The Factory of the Future? The Contradictory Restructuring of an Assembly Line in France*

*Juan Sebastian Carbonell***

Abstract

This paper studies how the introduction of new technologies and a new organization of work transforms the labour process at an assembly line of the PSA group in France. The firm presents the new organization as an innovative modernization bringing forward the "Factory of the Future" through concepts directly inspired by *Industrie 4.0* and *Industrie du futur*. At the same time, this modernization also responds to the need for the plant to become more competitive in order to face the consequences of the economic crisis of 2008. Drawing from data obtained through fieldwork (interviews with workers, union representatives and internal documents), the author shows that behind the rhetoric of modernization and industrial excellence, the firm intensifies work in assembly operations and workers lose autonomy.
Keywords: digital manufacturing, unions, automotive sector, Industrie 4.0

1. Introduction

In 2011, Germany was the first country to establish an industrial program inspired by the "Fourth Industrial Revolution" focused upon new technologies and model factories with *Industrie 4.0*. In 2015, the French government followed these efforts with a program called *Industrie du futur*. However, German firms adopted this model in order to maintain and develop dominant positions, whereas French firms did it in order to maintain or improve their "competitiveness" i.e. profitability (Bidet-Mayer, 2016; Kohler and Weisz, 2016). This is particularly the case with the French au-

* Articolo proposto: 14/05/2020. Articolo accettato: 28/09/2020.
** Gerpisa, ENS Paris-Saclay, IDHES. E-mail: sebastian.carbonell@gmail.com.
I would like to thank Stephen Bouquin and Solange Manche for their remarks on this article.

tomotive sector that suffered greatly during the economic crisis of 2008 since it faced a decrease in employment and in direct investment in the years following the crisis, and thus turned to high-tech manufacturing as a means – among others – to overcome its critical situation (Alliance Industrie du Futur, 2017, p. 62-78).

Different technologies that draw from the "Fourth Industrial Revolution" are now common in the automotive industry. Research has documented the use of artificial intelligence (AI) and the hidden labor behind it in the development of autonomous cars (Tubaro and Casilli, 2019), and recent research has begun to shed new light on how the labour process is transformed in order to create «high-tech factories», reducing workers' autonomy (Butollo, Jürgens and Krzywdzinski, 2018) and transforming their skills (Krzywdzinski, 2017; Pfeiffer, 2016).

This paper draws from empirical data to show how the introduction of new technologies and new organizational set-ups – the suppression of one of the two assembly lines in the plant and the "modernization" of the remaining one – transforms the labour process at a PSA Group automotive plant in Mulhouse, France.

The introduction of a new work organization can be understood in the context of the economic crisis of the French automotive industry after 2008. In July 2012, PSA announced 4000 layoffs in French factories and the closure of the Aulnay-sous-Bois plant that employs over 3000 workers. The report demanded by the French Ministry of Industry declared that PSA plants were «over-sized» (Sartorius and Serris, 2012), with the capacity utilization of the firm's assembly plants in Europe reaching only of 74 % in 2011[1]. All those different factors (drop in sales, layoffs, difficult financial situation, overcapacity) pushed the firm to find a better adjustment between its production capacities and the real level of production.

The restructuring of the assembly plant at Mulhouse then seems then contradictory. On the one hand, the firm presents reorganization as an innovative "modernization" bringing forward the "Factory of the Future" or the "Excellent Plant" through concepts directly inspired by *Industrie 4.0.* and *Industrie du futur* programs that promises the workforce better working conditions (Groupe PSA, 2016a). On the other, this process also responds to the need to increase the competitiveness by scaling up the productive capacity into a single assembly line of the plant in order to face the consequences of the financial crisis. How does this new assembly process change

1. The audit-report suggested that in order to be profitable, utilization of equipment should be above 75% and even reach 80% of production capacity.

the nature of work? How do workers and union representatives respond to this new organization of work?

Following recent critical research on digital manufacturing in the automotive industry (Pardi, Krzywdzinski and Luethje, 2020; Pfeiffer, 2017), I will show that behind the rhetoric of modernity and innovation, these new forms of organizing work putting in place technologies inspired by *Industrie 4.0* and *Industrie du futur* maintain the old precepts of intensification, control, and discipline in the labour process. I will demonstrate that the new organization discharges workers from mental operations and from some of the most physical operations, but that they also lose their autonomy, i.e. their discretionary power.

The paper will first present its theoretical framework (2.). Then, we will describe the research methodology (3.) and the main characteristics of the new organization of work and the objectives of the firm (4.). Lastly, the paper will present the main research results regarding the new work organization, namely the use of discipline, the effects on worker autonomy and the reaction of union members to the new organization of work (5.).

