ROBOTICS AND QUALITY: A SOCIOMATERIAL ANALYSIS OF ASSEMBLY LINE

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Abstract. Automation of manufacturing industry has been on agenda for nearly five decades now. Today, the affordability and efficiency of automated solutions make them increasingly relevant to Small and Medium-size Enterprises (SMEs). Their continued survival depends on the quality of the end product and as much as any SME might intend to increase its business potential, it can't afford to lose quality by the time it turns to automated solutions. Here, we focus on an assembly line soon to leave its manual processes to automation. It is a case from a manufacturing plant, and we ask what happens to quality once the automation solutions are in place? Exploiting the five notions of Sociomateriality, we explore the changes in the socio-technical configurations of the workplace each of which, we discuss, are consequential for quality. We show while quality is an ultimate business goal for any SME; it is first and foremost a practical problem at the shop-floor. We discuss how quality originates from socio material configurations and distinguish the process-quality from product-quality while attending to working-life quality. We address the challenge of translating the quality which once was in hands, tools, and the relationship among them, to the quality of exact calculations of automated solutions.

Keywords: Quality, Sociomateriality, Automation, Robot, SME

1 Introduction

Small and medium-size enterprises (SMEs) comprise 99% of all businesses within the European Union (European Commission, 2015). According to International Federation of Robotics (2018), the adaptation of robots in 'general industry' -excluding automotive and electronics- has been rather low. The trend, however, is changing. Having an opportunity to automating their processes, many SMEs nowadays consider advance automated solutions. Recently, automation without robotics has been the sheer force to changing work arrangements (see Nof, 2009; see also Bainbridge, 1983; Lee, 2008; Parasuraman and Riley, 1997). Today, robotics as an important subset of automation (Nof, 2009), pushes the automation forward and is expected to arrange work differently from the way it was approached and appreciated in the manual operations. In this regard, it is plausible to assume that many SMEs will face the infrastructural turn compelling them to accommodate the consequences of robotic transformation.

In the literature on the effect of robots into the workplace, many studies focus on the changing dynamics of work practices (Hancock, 2013; Hoc, 2000), the way the practitioners react to robots (Balfe & Wilson, 2018; Brain, 1998), the challenges in developing interfaces (Miller & Parasuraman, 2007; Calhoun et al. 2018; Thrun, 2004); and issues on safety (Haddadin et al. 2008; Zinn et al. 2004). In Information Systems (IS), several studies have examined the introduction of robots in the workplace. Sergeeva, Huysman and Faraj (2015) looked into the space of work environment in a hospital by studying the transformative effects of robotic technology into the collaborative work practices. Another example is Mettler, Sprenger and Winter (2017) who introduced a new method to map the attitudes of end-users towards service robots. Aleksander (2017) also considered the overall effect of robots at work and suggested clarifications regarding the confusion in branding the use of robots at workplace as cognitive robots or intelligent robots. He asks for the re-evaluation of the way we perceive robotic technology and talks about the necessity for education and re-skilling of humans. We can also find related research on the way automation/robotization changes work arrangements in other domains closely related to IS literature. One notable example is the study by Barrett, Oborn, Orlikowski and Yates (2012) where they draw on two theoretical perspectives (Suchman's *plans and situated action* and Pickering's' *mangle of practice*) to explain the reconfigurations of boundary practice at a hospital pharmacy. They raise concerns and responsibilities of three occupational groups with robotic technologies and show how robotic solutions is consequential for all the people engaged in the work at pharmacy leading to disruptions in skills, jurisdictions, status, and visibility.

The literature on issues, challenges and effects of robotic solutions into the workplace is ample. However, despite some important works on all aspects, there seems to be no sign of how eventually quality, as a sum of quality of product, process or working life, plays out in the disrupted work-environments. In this paper, we focus on the manufacturing industry, where we study the newly automated assembly work. We are particularly interested in the relation between product quality and process quality in the manual process compared to the automated one. Our site of study is an industry where according to Chiasson and Davidson (2005), there is a lack of 'serious' studies in Information Systems. We carry out the research before, during and after introducing robotic solutions. In doing so, we ask, what happens to quality once the automation solutions replace the tools and machinery use? How does the relation between different types of quality emerges at the time of automating the assembly work? By answering these questions, we explore quality and investigate if and how the old ways of defining and promoting quality of production is preserved or persevered in today's automated processes.

