceiving themselves as doing something that is relevant to the company. To them, making sure that the machines are running is ‘the actual work’. Therefore, it is their improvisation skills swiftly bringing the machines back on track that they consider as being crucial for the company’s survival and its good performance. All the ado about SAP and the system switch seems like an upside-down situation to them: they do the crucial work and SAP should support it. However, it now seems like SAP is central and they have to support it.

¹⁰ The tool workshop is in charge of purchasing, modifying or building spare parts needed for defective machines. If there is time left, they also develop new parts that are aimed at improving the machines – making them run more smoothly or easing their maintenance.

Following the thread of constant repair shows that it is not constrained to the production hall, but can also be found in the daily work of interacting with the new ERP software. Two years after its implementation, it is generally perceived as running well and as having indeed contributed to Company N.'s recent improvements in performance. F. and J. from the production planning department claim they are well beyond struggling with the system. Like the production manager, the planning department has a failure-related unit of measuring the quality of their work: it is the amount of 'errors in production' caused by their planning. Hence, their evaluation of the SAP implementation process is based on the number of errors in production and these are, according to J., none: 'We didn't have any errors in production because of SAP.' This is a story of success, but at a closer look it is one of successful repair work on a daily basis.

J. and F. describe SAP as precise, but also as stubborn and cumbersome: 'SAP doesn't forgive any mistakes.' If something is not quite right to the system's logic it does not proceed. 'It turns red and you're stuck. Then you have to find the mistake.' This might also mean finding the person who has the proper 'access rights' to change whatever is wrong. The new software dictates its needs and its rhythm in a much stricter way than the old software used to do: 'In the old system, you could smuggle things past.' For instance, in a stressful situation, it was possible to 'just overwrite something'. It did not demand the same precision as SAP. The latter is stricter, which could be seen as beneficial and perhaps it will be beneficial in the future. But right now, this strictness is a problem, not only because it slows things down (by 'demanding more handgrips'), but also because it rests upon a data base that is riddled with mistakes, even though they are minor. Next to the errors within the master data already existing prior to the takeover, the system switch itself caused additional disorder. F. explains that part of the data takeover was 'also only done with EXCEL lists' and 'copying errors' occurred ('something got mixed-up'). J. comments: 'Interfaces, it was said, whatever that means.' There are also problems concerning the system's automation. For instance, the system chooses production lines by itself following technical criteria, but it does not take into consideration¹¹ whether there are free capacities on those lines or not: 'Then we realise, we don't have any free capacities on that line, so we have to decide on another line instead. Then we have to plan anew. This is still rather chaotic.'

At the beginning, J. and F. were 'railing now and again'. Now, two years later, they just 'got to know it': 'You have to *learn* how to use it.' Using the new system,

¹¹ Speaking of the system as a proper agent is taken from the interviewees. For conceptual considerations on this see for instance Latour (2005).

however, seems to translate into repairing it. J. underlines the central contribution of her experience and her comprehensive knowledge of Company N. that serves as a 'means of surveillance and protection' of the system: 'To me, knowledge is key. If you have been working here for more than 20 years and you are setting up an order, you immediately see if something is not right, if there is something wrong written in the article. You see it and then you remove it. But if you strictly followed the system, without the knowledge, the background knowledge, the biggest mistakes would happen.' Therefore, J. and F. check every production order they set up in the system and they do this by relying on their combined knowledge from experience: 'We still do this today, having another look at an order. We don't nod anything just through.' They agree that without them correcting the system constantly there would have been numerous errors in production. If they left the system to itself without adjusting and supplementing it, 'it would be a catastrophe.'

These extracts from Company N. suggest repair can be considered as a daily, never finished activity. Working routines are marked by failing machines and the ensuing need to repair. This is not only the case for the workers in production, but also for clerks like F. and J., information or knowledge workers if you like. Their daily work is entangled with the properties and obstinacies of the new ERP software. It has to be monitored and fixed constantly in order not to cause any trouble. Both, the information workers as well as the workers in production, interact with specific machines and this interaction translates into mending the machines' performances. They have to be repaired continuously in order to integrate smoothly with the context. If they were not 'darned' in this way, they would cause all kinds of minor and major disturbances.