2. Theoretical framework

We can distinguish three types of recent studies on the digitalization of work and new technologies. The first type tends to engage with the emergence of "platform capitalism" (Srnicek, 2018) and the so called "gig economy" (Scholz 2018; Woodcock and Graham, 2020). Focusing on its effects on workers, this research specifies how different aspects of job quality such as economic security, enjoyment and autonomy are affected in different sectors. For example, Cécile Jolly (2019) considers digitalisation as a threat to collective action and bargaining power of workers. With regard to working conditions, Peña-Casas, Ghailani and Coster (2018) show that in the service sector, digitalisation can affect physical and mental health of workers with excessive working hours, stress and burnouts, etc. due to the obligation to be available at any given time. Whereas studies in sectors like food delivery show that platform-based work generally means a deterioration of working conditions as a whole (Goods, Veen, Barratt, 2019).

The second type of research tends to engage with digitalisation and new technology at work in terms of the replacement of human tasks by machines, in the perspective of a "future without work" (Autor, 2015; Byrnjolfsson and McAfee, 2014), with AI being at the center of the debates on employment (Petropoulos, 2019).

Finally, a third approach has just begun to shed light on consequences of digitalization on more "traditional" sectors such as the auto industry (Krzywdzinski, 2017; Pardi, Krzywdzinski and Luethje, 2020; Pfeiffer, 2016, 2017). This research has developed a twofold critical approach to digital manufacturing. Firstly, this research analyzes the discourses on digital manufacturing as a political project whose aim is to create hypes and trends in order to produce acceptance and to attract investors. Secondly, similarly to the studies on job quality, this research focuses on how the concrete transformation of work and the introduction of new technology modifies workers' skills and autonomy in the labour process in ways that fail to fulfill the promises of *Industrie 4.0*, and demystify the whole idea of a technological revolution.

The study of skill, autonomy and control is not new in the sociology of work. It's part of a long and ongoing sociological tradition of labour process studies (Knights and Willmott, 1990; Thompson, 1983) that draw from the debates sparked by Harry Braverman's *Labor and Monopoly Capital* (1974). Braverman's thesis can be summed up as follows: in the context of capitalist economies, surplus value is obtained and increased by management through the reduction of manual workers' autonomy. This is achieved by a decrease of the level of skill required in production and by an increase of the managerial control over the process as a whole. For Braverman, the use of machinery and new technologies at work can then be understood as a means to increase management's control over work. In this classical view, the increase in productivity makes it possible for the firm to control living labour more efficiently by making the work process less dependent on workers' skills (Thompson, 1989).

Due to its contribution to understanding the changing workplace, labour process theory can be useful in order to study the potential outcomes of the so called Fourth Industrial Revolution (Briken *et al.*, 2017). In particular, it can challenge the assertion that *Industrie 4.0* and digital manufacturing can increase workers' autonomy. Even though Krzywdzinski (2017) points out that since Braverman, there is no consensus among scholars in the abundant literature on the effects of new technology on the workforce's skills and autonomy, empirical research has established the fact that «the use of digital technology intensifies the tendencies towards standardization and control of work in lean production» (Butollo, Jürgens, Krzywdzinski, 2018, p. 17).

Despite the contribution of labour process theory to understanding the transformations of the workplace, our study shows that the consequences of digital technology in manufacturing go beyond autonomy, deskilling and control. For example, the debate on the intensification of work has been particularly important in French sociology and in sociology of work in gen-

eral. This notion can refer to different phenomena: an increase in production rates, the degradation of working and health conditions and an increase in the mental workload (Askenazy, 2004). Intensification can also have different origins. Valeyre (2004) differentiates between market-driven intensification, a «product of greater exigencies on the demand side, particularly time pressures» (Valeyre, 2004, p. 644), and incident-driven intensification, which is a response to technical problems or disruptions in automated environments. For Hatzfeld (2004), intensification can also be difficult to objectify, since it can involve a subjective dimension, such as fatigue and the quality of the work environment.

The literature on work, especially in the automotive sector, has insisted on one last imperative of the introduction of new technologies in assembly workshops that can be found in different empirical accounts of assembly work. The linearity of the production process (Rot, 2002) has become a concern for management as it tries to suppress line stoppages or downtime and useless movement and operations. Having enough parts is key in just-in-time organization. Graham (1995) notes this in her account of assembly work at Subaru-Isuzu Automotive in the USA: «Keeping parts stocked was stressful. SIA uses "just-in-time" production, a method that puts the burden of parts shortages on the shoulders of workers and material handlers. (…) Almost daily, some member of the team would experience the pressure of an impending parts shortage as Materials searched for the part in a truck at the loading dock» (Graham, 1995, p. 77).

3. Methodology

In order to illustrate the different consequences of new technologies in manufacturing, I conducted fieldwork between 2013 and 2017 on the consequences of the economic crisis of 2008 in the automotive sector in France. The automotive industry has been at the center of the debates on new technology at work because it is representative of new trends of industrial organization as a whole (Gorgeu and Mathieu, 2005). It is equally one of the largest capital-intensive industries that makes use of operational robots and a large proportion of unskilled workers (Pardi, Krzywdzinski and Luethje, 2020).