The purpose of the study is to challenge the widespread belief and conventional assumption that automated solutions lead to better quality. We focus on quality for whom and quality of what? We are particularly interested in problematizing the betterment of different aspects of the claim on product, process or working-life as the modern facilities takes over the shop-floor. The underlying aim of the research is to provide an underlayer for the future investigations of innovative automated solutions such as co-bots. In other words, the present account is an introductory part of a larger plot where we eventually aim to show how tools, machinery, automated solutions and collaborative robotics carry distinctive weight on quality. All in all, we intend to discuss the issue of quality with a theoretical lens that captures sociomaterial practices at the assembly work whether they originate from a human-tool, human-machine or human-automated control configurations. By attending to both sides on equal measures, i.e. the human and the technical, and most importantly the practice that emerges from their inter-actions (Orlikowski, 2007), we believe Sociomateriality works as a lens through which various dimensions of quality at the shop-floor come to foreground.

In the following section, we outline Sociomateriality as a theoretical perspective, present the methods used and describe the empirical case. Then, we offer a sociomaterial analysis of the result section. At the end, we show how the five notions of Sociomateriality help to explore the issue of quality for product, process and working-life.

2 Five notions of Sociomateriality

The theory of Sociomateriality (Orlikowski, 2007) has gained considerable attention in studies of organization and work, being particularly useful when the intricate intra-relation between the social and the material is of major concern. Since our aim is to study different socio-technical reconfigurations of an assembly before and after automation, we find the approach suitable. Sociomateriality is, as its name might suggest, attends to social and the material aspect of quality; a concept built upon the intersection of technology, work and organization and attempts to understand how human bodies, spatial arrangements, physical objects, and technologies or in one word all that is material are entangled with language, action and interaction or in one word all that is social (Jones, 2014; Leonardi, 2012).

There is no consensus on the definition of Sociomateriality (Jones, 2014; Leonardi, 2013) and many have pointed out that it might be a new label for existing popular streams of research such as socio-technical systems (STS) (cf. Barley, Meyerson, and Grodal, 2011) or actor-network theory (ANT) (cf. Contractor, Monge, and Leonardi, 2011). There might be similarities between STS, ANT and Sociomateriality. However, we believe notions such as ‘entanglement’, ‘interpenetration’, or ‘embodiment’ receive unique treatment under sociomateriality. Such notions, within manual work arrangements, have never been attended, we argue. Further, Jones (2014), maps different layers of the Sociomateriality and asserts that the five key notions of *materiality*, *inseparability*, *relationality*, *performativity* and *practice* point to different dimensions of Sociomateriality. These five notions are central in our understanding and as a result in taking advantage of Sociomateriality modifying our direction to categorize, analyse and discuss the dynamic of the workplace. The five notions help us go beyond the “ideational realm” and not to study quality solely as a “mental activity” but through the “sociomaterial practices” that the quality is enacted (Carlile, P.R., Nicolini, D., Langley, A., Tsoukas, H. 2013, p. 2). We, briefly, take a close look at the five notions.

Materiality is the key notion built into the term Sociomateriality. By materiality, depending on the context, we might refer to concepts such as “artefacts, the tangible, machine, nonhuman, and technology” (Jones; 2014, p. 907). Yet, there is an inconsistency and ambiguity in referring to it. Its significance, apparently, lies in its capacity to counter-balance the absolute orientation towards the physicality of technology. According to Leonordi (2010), what we consider as nonhuman, machine or IT-artefact should not necessarily suggest tangible objects. Data, codes, algorithms also have their own side of materiality.