Summary

Repair seems to be a rather ubiquitous activity at Company N. At least that is – maybe not surprisingly – what the analytical lens of repair suggests. Firstly, there is an exceptional situation, the introduction of a new enterprise software, demanding a lot of repair work. The implementation of a new system can be understood as a disturbance coming from the outside. It stirs up the existing information infrastructure consisting of well-established and well-known tools and their entanglement with the ways of doing things. People like F. are hired to accomplish the work of repair ensuing from the disruption. But many other employees also enter a phase of transition, learning and repairing. Here repairing means to articulate the new system and to integrate it into local and personal workflows. This demands a couple of adjustments from both sides: the software and the organisational processes. However, it can also fail. In the

production hall, the new tool collides with existing processes. Adjustments to either the system or the existing processes do not seem within the realms of possibility. What follows is a more comprehensive workaround including some kind of makeshift. In the case at hand it is based on 'leg work' and good old paper turning out to be an indispensable tool of repair.

Next to these exceptional needs for repair, there is a form of daily, permanent repair. At Company N., work in production encompasses the necessity to attend constantly to the 'buggy' machinery stemming from a range of different suppliers and varying considerably in age. 'Firefighting' like this is what one of the managers notes is a 'well trained attitude' at Company N. But also, the information workers of the planning department interact with a somewhat failing machine: the new ERP system by SAP. On the one hand, it is based on a database that is not free of mistakes, on the other hand, its programmed procedures do not always fit the context. It is strict and powerful in the sense of narrowing and automating processes, but precisely these features also make it susceptible to causing errors. Hence, there is constant need to check and adjust the system.

Discussion

In this final section, I would like to discuss three aspects of repair in organizational contexts that the case of Company N. as well as the literature on repair are pointing to and that seem to be worth exploring further: the ubiquity of repair; repair as integration of work, and making repair work visible.

Ubiquity of repair

The case of Company N. pointed to the ubiquity of repair. It does not have to be related to crises and situations out of the ordinary, but it seems to be part of day-to-day routine. Also, it does not stand in opposition to the overall economic well-being of the company. Repair appears as a permanent layer of organizational practice, as a sphere of attention and action that runs along and accompanies every activity. It revolves around the 'endless small forms of practical "subversions", taken up in the name of getting the work of the organization done' (Suchman, 2000: 313). This view of repair as encompassing the numerous routinized everyday practices of checking, correcting, supplementing, bridging, integrating, bypassing and so on corresponds with Henke's (2000) expansion of the concept of repair that has developed within ethnomethodology and conversation analysis 'meaning the practice of mending social order' (Henke, 2000: 55; Garfinkel, 1967; Schegloff et al., 1977). While its focus lays on discursive repair – the acts of filling the gaps of understanding in a conversation

– Henke recommits to repair as a material practice.¹² He describes the workplace as ‘a conglomeration of the social and material stuff that workers move through as they do work’ (Henke, 2000: 60). People’s bodies integrate with machines, tools and other people. Together they form associations or networks of skill. For Henke, skill is an ‘interactional effect’ (Henke, 2000: 61). It means to articulate, maintain, repair and secure the sociomaterial networks of doing a job.¹³ This idea is also relevant in the context of technologies of automation: Their alleged ‘magic’ relies on the continuous effort of configuring, calibrating and adjusting: ‘Such work of alignment is not a bug’, Lilly Irani (2015) writes, but an indispensable element of technologies of automation and a skill workers excel at.

Repair then, both in its discursive as well as in its material sense, directed towards both low and high technologies, constitutes a “built-in” feature of the workplace’ (Henke, 2000: 60). It attends to the numerous and indeterminable disturbances of sociotechnical associations, be it obstinate software, material wear out, responsibility disputes, ‘or a bird that flies into the factory’ (Irani, 2015). Repair work is not extraordinary, but on the contrary: it is the norm and it is that which ‘makes the workplace normal’ (Henke, 2000: 57). It is carried out by everyone and not just by those having the term in their job title. In the same way, every organization could be considered a repair shop in the first place, and a manufacturing business, a design agency, a government office or a citizens’ group only in the second.

Repair as integration of work

The division of labour means to divide work, but also to relate these divisions to each other (Strauss, 1985: 16). Anselm Strauss, Susan Leigh Star and Lucy Suchman develop the term ‘articulation work’ to describe a ‘supra type of work’ interlocking tasks, workers and units to form ‘the arc of work’ designating the totality of tasks (Strauss, 1985: 16; Star, 1991). “Articulation work” names the continuous effort required in order to bring together discontinuous elements – of organizations, of professional practices, of technologies – into working configurations.’ (Suchman, 1996: 407) Articulation work can be found on a small scale, when workers articulate their specific working environment in order to get a certain task done. But articulation work can also relate to larger scales, to

12 However, the fact that Garfinkel and his colleagues chose the term repair, points to their understanding of language and conversation as a material practice, having dimensions of time and space and resting upon collaboration instead of individual cognition.

