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Workplace Learning through Human-Machine Interaction in a Transient Multilingual Blue-Collar Work Environment

This article explores processes of jointly negotiating work practices (i.e., workplace learning) in a contemporary blue-collar work environment characterized by transience, language diversity, and limited opportunities for human-human interaction. The article is based on linguistic-ethnographic fieldwork in a metal foundry in the Dutch-German borderland, where many employees have temporary contracts and diverse language backgrounds, and where many production tasks are delegated to machines. The article shows that human-machine interaction, combined with a newcomer's ability to observe and hypothesize, can fulfill vital functions for workplace learning processes, while the temporariness of work relations can demotivate employees to invest in these processes.

Dieser Artikel untersucht Prozesse der gemeinsamen Gestaltung von Arbeitspraktiken (d.h. Lernen im Prozess der Arbeit, auch Workplace Learning) in einem aktuellen Blue-Collar-Arbeitsumfeld, welches von Kurzlebigkeit, Sprachenvielfalt und begrenzten Möglichkeiten der Mensch-Mensch-Interaktion geprägt ist. Die Untersuchung stützt sich auf linguistisch-ethnographische Feldforschung in einer Metallgießerei im niederländisch-deutschen Grenzgebiet, wo viele Mitarbeiter befristete Arbeitsverträge und unterschiedliche Sprachhintergründe haben, und viele Produktionsaufgaben an Maschinen delegiert werden. Der Artikel zeigt, dass die Mensch-Maschine-Interaktion in Verbindung mit der Beobachtungs- und Hypothesenbildungsfähigkeit eines Neuankömmlings zentrale Aufgaben für die Lernprozesse erfüllen kann. Die kurzlebige Natur der Arbeitsbeziehungen kann dagegen eine demotivierende Wirkung auf die Bereitschaft der Mitarbeiter haben, in diese Prozesse zu investieren.
[workplace learning, human-machine interaction, community of practice, transience, blue-collar workplace]

Practices, or "those repeated social and material acts that have gained sufficient stability over time to reproduce themselves" (Pennycook 2018, 53), play an important role in any work environment. Work practices may have positive or negative consequences for areas such as productivity, workplace safety, and job satisfaction. The concept "community of practice" is typically used to refer to a group of people who have developed particular practices during a shared history of mutual engagement (Wenger 1998, 83; King 2014). This means that these practices are not

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based on some preexisting script that, in this case, employees have brought to their workplace. Instead, these practices are jointly negotiated over time and on the whole, it is hard to imagine that much work can be done without them.

The aim of this article is to explore how jointly negotiated work practices can emerge in a contemporary blue-collar work environment that seems far from ideal for this to happen, namely a production department of a metal foundry in the Dutch province of Limburg, less than three kilometers from the Dutch-German border. In this work environment, opportunities for human-human interaction are limited due to mechanization, as a consequence of which many employees work with particular machines, either alone or in pairs. Moreover, these machines produce a lot of sound, which further limits the opportunities for human-human interaction. Besides this, when human-human interaction occurs, employees are often confronted with language diversity and the transience of work relations, both of which could impact the joint negotiation of work practices (Mortensen 2017). The languages spoken in the metal foundry include Dutch, German, and local dialects from Limburg (hereafter: Limburgish; Cornips 2013), as well as Arabic, Polish, Russian, and Turkish, among others. The individual language repertoires of employees who work in pairs often do not overlap much.

Although mechanization frustrates processes of jointly negotiating work practices (i.e., workplace learning) in the foundry, the article shows that it also enables various forms of workplace learning, which emerge through human-machine interaction. By analyzing a critical case, during which the challenges of transience, language diversity, and limited opportunities for human-human interaction come together, the article shows how human-machine interaction can help to overcome some challenges, while others still remain. The main participant in the case study is a temporary employee from Poland who needs to learn how to work with a particular machine. At first, he receives some help from a more experienced employee from the Netherlands. They have no shared history yet, and the overlap in their individual language repertoires is limited. Later, the employee from Poland is left to work with the machine on his own. Applying a posthumanist framework (Latour 2005; Pennycook 2018), the article discusses the employee's workplace learning process, and the diverse functions of human-machine interaction that emerge during this process.