Inseparability highlights the interdependency of social and material. In theoretical terms, both 'social' and 'material' refer to separate concepts but in practice it is difficult to distinguish them separately. This is obviously a complicated assertion. On the one hand, social and material have an "entangled, inseparable, intertwined, intermingled, interpenetrated, and fused" relationship (Jones, 2014, p. 898). On the other hand, the relationship is intra-action suggesting that they neither interact mutually nor impact each other unidirectionally (Jones, 2014). The main point here is to focus on mutual constitution and avoid investigating them separately from each other.

Relationality, similar to the previous notion, engages in an ontological discussion of Sociomateriality. Being relational means that the existence of social (agency) and material (agency) depends on each other i.e. material grows its attribute and capabilities in coming together with social and vice versa (Jones, 2014). Moreover, relationality hints a symmetrical agential relationship (Jones, 2014). However, as much as symmetricity might imply the existence of equal or balanced agency emerging from social or material, it does not necessarily mean that they are of similar essence.

The key term in understanding performativity is enactment. Consider an utterance that does more than informing. Once an utterance such as 'come' is expressed, depending upon audience and situation, it perhaps occasions acts of requesting, inviting or greeting, for example. In other words, it enacts performances or as Jones (2014) asserts it provides "performative accounts of social/material entanglement" (p. 899). In the previous notion, we mentioned that there are no prior properties attached to social and material before their engagement. In performativity, similarly, creation of reality is visible only when social and material meet each and not before.

Jones (2014) maintains that we can acknowledge the notion of practice, for the most part, "as the enactment of performativity" (p. 899). It means that, similar to previous notion, the creation of reality or the enactment of performances does not happen in a vacuum. It accompanies some mental or bodily activities, states of emotions or motivational knowledge; all or part of which makes up the notion of practice.

3 Empirical setting

The industrial context we took an interest in is a plant with a crankshaft assembly line undergoing process change. For over 20 years, manual assembly procedures ran the assembly line making up the various arrangements of work that support and facilitates its production. It is a small plant in a rural area which operates from 7 a.m. to 9 p.m., manufacturing crankshafts for various end-products such as chains-saws, or leaf blowers. The cost of machinery, automation equipment such as control systems or industrial robots along with other facilities in the plant -both for the production and assembly- exceeds millions of Euros to the point that it fits into a definition of an SME (European

Commission, 2015). It is a huge enterprise for the community considering the fact that the city in which the plant is located hardly reaches two thousand residents. The plant is a small subdivision of an industrial group with a work-force of 13000 employees worldwide. The main and the only responsibility of the plant is to manufacture a small but crucial crankshaft for various outdoors power products. Considering the indispensable value of the crankshaft for the wide range of the production line across other plants, it makes all the sense for the company to look for automation solutions in the assembly of the crankshafts too.

The focus is on this particular line where the reconfiguration of the work practices in three phases: before, during, and after the automation is plain and evident. As a work-in-progress study, however, the after-the-automation part is yet to be added. Data collection has so far been carried out for six months. The study is ethnographically oriented using in-plant observations and semi-structured in-depth interviews as main inquiry methods. So far, there have been two periods of intense researcher engagement; approximately one month of study of the manual production prior to the robotic implementation, and then 2 weeks of study during the actual implementation of the robotic solution. The data gathering strategies include non-participatory observation in manually run production line and the video-recordings of various human-tool, human-device and human-machine configurations during these weeks. During the robotic implementation, observational studies were conducted for two weeks during which installation of the new system took place. During this time, there were experts in automation consulting, instructing and working together with the plant employees. We observed the installation process and the first trials with the automated process. We were allowed to listen to in-action discussions among experts and employees and had the opportunity to ask questions when they were not fully occupied. There are also over 15 hours of video recordings of the manual process. The analysis is based on data obtained from video recordings and observation only and does not rely on interview data.