In this article, I will focus on the specific case of the PSA-Mulhouse plant in eastern France, which is the second largest PSA plant in France and one of the oldest. Unlike other plants, it has never benefitted from a large-scale study. Until 2017, production was divided into two workflows: "System 1" assembled Citroën and DS models, and "System 2" assembled

Peugeot models. The firm then implemented a new, more flexible and cost-effective, work organization (described in the next section), which assembles different types of vehicles (Peugeot, Citroën and DS) by using only one system thanks to an EMP2 platform[2].

The plant is also known for using an unskilled workforce, particularly in assembly operations. In 2013 the plant employed around 7400 people, including 5900 manual workers. The temporary workforce – employed mainly in manual work – varied considerably during the research. The plant employed around 200 temp workers in 2013, 1400 in 2016, but only 700 in 2017. Lastly, two thirds of the operators work in 2x7 hours shifts and around 500 operators work in the night shift.

This research was made possible thanks to two union officials, one from the CGT and another from the CFDT of PSA-Mulhouse, who introduced me to their colleagues and friends and gave me access to needed documents such as union leaflets, reports and brochures, as well as internal documents from management, notably the minutes from the Health Committee (comité d'hygiène de sécurité et des conditions de travail) of the assembly workshop and from the plant's Workers Representatives Committee (comité d'établissement). I conducted fifty-one semi-structured qualitative interviews with workers. All were manual workers except for one maintenance worker, one logistics technician and one foreman. Most of the interviewees had ties with unions or were trade union representatives, mainly from the CGT and the CFDT unions. All but three of them were men, and almost all of them had an immigration background from Southern Europe, from Eastern Europe, from the Maghreb or from overseas France. Interviews were carried out at their homes or at cafés in Mulhouse before or after their shifts, with some exceptions of interviews that were carried out at the unions' offices at the plant.

I met some workers several times in order to understand how they evaluated the changes in work organization over time and the effects of these changes during PSA's crisis (work time, working conditions, employment, union activity). Interviews also aimed to establish workers' trajectories in the firm (hiring date, changes in working positions in the plant and union membership). Interviews ranged from forty five minutes to two hours and a half and lasted one hour on average. With some exceptions, they were transcribed in full and analyzed following French "ethnographic sociology" (Beaud and Weber, 2010; Beaud and Weber, 2012), which focuses on long-

2. The *Efficient Modular Platform 2* is the base structure of the vehicle that allows the construction of different models.

term fieldwork, monographic studies and reflection on the conditions of the production of data.

The French system of industrial relations is characterized by union plurality. Since 2008, unions achieve bargaining power if they obtain at least 10% of the votes during the elections that occur every four years at the level of the plant. During the 2015 elections at PSA-Mulhouse which canvassed all personnel, the CGT obtained 22,3% of the votes, and the CFDT 21,9%, whereas FO, CFTC and CFE-CGC, formed info a pro-business electoral front called «the Alliance», secured 53,6%[3]. As a result of being introduced to workers by members of the CGT and CFDT, I interviewed mostly members and sympathizers from these unions.

Elected delegates are appointed to the Representatives Committee, while members of the Health Committee are designated by unions among elected delegates. The Representatives Committee discusses the economic situation of the plant and the firm, whereas the Health Committee discusses every-day work, safety and health conditions. In big plants, there can be a Health Committee for every workshop, as is the case in this study. These two committees discuss in different ways the ongoing transformation of work organization, one focusing on its economic and employment aspects and the other on health and working conditions.

4. The new organization of work on the assembly line

The new organization of work consists in the automation of the feeding of parts to the assembly line and in the upstream treatment of product diversity thanks to the assemblage of kits. As we said, these innovations are presented by management as a means to achieve the “Factory of the Future” (Groupe PSA, 2016a).

In the old system, the supply of components at the workstation was assured by workers themselves with parts racks positioned at the edge of the assembly line. They used the Kanban system that allowed them to pick from these racks the parts corresponding to each vehicle before assembly[4]. Kanban was an organizational innovation from the Toyota Production System, whose goal was to reduce intermediary stock: workers would only

3. Despite the electoral results, the CGT and CFDT have a majority of the manual worker’s vote (28% and 24,7% respectively).

4. In its original meaning, kanban is a sheet of paper with the type and the number of pieces to assemble (Shimizu, 1999).

have to pick the exact type and the exact number of components needed at the workstation for each type of vehicle. In the new system, called full-kitting, the supply of the assembly line is ensured by supply kits, which are racks made of white and grey metal tubes. These contain the parts that are going to be placed in the vehicles at the workstations. The references to the parts that are going to be assembled are no longer in the kanban, but in the kits that are unique to each vehicle. This system allows workers to pick the parts directly from the kits without having to move away from the workstation at the assembly line.