The article starts with a literature review about existing linguistic-ethnographic research in blue-collar work environments. The methodological background of the study (including its ethical considerations) is then elaborated upon. The subsequent sections focus on the theoretical framework and the empirical material as the basis for the final discussion about the implications of the study for our understanding of language, workplace learning, and mechanization in contemporary blue-collar work environments.

Language and Workplace Learning in Blue-Collar Work Environments

"Transience" and "language diversity" characterize many contemporary blue-collar work environments. Lønsmann and Kraft (2017, 138) define blue-collar workers as laborers in the primary sector (e.g., agriculture) and the secondary sector (e.g., manufacturing), whose jobs are "often, but not always, temporary, and low-status." Furthermore, many studies of blue-collar workplaces highlight language diversity as a prominent theme (e.g., Goldstein 1997; Handford and Matous 2015; Kleifgen 2013; Kraft 2017; Piller and Lising 2014; Sunaoshi 2005; Theodoropoulou 2019; Tutt et al. 2013), although there are well-known exceptions to this tendency (e.g., Daly et al. 2004; Holmes and Marra 2002; Holmes and Woodhams 2013).

Several studies that focus on language diversity in blue-collar work environments show that employees with similar ethnolinguistic backgrounds tend to work together in groups here, and that they often speak a different language at work than the country's official or majority language (Goldstein 1997; Kleifgen 2013; Piller and Lising 2014). Kleifgen (2013, 162) points out that "an open policy regarding self-

selected teams and multiple-language use" can positively affect processes of workplace learning in such settings. However, in work environments where learning typically depends on interactions between employees whose individual language repertoires do not overlap much, communication may still be a challenge.

In a study of a manufacturing company in the United States, Sunaoshi (2005) found that higher-ranking workers from Japan had difficulties using English in their interactions with lower-ranking workers from the United States. Despite such difficulties, the study found that interactions became more effective once workers had spent more time with each other (Sunaoshi 2005, 192–193). Similar observations have been made on construction sites in the United Kingdom (Tutt et al. 2013) and Qatar (Theodoropoulou 2019), where workers with diverse language backgrounds developed a shared repertoire over time. These findings suggest that language diversity can become less of a challenge when workers spend some time together and, thus, develop particular ways of interacting.

On the other hand, these findings also suggest that jointly negotiated work practices may not be as likely to emerge in an environment that is not only characterized by language diversity, but also by transience. On a construction site in Hong Kong, Handford and Matous (2015, 95–96) found that time pressure, combined with the importance of safety, could explain why the construction workers spent little effort on interpersonal accommodation, particularly on the side of full-time employees from Japan toward contracted employees from Hong Kong. Another explanation is that these employees possibly did not see much value in spending time on creating goodwill, as their work relations would be short-lived (Handford and Matous 2015, 96). Thus, transience may not only pose a challenge to workplace learning due to a lack of time, but also due to a lack of motivation.

One strategy that people, whose individual language repertoires do not overlap much, may use when they need to interact, is to employ certain multilingual modes, such as a lingua franca (Hülmbauer, Böhringer, and Seidlhofer 2008), receptive multilingualism (Ten Thije and Zeevaert 2007), code-switching or code-mixing (Muysken 2000), languaging (Jørgensen and Varga 2011), and translation or interpretation. One additional strategy to deal with both linguistic and auditory challenges is to rely on nonverbal communicative modes. Various studies of blue-collar workplaces have, in fact, highlighted the important role of nonverbal modes such as gestures, objects, sounds, gaze, and body positioning (Gherardi and Nicolini 2002; Kleifgen 2013; Sunaoshi 2005; Theodoropoulou 2019; Tutt et al. 2013).

Nonetheless, in a study of workplace learning on a construction site in Italy, Gherardi and Nicolini (2002, 206–208) found that verbal resources played an important role in the construction of "memorable events," as the situated use of certain words (e.g., "always," "never," "you should," "well done") helped newcomers to memorize specific situations in specific ways, and to develop a sense of how to see and feel in this environment. This indicates that situated combinations of verbal and nonverbal modes might be essential for the development of a "professional vision" (Goodwin 1994).