The manual process of assembling different components comprise three stations. Each station comes with different configurations of technology and human. The technology of assembling different parts of the crankshaft, based on which all the three stations were established had remained the same almost for two decades. The three stations include three assembly-line workers, a press-machine and some rudimentary tools like hammers and vice and instruments for measuring the assembled product. The work consists of attaching different parts of the crankshaft manually at the first station and letting the press-machine join them by exerting pressure. A heavy-duty work-bench vice, a sledgehammer, a reverse plier and analogue tolerance meter are used to do straightening at the second station. The third station is used for packing and wrapping the end-product into containers. Diagram 1 shows the overall set-up which comprises the human-machine configuration in station1 and the human-tools/device one in stations 2 and 3.

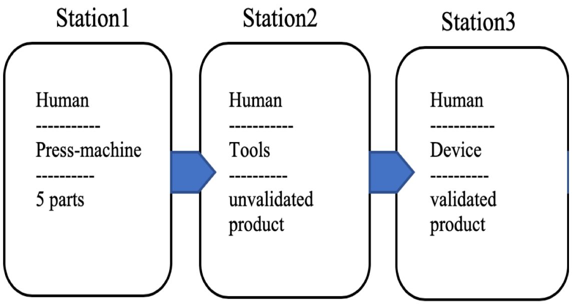

Fig. 1. Old set-up (manual process)

Table 1. Manual assembly line process

Station1	1. Manually carrying 5 parts in separate packages 2. Manually collecting each part separately 3. Manually evaluating each part 4. Manually assembling loosely five parts next to each other 5. Manually inserting the loose cluster of parts into press-machine, and press together
Station2	6. Manually straightening with the help of a hammer and a reverse plier 7. Manually validating assembled product with help of measuring devices 8. Repeat 6 and 7 until product manually validated or disposed of
Station3	9. Manually packaging the products in the containers 10. Manually storing and transporting the containers with help of carriages

The new technology, however, means disrupting the old-fashioned procedures. Equipped with the cutting-edge industrial robots, the new technology brings forward new automation options to the assembly line. In diagram 2, we have illustrated the automation solutions equipped with 6 industrial robots which will soon take over the entire assembly line. Similar to the old set-ups, the modern set-up is divided into 3 stations.

All the stations, contrary to the old-setup, are surrounded with glass windows and wired cages. The work consists of feeding station 1 with five different parts (blue pentagons indicating inward movement into station 1). Here, different robots grasp different component, joining them together while relying on the press machine in the middle of station 1. Still unvalidated, the product is handed over to straightener machine at station2. After being straightened up to a pre-determined degree, the robot at station 3 lets the quality-control check the straightened piece. If validated, the laser machine generates beams to certifying it with a unique serial number. If not, it ends up in the defects. The certified ones out of the laser machine get packed in the container, waiting for other straightened, validated and certified pieces to store up. The containers, al last, find their way out with the help of the last robot when they are fully packed.

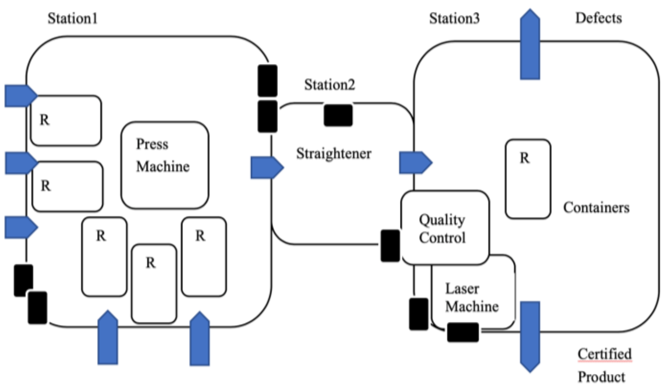

Fig. 2. Modern set-up

Table 2. Automated assembly line process

Station1	1. Manually carrying 5 parts in separate packages 2. Manually feeding each parts to separate entries 3. Automatically assembling five parts next to each other 4. Automatically inserting the loose cluster of parts into press-machine, and press
Station2	5. Automatically straightening with pre-programmed algorithm 6. Automatically validating assembled product with preset values 7. Automatically certifying assembled product with laser stamp
Station3	8. Automatically packaging the products in the containers 9. Automatically storing and transporting the containers with help of carriages