The kits containing the parts for each vehicle are themselves assembled upstream in the kitting area that replaces the preparation area at the edge of the assembly line. The components are loaded onto the kits and transported to the assembly line by autonomous trolleys called Automated Guided Vehicles (AGV). Around 300 of these trolleys follow 24 magnetic trips attached to the floor that connect the kitting area and the workstations at the assembly line. AGV move at 3 km/h (walking speed is around 5 km/h). Once positioned at the workstation, the kit follows the worker during all the operations. At the end of the assembly line, the AGV retrieves the empty supply kit and returns to the kitting area so the cycle can start over. The introduction of AGV modifies the hierarchy of circulation in the assembly workshop. Every halt of an AGV can stop the assembly line and produce downtime. The importance of AGV is summarized in internal documents and briefings: «priority to the workflow = priority to the AGV» (Groupe PSA, 2016b).

The idea of an automated trolley supplying the assembly line is not new. Thompson (1994) describes the use of wire-guided AGV in a manufacturing plant in the USA, where the AGV connects machining tools disposed in the shape of a horseshoe. At the PSA plant however, the movement of the AGV is controlled by Internet through Wi-Fi. The trolleys are also equipped with sensors that make an AGV stop if someone crosses its path.

The principle of full-kitting is simple: the goal is to carry the right supply kit, with the right components, on the right vehicle, in the right quantity, and at the right time. Before, if there was a problem with the components during the supply of the assembly line, it could produce delays in the final assembly. This is a permanent issue in the automotive industry, where variety has replaced standardized production, increasing the mental workload of assembly workers (Limière, 2011). Diversity used to be managed partially by workers themselves with the Kanban system, where they had to pick the right part for the vehicle at the edge of the assembly line. With the implementation of the full-kitting, diversity is no longer connected to the

workflow. In the long run, 96 % of components of the vehicle should be delivered on the assembly line by those kits.

A new occupational position is created in the shop floor: the kitter, whose role is to assemble the kits. The introduction of the full-kitting highlights the internal logistics of manufacturing. The work of the kitter ressembles the work of pickers found in the warehouses in the logistics sector. At the PSA plant, the supply system in the kitting area is called "pick-to-light". In order to assemble a kit, the kitter approaches a box where a light flashes. He takes a certain number of parts. He pushes a button to indicate he has taken the parts and proceeds to the next box where a light flashes. These operations have to be carried between the arrival of the AGV to the kitting area and its departure to the assembly line. Pick-to-light is a supply system originated in the logistics sector as a part of lean logistics (Wright and Lund, 2006) as is the pick-to-voice system which is voice-controlled (Gaborieau, 2012). The pick-to-light system reduces the picking time and accelerates the rate of supply of the workstations at the assembly line. Intensification then takes the form of an increase in the production rate.

As a result, downtime due to parts shortage is less frequent on the assembly line, since operators no longer need to focus on having enough parts or having the right parts. These are delivered directly to the workstation by an AGV. According to management and some workers interviewed, the suppression of movements around the assembly line reduces mental workload. Workers no longer face the «wall of components», as some call the parts racks at the edge of the assembly line (Groupe PSA, 2015), and can concentrate on the assembly operations. A logistics technician puts it in the following words: «Before, you had all the components at the edge of the assembly line. Operators would walk 150 meters around his workstation, they used to run. Now, the aim is that the operator has all the components brought to him in less than three meters».

This concern with linearity will have different consequences in workers' stress and accountability in the workshop, as we will see in the next section.

5. Research results

5.1. Excellence through discipline

While concrete aspects of the workflow and the labour process are modified by these organizational innovations, other aspects of the work environment are modified by new rules. There are two types of rules in the workplace. On the one hand, rules related to work organization, or pre-

scribed labour. On the other, «proscribed disorder» (Gaudemar, 1982, p. 87), meaning a code of conduct or rules that do not have direct consequences on production (such as the prohibition of smoking or even singing) and whose aim is to normalize workers' behavior.

Management presents new attitudes in the workplaces as being part of the ongoing technological "revolution" aimed at achieving the "Excellent Plant". When PSA specified the reorganization of the assembly line, it said that many of the attitudes and behaviors tolerated in the old assembly line will no longer be allowed. It then established a whole series of new bans or presented as such: some of them were already in existence, such as the ban on eating at the workstation, although they had been accompanied, in practice, by strong tolerance. "Small arrangements" were permitted, allowing the work environment to be more pleasant for operators. This is how Luc puts it:

> Before, you could drink your coffee at your workstation, you could put down your backpack. You could eat biscuits if you wanted to. You can't do that anymore. You can't do anything. Today they try to ban coffee, but the reason is not even linked to quality. Because they are obsessed with hygiene. […] They call it the "Excellent Plant". Everything is clean. You have to respect everything.

For the interviewees, no longer being able to eat or drink at the workstation is seen as a prohibition which does not make sense because it reduces their autonomy in the workplace: it is experienced as the imposition of an abstract productive logic even upon seemingly insignificant gestures.

These rules, or «proscribed disorder», do not organize production directly, and whether they are followed or not has no immediate consequences on productivity, but they are in a way a barometer of the degree of management control over the behavior of workers. This is best illustrated by the unsuccessful attempt of management to ban signs of union membership on the assembly line, as recounted by Mohamed, an assembly worker and a CFDT delegate:

> At one point management told us that since we were going to become a premium factory, that the walls were white, that the only colors we would see would be the vehicles' colors, [and] it would be good for them to see the union leadership so we can negotiate not to wear a union t-shirt. Obviously all [unions] agreed to say: "Out of the question".