13 For the concept of sociomateriality see Suchman (2007); for its reception in organization studies see Orlikowski and Scott (2008) for instance.

the integration of different steps of work accomplished by different units into a coherent process of value creation.

Articulation work includes or is commensurate with repair work, as the following specification of the concept suggests: it is characterized as ‘artful’, related to an ‘open horizon of mundane activities’ and aimed at ‘keeping [everyday working practices] working’ (Suchman, 1996: 407). It means to mesh and to patch ‘in the face of whatever contingencies may exist to hinder or impede the organization’s existence’ (Strauss, 1988: 1984). Failure of articulation work is described ‘in such terms as “Things are going wrong”’ (*ibid.*). Therefore, articulation work is that part of work attending to ‘potential organizational breakdowns’ (Strauss, 1988: 172). As Jackson sums up, repair is ‘itself a facet or form of articulation work (and vice versa)’ (Jackson, 2014: 223).

Articulation work is based on and intertwined with ‘artefacts that organize’ (Ribes et al., 2013). They are themselves ‘central sites and carriers of key organizational properties and functions’ (Ribes et al., 2013: 2). The stability and durability of organizations is linked to ‘artefacts, equipment, and material resources’ (*ibid.*) mostly neglected by social and organizational scientists. Ribes et al. underline the persistence, obduracy, and relentlessness of information technologies eventually concluding that ‘[o]rganizing is sustained by technical actors’ (Ribes et al., 2013: 10). As mentioned and explored above, Company N. relies on an ERP system, a planning table, the circulation of paper, doing things ‘on call’ and ‘legwork’ in order to coordinate different steps of work. These are the company’s tools of mending the division of labour, integrating and sustaining the organization as a whole. But in the case of Company N., it was the SAP system that prevented the smooth integration of labour and that therefore needed repair. Contrarily to the assessment of Ribes et al., the system’s persistence, obduracy, and relentlessness posed a problem. Thus, it is probably worth following up on how successful articulation work relates to the obduracy of systems.

Making repair work visible

Many texts on repair argue that it keeps being neglected, overlooked or ignored (cf. footnote 1). Within the ‘productivist bias’ (Jackson, 2014: 226) the ubiquity of breakdown and repair comes as a surprise. Dealing with disruptions, gaps, and inconsistencies is then described as belonging to the realm of ‘informal tasks and “behind the scenes” work’ (Star and Strauss, 1999: 9), work that is not part of the job description, but at the same time crucial for getting the job done. Yet, ‘[n]o work is inherently either visible or invisible’ (Star and Strauss, 1999: 9). Rather,

the question is *what the visibility or invisibility of certain kinds of labour reveals about structures of power, knowledge and agency.*

The scenes of repair from Company N. hint at this entanglement between repair work, its invisibility, and struggles of power. Purchasing SAP is motivated by repairing the organization's 'arc of work', hence the way it integrates different components of labour into a coherent whole. On the one hand, it is said to *replace* the predecessor system being at the brink of breakdown. As an 'artefact that organizes', it would then cease to sustain the organization meaning that 'no one knew what to do anymore'. On the other hand, SAP is also supposed to *improve* the integration of labour. As Company N. was bought up a couple of years ago and now forms one out of four different locations, SAP is expected to help the networking of those four plants. This not only means being able to access and monitor their respective processes via the software, but also to standardize them so that they can eventually be managed in a more centralized way. Hence, rather than just replacing the old erroneous system, SAP comes along with the idea to restructure existing and locally shaped ways of doing things. It follows that these local skills and the related knowledge are subject to devaluation. Instead, being able to handle SAP is now what makes an employee more valuable and less replaceable.

But, by making repair work visible, it becomes clear SAP does not fully live up to these high(-tech) expectations. Firstly, the lens of repair has exposed that working with the new system translates into constantly aligning it with local requirements. It is not only F.'s knowledge of SAP that is crucial to articulating it, but also J.'s extensive knowledge of the company. Due to her familiarity with the company's products, machines, and processes they are able to monitor and correct the system. As they say, they never leave the system to itself. Secondly, the case has shown how the pressure to service the system is resisted by referring to the pressure of keeping production up and running. The workers in production make the claim that without them attending to the 'buggy' machinery making up the production facilities there would be no product to manage and sell – no matter whether SAP increases overall efficiency. They push back against the management's plans by pointing to the importance of their skill set of continuously preventing the breakdown of production. Hence, rather than succeeding in streamlining locally shaped workflows, SAP actually relies on local adaption and regulation – the work of articulation and repair. This way, SAP becomes part of the struggle over power and resources between different parties. In the face of automation and rationalization, it is through the necessity of repair that workers (blue as well as white collar) reclaim their value.

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