The major obstacle for the automation solutions is the straightening step. In both procedures; the manual and the automated one, Station 2 takes on the duty of straightening. Both procedures differ from each other several ways. While workers are involved directly with and responsible for the validation in the manual procedures, the same task is pre-programmed with a state-of-the-art robot responsible for straightening while workers only act as indirect operators. In addition, the manual process is highly dependent of handicraft where every worker carries out the straightening, one at a time, with different tools and devices at their disposal. The new machine, however, replaced the workers' dexterity as well as the tools with an algorithm performing the straightening in five batches. In the manual process, this step was the bottleneck for the assembly line and consequently a serious hinderance for the production line. It is also worth mentioning that the way the new machine actually does the straightening is black-boxed for the workers- now acting as operators instead of assemblers- as they only have access to its parameters through control panels and can check its status through monitors. comparing two processes, it proves to be substantial how much change depends on the dynamic of the straightening step.

4 A sociomaterial analysis

A quick comparison between the traditional and the automated set-ups is not all about, and should not reduce the occasion of change to, the change of machinery. The extent and consequence of change requires in-depth analysis. Having introduced the setting, the layout and the process, we now use the aforementioned five notions of Sociomateriality to analyse the accounts of this study. This section is meant to break down the descriptive account into analysable chunks in order to further clarify the changes in practice from a traditional assembly line into an automated one. In so doing, we dissect the "sociomaterial practices" and the way "objects, artefacts and materiality actually matter in organizational activity" in both set-ups (Carlile, P.R., Nicolini, D., Langley, A., Tsoukas, H. 2013, p. 2). This is, however, a partial and non-exhaustive examination and tends to bring forward those aspects of practice consequential in discussing the concept of quality at the shop-floor.

4.1 Materiality

There are obviously differences between the physical characteristics of machines, tools and devices in the one hand and with the robotic solutions on the other. If we take materiality in the sense of physical characteristics, we see that, for example, the interface between the human agent and the technical agent is not the same in both set-ups. Manual solution requires close proximity and direct contact while the interaction with the automated solutions happens through the proxy of panels and screens. The consequence, then, is a rearrangement of work to accommodate the materiality of robotic solutions. For example, analogue data become digital and close sources of data become sources through proxies of monitors. Furthermore, no worker has ever seen codes or algorithms in manufacturing process in the traditional set-up. The digital characteristics of the output and process has been all non-existent. The kind of data that the staff has grappled with then has always been in an analogue form. The prospect changes in the wake of robotic solutions. What the workers are supposed to deal with are lines of codes and bars of graphs on panels now. In other words, they deal with the digital or the representational reality of the quality and do not have any tactile association with quality as they lose touch with the parts and the final product.

However, it is not just the physical characteristics of the product that could be thought of in terms of materiality (cf. Leonardi, 2010). The change in the layout in both set-ups corresponds to the notion of materiality, too. Strictly speaking, there is enough room for the staff to move in the space separating the stations in manual set-up (diagram 1). The available space is not just the necessity or the limitation for the work done in the traditional set-up. Rather, the space can be regarded as an affordance that facilitates the work in a traditional setting of assembly. However, with the robotic solutions in place, no space has been saved for human agents to move between the stations.

Moreover, three screens and four panels support the interaction between the staff and the robotic solutions. This way the format of work practices shifts to adapt to what is afforded by the screens and the panels. The close proximity in the manual is a necessity to manually assemble the end product, but this contact is also the source of the handicraft skilled judgment of product quality assurance and the basis for an effective manual straightening process. In the automated process they have to rely on the robotic system (codes and algorithms through interfaces) and read information about quality as they are translated into numbers on the screens.