New rules can be subverted under the eyes of supervisor, as Christian says in the following interview:

> I brought a coffee machine to the work team. Because in the other teams there were [machines], in mine there was none yet, the monitors[5] never had time. So, I found it at the flea market, I brought it back to work, a lady brought us a kettle. Now we can drink tea and coffee. So people can see people discreetly with their mugs, they hide to take their mugs.

Subversion of rules can always develop at the margins of the assembly line by adapting to the new framework imposed by management. Christian's remarks reveal a desire to make the new organization of work livable without engaging openly in trade union fights around the prohibitions. These circumvention strategies also make it possible to test the limits of the new framework.

The new organization of work does not make it impossible for new forms of solidarity to emerge, nor does it make unionism impracticable. The new set-up both tests old union practices and pushes delegates to reinvent new ones.

5.2. Accountability and autonomy

Workers' experience is modified by the new work organization. Some workers expressed hopes that some more physical operations would disappear with kitting, but at the same time expressed discontent that autonomy declined.

This is best expressed by Craig, an immigrant temp worker. He was one of the first workers to be transferred to the new assembly line. He began his interim work in 2014 at the sun visor workstation which is, according to him, relatively physical and difficult. Being young, he is also rather foreign to unions and political stakes in the workshop:

> Frankly, it's a lot easier to move components, because the parts arrive directly in the kit. And so, I know that at such and such a location, my component is there. Such component is at such location, I take it, I mount it directly. In the end, we no longer make mistakes. It is rather the kitting people who can make mistakes. (…) We are rather concentrated, and it is easier. It's easier in the sense that in the old assembly line, where we ran all the time. Sometimes you no longer had components at your workstation, so you had to go get the parts. And if the monitor is not nearby, because he is helping another colleague, at that moment you have no choice [other than to go get the parts].

5. The monitor is a position between the operator and the supervisor. He is in charge of the quality of work, but normally he has no disciplinary powers.

As we said, full-kitting can ease certain physical operations (like lifting the sun visor in his case) and work therefore appears to be easier and less tiring. Workers no longer have the impression of «running all the time», which allows them to concentrate on the assembly operations. Beyond easing physical effort, full-kitting reduces mistakes and errors during assembly because workers no longer need to know if they have the right part for the right car, or if they have enough parts to continue working. This provokes a displacement of accountability in the workshop. Craig puts it this way:

> What I appreciated in the new system is the ease of having the parts next to the kit. Because when I was on the old assembly line, sometimes I made mistakes with the hubcaps. I mounted the hubcaps on the right side of the car and there was hubcap B and C. So, the B it was the black hubcap and the C it was the chrome one. So, with the pressure of the assembly line, if I miss the operation two or three times, I can find myself downstream at the bottom. I have to go up quickly, you pull the [Andon] cord[6] and there is no one [to help you]. (…) And it worked a lot on my morale. (Laughs) Every day I said to myself: the objective today is zero non-compliant hubcaps, that's it! So [in the new assembly line] we don't have that problem.

Lean manufacturing made «zero error standard» one of its principles (Womack, Jones, and Roos, 1990). The reduction of errors is obtained through self-monitoring, that is to say the accountability of the employees and their assimilation of quality standards. The desire to avoid sanctions means that they align their objectives with those of the firm and seek to minimize the mistakes made and ensure quality production.

However, «zero errors» is more an ideal than an actual practice, because the acceleration of the assembly line makes work more prone to human error: under the pressure of the speed of the assembly line, it is impossible not to make mistakes. Employee accountability and the internalization of managerial values have the perverse effect that workers hesitate to declare errors, for fear of being sanctioned. This is how Alberto, assembly worker and member of the CFDT union, puts it:

> The problem is that people want to avoid making mistakes. So they do not seek help and try to fend for themselves. Except that by doing this, they will quickly realize that they will not be able to manage the situation. When it is an occasional problem, yes, when it's be several in a row, it’s no longer manageable.

6. The Andon system allows an operator to report an error on his station. An operator can stop the line by pulling on a cord. The monitor then comes to assist the operator at his station. However, the line stoppage is recorded in the computer system, which is why, as this worker says, some operators try to avoid using it.

> So it's really accepting that when you can't, you'll call [the monitor]. There is a system which is set up, the famous Andon system, but which at one time was misused. That is to say that the monitor was always nearby. When people had a problem they called the monitor so that he came to solve the problem without there being a trace somewhere. And we managed to solve many problems without declaring it.

On the old assembly line, if an operator ran out of parts and the monitor was not present, he risked stopping the line. In some strategic positions (seats, wheels, etc.), there was no tolerance for downtime. «Small arrangements» (as some workers put it) could then exist between operators and monitors. The latter assisted an operator in difficulty so that the assembly line did not stop. Downtime was not then recorded in this case and neither party was sanctioned by management.