4.2 Separability

In both set-ups, there is a persistence existence and continuation of human actors who, not only, form the social aspect of the work practices but also appear to be inseparable from its materiality. That is to say, whether in close proximity or through proxy, the materiality of both set-ups is understandable on account of the "social, human, people, organizations, and work" (Jones, 2014, p. 897). The physical characteristics, the interface, the codes and the charts become relevant and known by the help of the social dimension. On this regard, Leonardi (2013, p. 62) asserts that:

"objects or phenomena do not have agency; people attribute agency to them when they use equipment, machines, formulae and other various apparatuses in an attempt to explain the machinations of the universe through the imposition of causality".

In our argument on quality, the social dimension gets primacy as the quality gets initiated by the help of it. It seems appropriate to conclude that quality is primarily a social concept and then a material construct.

Furthermore, whether engaged with machinery or rudimentary technology such as pliers, the staff, in the traditional set-up, are well aware of the fact that their performance depend on and can be seen in connections with the technology visible to everyone. Now comes the new set-up, the new layout and the new processual routine to get used to. The dynamic of their practices with the new technology changes, but the fact that their performance is inseparable from the technology is a constant assumption while they no longer regard their performance how they were used to.

4.3 Relationality

It is deceptively easy to think of technology as determining performance when one thinks of the assisting role of technology in the performance of work, especially in the context of an assembly line where performance of work is so closely tied with the application of technology. To clarify the matter further, take the press machine, for example, which is responsible for the part of the work that could not be done by human actors. With the traditional set-up, the practice of using the press-machine is carried out directly. In the set-up with the automated solutions, however, the interaction happens indirectly; via lines of code sending operational signals for its activation. In both cases, the performance is dependent on but not determined by materiality. Rather, performance, in both cases, is "a relational product of their [human and technology] intra-action" (Jones, 2014, p. 911).

There is also an issue of flexibility that comes to light when we think of the notion of relationality. The implication here could be seen with having similar stations for both processes but not the same division of work routines. In both set-ups, the whole process of assembly line is divided into three stations. The work routine in each set-up, however, is not similarly divided. The assembly line with automated solutions needs to proceed from station1 to station3 constantly and in tandem. The workers could only engage with the whole set-up. This was not the case with the work arrangements in the old set-up as the staff could work on one station alone for a certain period without having to move to another station or even care for the whole set-up. That is, there are work practices uniquely associated with each station in the traditional set-up which, in return, supports control and flexibility of the entire assembly line. The work practices in the modern one, however, become relevant when we consider working with the entire set-up where control and flexibility is not as similar as the old one since there is, no longer, any work associated with single stations. It might seem controversial to perceive quality of a process with an unlike understanding of control and flexibility.

4.4 Performativity

This notion could be best exemplified with the validation and certification process where the enactment of reality of quality takes place. Unlike the validation step, which is present in both set-ups, there is no certification step observable in the old set-up. With automatic solutions, a new machinery is responsible for certifying the end-product with a laser machine, creating a reality that has not been existent in the assembly line before (diagram 2). Moreover, the validation step itself changes into another shape. In the work with machinery, the staff used to validate the state of the previous step in the process either by looking at or feeling the components or the assembled product at their fingertips. They would perform the validation step once they had put the parts together and carried out the straightening. In case of a problem, they could, trusting their experience, look for the reason and remedy it no matter if the problem had originated from the press machine or further; from the manufacturing line.

With the robotic solutions, the staff create a reality of validation different from the one in the old set-up. The new reality comes with the help of representational models and charts highlighting the properties of the parts and the products. By checking the ongoing process through panels, the staff could validate each step in different manner. As the number of panels indicate, every step in the new process is under continuous observation. However, given their digital reality of validation, the staff do not need to keep track of the panels continuously, since the validated data can be stored, accessed and examined in later occasions. Quality, in terms of validation, is the responsibility of the workers, managed by their experience and delivered by their engagement with machinery, tools and devices. Quality, in terms if validation and certification, is the responsibility of robotic solutions which operate under the supervision of the workers and reflected digitally on charts and graphs.

4.5 Practice

According to Jones (2014) what we consider as a sociomaterial practice goes beyond envisioning what people do and includes factors such as bodily movements, affect, or motivation accompanying such practices. To clarify the matter, in terms of bodily movements, the staff in the old set-up were required to sit at the first station, stand in the second, and move in the third one during one shift. With the automatic solution in place, the work practices are not bound to the bodily movements, rather the staff can perform their task at ease! Better ergonomics comes with automated solutions.

Regarding affect and motivation, we can also compare two set-ups with differences between repetitive tasks, levels of responsibility, stressful mishaps and scheduled work periods. Each comparable item has a significant influence on the mental states of the staff. To analyse the notion of practice, our data gathering includes in-depth interviews that are ongoing at the moment.

5 Discussion

The five notions constitute what we called and employed as a Sociomaterial lens (Figure 3). Each notion could be traced back to different philosophical paradigms; for instance, Materiality goes back to Heidegger's and McLuhan's writings (Ou, 2016) and separability's origin to Barad's take on quantum physics (Orlikowski, 2007). Detailing each notion's background is outside the scope of this study while it is important to acknowledge that all of them, under the roof of Sociomateriality, receive a generous treatment and as a consequence modify our understanding of 'entangled' or 'imbricated' practice (figure 3). This might also explain the reason we encountered overlaps in analysis under several notions as each notion relies on, regulates while simultaneously supports the insights brought up by other notions.

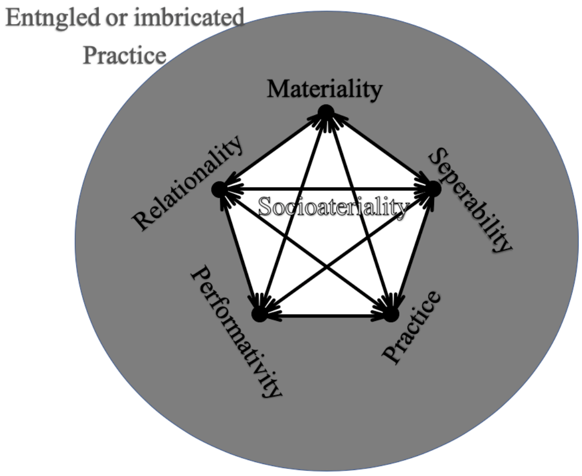

Fig. 3. Sociomateriality as a lens on practice

As we have shown, station 2 was responsible for the straightening step in both set-ups consisting of either ‘simple physical technologies’ (cf. Leonardi, 2013) or automated solutions. Quality in process and product arguably relies on what the station 2 delivers. In the traditional assembly line, quality is not limited to the properties of the product, rather it includes a processual narrative entwined with the properties of the product; with consequences on the work-life quality. In its simplest and uneducated form, the change in quality is often reduced to man-made and automatically made polemic. Change of quality is more than that. The automation processes deliver product quality while at the same time strips away old narrative substituting it with a one that deals with whole set-ups instead of a single station. This is how the assemblers turn into operators as they required to grapple with quality through panels and screens from now on.

As said, the quality goes also beyond the polemic of hand-made, machine-made or robot- made. The narrative on quality is not restricted and could not get simplified through the fact that a product is, no longer, made by dexterity of some worker. The narrative of quality takes issues of flexibility, control, validation/certification steps together with the all parameters that influence the mental states of the staff. In light of the definition by Orlikowski and Iacono (2001), and Iivari (2017) on ‘IT artefact’, we consider automatic solutions as an ensemble of ‘IT artefacts’ as they are not only bound to physical characteristics but include procedural elements, lines of codes, user documentations and other unseen yet consequential characteristics with the ability to process information and mediate work (cf. Wiegel, 2010).

With the help sociomateriality, we compared different issues with the new IT artefact in place while making it consequential to quality in new ways where eventually we believe that quality is a sociomaterial property. By investigating the change process, we meant to make visible its effect on quality at the shop-floor. We, however, have reservations for discussing it any further since as an ethnographically-oriented research, we are gathering more data with interviewing different stakeholders including workers, managers and consultants. We can then provide the reader with more analysis and discussion - more than what have already- hoping to achieve a broader view on the way quality is managed and plays out in the modern set-up.

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