However, these arrangements are no longer possible with the supply of parts directly to the workstations by AGV. Errors are reduced in the assembly process through the supply of components directly on the kits. This does not mean that errors have disappeared, only that they have been displaced to the kitting area, as the logistics technician quoted before says:

> Before you had fifty thousand pieces. This reference is fine on this car… No, it's not that one, I was wrong… Now everything is already prepared beforehand. If ever there is an error, it is in the preparation.

There is therefore a displacement of guilt and accountability to the kitters: if an operator is left with a wrong component in the kit, he can more easily stop the line and call the monitor without fear of a sanction.

The reduction of movement around the workstation and the concentration on assembly operations modifies another aspect of the work experience as Christian, worker at the assembly line and member of the CGT, puts it:

> You really feel like you are in prison. We are blocked by the kits. (…) At the same time, the components follow you, so you don't even see the time passing on the car.

Alberto puts it in similar terms:

> You felt the time in relation to your movement [around the workstation], when you looked around, you knew when you were late, early, or on time. You no longer have these markers. A lot of people are confused… We don't know when it's the beginning and when it's the end [of your workstation].

This complaint is also present during the meetings of the Health Committee of the assembly workshop: operators lack space and feel confined at their workstations. For Luc, after the reorganization, «[the firm] makes you feel that you are there to make cars». In the previous configuration, markers on the floor separated the different workstations, while in the new configuration the absence of visual markers reinforce a geography in which workers must concentrate only on assembly operations.

5.3. Rethinking union activity in a new configuration

As made evident in presentations at the Health Committee of the assembly workshop, improvements in working conditions were promised on several levels, both on the workstations and on the general climate (atmosphere) of the workshop (better lighting was presented as a major change). For some employees, the reorganization of the assembly line could have positive aspects, as reported by Mohamed: some operators were «confident» that things would improve thanks to the «millions» invested.

Apart from a few CGT leaflets, few voices were raised against the reorganization of the assembly line. Rather, for delegates from the Alliance, the investment in a new assembly line was a medium-term guarantee for jobs. Some delegates, notably from the CFDT, were vigilant and willing to improve working conditions to the extent possible (through, for example, participation to working groups). The challenge for trade unionists from the CGT and the CFDT is then to find their bearings in the new workshop, to learn to orient themselves in an unknown environment and to form new habits of union work. As Giraud, Pélisse and Pénissat (2018) show, when trade unionists are faced with changes in working conditions following organizational innovations there can be forms of «critical appropriation » of and adaptation to new organizational contexts. Krzywdzinski (2017) shows also that strong employee representation can encourage job enrichment and improvement of vocational skills during technological innovation. However, our study shows that unions and union representatives in committees tend to leave aside issues of job enrichment and skills in favor of safety and work intensity issues.

In an interview with Luc, an assembly worker and member of the CGT, just a few months after his transfer to the new assembly line, he describes his impressions of the new work process:

> Before, you had Kanban. You picked the parts and put them in the car. Now, you have a situation where people take the parts directly from the [kit] and put

them in the car, which prevents movement around the workstation, which overburdens the workstations and allows for productivity gains and so on. That's the other thing, the production rate. Everyone is working on the new assembly line since Monday, but it's been three months since we've been working here! (…) And now, it's 62 vehicles/hour, it's very fast, it's only 57 seconds per vehicle, which is very, very fast.

Concrete labour is decomposed and redistributed in the assembly workshop between assembly workers and kitters. Work becomes simpler and workers see fewer prospects for requalification. This example illustrates the idea that «the simpler and the more repetitive is an operation, the easier it is to find and to apply technical solutions that are cost-efficient» (Coriat, 1990, p. 200). As the same logistics technician puts it:

The goal is that operators can be replaced by anyone. The goal is that there are no longer professional skills, that anyone can accomplish any given operation during assembly. (…) You follow the robots. You look at them, if something is wrong, you control the visual aspect. You don't need any serious training to do anything. The goal is that anyone can do anything.

When I ask him about the stakes of union work in the new assembly workshop, Alberto describes a power struggle:

We are really in a period where they are seeing what people are ready to accept. It's pretty… palpable. Because people quickly give up. The problem is that today we only make 75% of the expected production and when the remaining 25% will arrive…

This power struggle is best exemplified in the debates during the Health Committee of the assembly workshop. A multitude of «serious and imminent danger» (*danger grave et imminent*, DGI) notifications were filed by members of the Committee (mainly from the CGT) between September and November 2017 concerning the problems encountered with the new assembly facilities. The Force Ouvrière union, not used to declaring DGIs, also made a statement to the Health Committee on September 8 denouncing the working conditions of kitting workers[7].

Another way in which union members tried to formulate new demands concerned the speed of AGV. Alberto has had several reports from operators regarding the speed of AGV. Workers in the kitting area claimed that

7. We can read these debates in the minutes of the Health Committee of the 6th, 8th, 12th, 22nd of September and of the 13th October and 9th of November 2017.

they could not make their kits on time, and that the robots left without the kits. This prompted the kitters to either kick the AGV to stop them or to run after them. Alberto then decided to measure the speeds of the AGVs using tape and a timekeeper, which enabled him to highlight the acceleration of the robots in certain parts of their trajectory. A new demand, which did not succeed, was made that a "halt" function for AGV, equivalent to the Andon cord, should be integrated into the trolleys.

The introduction of the new work organization raises a final question as to how union representatives position themselves vis-à-vis the overall process. From the start, they hesitated between denouncing the restructuring process of the assembly line and seeing it as safeguarding the future of the plant and its employment. Their fears for the future came mainly from the heavy cuts in jobs with the suppression of one of the two assembly lines. Questioning the organizational choices of management would call into question the whole process. For union activists it seems very hard to make demands that go against the general functioning of the new production system. Trade union activists feel forced to formulate demands which are compatible the new work organization.

6. Conclusion

This article is a contribution to the demystification of digital manufacturing and the idea of a "Fourth Industrial Revolution" in the auto sector in France. Using labour process theory's contribution to understanding the changing workplace and the role of new technology, this study on the reorganization of an assembly line shows two things that hide behind the rhetoric of "modernization". Firstly, that it can obscure the pursuit of a strategy that aims to counter the erosion of profitability PSA is going through. Secondly, that the organizational innovations that it introduces – the automated feeding of parts to the assembly line and the treatment of diversity through kitting – contribute to the intensification of work and the loss of workers' autonomy.

The establishment of a new work organization involves a redistribution of concrete labour and the types of accountability in the workshop. The assembly workers are more concentrated on the sole assembly operation, while the kitters prepare the kits containing the parts upstream. This affects the experience of assembly line work. The work seems easier to be carried out thanks to the reduction of certain number of physical tasks, and to the reduction of mental workload through the transfer of errors and accountability to the kitting area. However, work is more intense and workers lose

part of their autonomy. Also, new forms of discipline are introduced in the workshop. This reorganization of work poses new challenges for trade unions. Some, like the CGT, opposed the restructuring from the beginning, while others, like the CFDT, sought to improve working conditions once it was introduced.

The case study of a PSA plant illustrates the danger of seing in each organizational innovation a revolution that would overturn the old system of work in the workshop. For Pardi, Krzywdzinski and Luethje (2020) there is a «performative» dimension in technological and organizational innovation in the workplace. In this sense, concepts such as "The Excellent Plant", "The Factory of the Future" or *Industrie du futur* for example, are far from being neutral and can be seen as ideological-political projects that obscure some of the negative aspects of technological innovations.

References

Alliance Industrie du Futur (2017). *Étude filières Industrie du futur. Synthèse des impacts et des recommandations*.

Askenazy P. (2005). Sur les sources de l'intensification. *Revue économique*, 56, 2: 217-236. DOI: 10.3917/reco.562.0217

Autor D.H. (2015). Why Are There Still So Many Jobs? The History and Future of Workplace Automation. *Journal of Economic Perspectives*, 29, 3: 3-30. DOI: 10.1257/jep.29.3.3

Beaud S., Weber F. (2010). *Guide de l'enquête de terrain*. Paris: Éditions La Découverte.

Beaud S., Weber F. (2012). Le raisonnement ethnographique. In: Paugam S, *L'enquête sociologique*. Paris: Presses Universitaires de France.

Bidet-Mayer T. (2016). Tour d'horizon des politiques d'"Industrie du futur". *Annales des Mines - Réalités industrielles,* 4: 47-50. DOI: 10.3917/rindu1.164.0047

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

Briken K., Chillas S., Krzywdzinski M., Marks A. (2017). Labour Process Theory and the New Digital Workplace. In: Briken K, Chillas S, Krzywdzinski M, Marks A (eds.), *The New Digital Workplace How New Technologies Revolutionise Work*. Basingstoke: Palgrave.

Butollo F., Jürgens U., Krzywdzinski M. (2018). From Lean Production to Industrie 4.0. More Autonomy for Employees?. Discussion Paper, WZB Berlin Social Science Center, October 2018.

Byrnjolfsson E., McAfee A. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: W. W. Norton & Company.

Coriat B. (1990). *L'atelier et le robot. Essai sur le fordisme et la production de masse à l'âge de l'électronique.* Paris: Christian Bourgois Editeur.

Gaborieau D. (2012). Le nez dans le micro ». Répercussions du travail sous commande vocale dans les entrepôts de la grande distribution alimentaire. *La nouvelle revue du travail* [Online], 1. DOI: 10.4000/nrt.240
Gaudemar (de) J.-P. (1982). *L'ordre et la production. Naissance et formes de la discipline à l'usine.* Paris: Dunod.
Goods C, Veen A, Barrat T (2019) "Is your gig any good?' Analyzing job quality in the Australian platform-based food-delivery sector. *Journal of Industrial Relations*, 61, 4: 502-527. DOI: 10.1177/0022185618817069
Gorgeu A., Mathieu R. (2005). Les restructurations industrielles : une fatalité du marché ? Le cas de la filière automobile en France. *La Revue de l'Ires*, 47, 1: 37-58. DOI: 10.3917/rdli.047.0037
Graham L. (1995). *On the Line at Subaru-Isuzu. The Japanese Model and the American Worker.* Ithaca, London: ILR Press.
Groupe PSA (2015) *Planète Mulhouse*, Hors série « Plan de transformation » n° 4, spécial kitting, avril 2015
Groupe PSA (2016a). *Le pôle de Mulhouse. En route vers l'usine du futur*, 14th of April, 2016.
Groupe PSA (2016b). *Health Committee of the assembly workshop*, 24 of October, 2016.
Hatzfeld N. (2004). L'intensification du travail en débat. Ethnographie et histoire aux chaînes de Peugeot-Sochaux. *Sociologie du travail*, 46, 3: 291-307. DOI: 10.1016/j.soctra.2004.06.001
Jolly C. (2019). Collective Action and Bargaining In the Digital Era. In: Neufeind M, O'Reilly J, Ranft F (eds.), *Work In the Digital Age. Challenges of the Fourth Industrial Revolution.* London, New York: Rowman & Littlefield.
Knights D., Willmott H. (eds.) (1990). *Labour Process Theory*, London: Macmillan Press Ltd.
Kohler D., Weisz J.-D. (2016). *Industrie 4.0. Les défis de la transformation numérique du modèle industriel allemand.* Paris: La Documentation française.
Krzywdzinski M. (2017). Automation, skill requirements and labour-use strategies: high-wage and low-wage approaches to high-tech manufacturing in the automative industry. *New Technology, Work and Employment*, 32, 3: 247-267. DOI: 10.1111/ntwe.12100
Limère V. (2011). *To Kit or Not to Kit: Optimizing Part Feeding in the Automotive Assembly Industry.* Ghent: Ghent University, Faculty of Engineering and Architecture.
Pardi T., Krzywdzinski M., Luethje B. (2020). *Digital manufacturing revolutions as political projects and hypes: evidences from the auto sector.* ILO Working Paper 3.
Peña-Casas R., Ghailani D., Coster S. (2018). Transition digitale dans l'Union européenne : quels impacts sur la qualité de l'emploi? In: Vanhercke B, Ghailani D, Sabato Sebastiano (eds.), *Bilan social de l'Union européenne 2018. Dix-neuvième rapport annuel*, ETUI.
Petropoulos G. (2019). The Impact of Artificial Intelligence on Employment. In: Neufeind M, O'Reilly J, Ranft F (eds.), *Work In the Digital Age. Challenges of the Fourth Industrial Revolution.* London, New York: Rowman & Littlefield.

Pfeiffer S. (2016). Robots, Industry 4.0 and Humans, or Why Assembly Work Is More than Routine Work. *Societies*, 6, 16: 1-26. DOI: 10.3390/soc6020016
Pfeiffer S. (2017). *Industrie 4.0* in the Making – Discourse Patters and the Rise of Digital Despotism. In: Briken K, Chillas S, Krzywdzinski M, Marks A (eds.), *The New Digital Workplace How New Technologies Revolutionise Work*. Basingstoke: Palgrave.
Rot G. (2002). Fluidité industrielle, fragilité organisationnelle. *Revue française de sociologie*, 43, 3: 711-737. DOI: 10.2307/3322881
Sartorius E., Serris J. (2012). *Rapport à Monsieur le Ministre du Redressement productif sur la situation de PSA Peugeot Citroën.* 11 septembre 2012.
Scholz T. (2017). *Uberworked and Underpaid. How workers are disrupting the digital economy*. Cambridge, Medford: Polity Press.
Shimizu K. (1999). *Le Toyotisme.* Paris: La Découverte.
Thomas R. J. (1994). *What Machines Can't Do. Politics and Technology in the Industrial Enterprise*. Berkeley, Los Angeles, London: University of California Berkeley.
Thompson P. (1989). *The Nature of Work. An Introduction to the Debates on the Labour Process*. London: The Macmillan Press Ltd.
Tubaro P., Casilli A. A. (2019). Micro-work, artificial intelligence and the automotive industry. *Journal of Industrial and Business Economic*s, 46: 333-345. DOI: 10.1007/s40812-019-00121-1
Valeyre A. (2004). Forms of Work Intensification and Economic Performance in French Manufacturing. *Eastern Economic Journal*, 30, 4: 643-658.
Womack J.P., Jones D.T., Roos D. (1990). *The Machine That Changed the World.* New York: Rawson Associates.
Woodcock J., Graham M. (2020). *The Gig Economy. A Critical Introduction*. Cambridge, Medford: Polity Press.
Wright C., Lund J. (2006). Variations on a lean theme: work restructuring in retail distribution. *New Technology, Work and Employment*, 21, 1: 59-74. DOI: 10.1111/j.1468-005X.2006.00163.x