Apart from the human employment of multilingual modes, translation, interpretation, and nonverbal communicative modes, human-machine interaction can also play an important role in mechanized work environments. In a study of workplace learning in a circuit board manufacturing plant in the United States, Kleifgen (2013, 61–63) observed how a machine produced rhythmic sounds that experienced employees could interpret as indications of a robotic arm managing or failing to pick a socket. This is how the machine became an active participant in the situated interactions and learning processes at work. The active role of machines has also been explored by Suchman (2007), who argues that machines cannot be as effective as experienced human tutors in situated learning processes, as they typically miss the circumstantial and interactional details that human-human interaction routinely relies upon (Suchman 2007, 182–183). Human-machine interaction alone may not overcome the potential challenges posed by language diversity, in other words.

Finally, language diversity may pose a challenge to workplace learning in relation to written communication. Written texts—or "literacy artifacts" (Barton and Hamilton 2005)—play an important role in many daily interactions in the workplace. In such institutional settings, texts are often thought to exercise power and control over work practices, but as pointed out by Ueno (2000) and Kleifgen (2013), they need to be recontextualized and (re)appropriated in order to become meaningful in situated interactions. Therefore, an inability to make sense of a written text may frustrate such (re)appropriations, as Lønsmann (2014, 100–101) found with regard to blue-collar workers in a multinational company in Denmark, who had problems understanding English signs, computer messages, and emails.

Methodology

This article focuses on one audio-recorded case, in which diverse circumstances that may challenge workplace learning (limited opportunities for human-human interaction, transient work relations, language diversity) come together. By analyzing this critical case, the article explores the question whether and, if so, how jointly negotiated work practices can emerge under these combined circumstances. Furthermore, the selected case can be considered typical in the sense that it reveals the functions that human-machine interaction can fulfill during such processes. If human-machine interaction helps to overcome the already mentioned challenges for workplace learning in this case, it can probably fulfill important functions in less challenging learning situations as well.

The selected case was recorded during a 3.5-month period of ethnographic fieldwork in the metal foundry, which took place between July 3 and October 15, 2017. During this time, I participated in various work practices in almost every foundry production department as an additional worker, e.g., by helping people lift heavy products. My participation in these practices implied that I worked different shifts, including night shifts. In total, I made 74 hours of audio recordings and 6.5 hours of video recordings of workplace interactions; I audio-recorded 11.5 hours of interviews; I took 139 photographs; I wrote approximately 150 pages of fieldnotes, and I collected a wide range of other data. The current article's case study is based on one audio recording, two photographs, and my fieldnotes.

As other researchers in blue-collar work environments have noticed as well (e.g., Holmes and Woodhams 2013, 280–281), the sound levels in the foundry posed a challenge to making good-quality audio recordings. Moreover, I found that employees' talk during work practices was often fragmented and full of deictic words, which made it impossible to interpret the recordings in case I was not present. Therefore, I am clearly present as a participant in the audio-recorded interactions, and I typically carried the recording equipment in the pocket of my work shirt. In the remaining sections of this article, I will further reflect upon the impact of my presence. As I wanted to find out how employees talked with each other, I decided that I could not act as their interpreter.

Due to the size of the foundry (which had around 500 employees during my fieldwork), the transience of the workforce, and my procedure of regularly changing work teams, it was impossible to get explicit consent from every employee before my fieldwork started. Therefore, I worked with implicit consent by hanging up a written announcement in three languages (Dutch, English, and German) in the workplace. The Ethics Review Committee Inner City Faculties in Maastricht has officially approved this research practice. Nevertheless, I still asked for people's explicit consent before recording them.

Finally, while I made observations in every single production department during my fieldwork, it is no coincidence that this article focuses on a case from the Finishing Department in particular. Work practices that made up the foundry production process were clustered into four departments: the Core Shooting Department (where sand cores were produced to mold the metal); the Melting Department (where metal

was melted); the Casting Department (where the melted metal was molded using the sand cores); and the Finishing Department (where the metal products, after hardening, were sawed, ground, blasted, welded, and quality-checked, among other actions). Among these four departments, the Core Shooting Department and the Finishing Department had the highest percentage of temporary workers (both around 60%), and the diversity of spoken languages in these departments was relatively high as well. In the next section, I introduce the Finishing Department in more detail.

Transience and Language Diversity in the Finishing Department

The main participant of this article's case study is VIN, a younger man from Poland.[1,2] When I met VIN in the metal foundry, he had lived in the Netherlands for almost a year. During this time, he had worked in three different places (consecutively) through a temporary employment agency (hereafter: agency). The foundry was his third workplace, and VIN had worked there for about two months when we met. As the current section shows, VIN can be considered a typical example of the foundry's historically developed labor recruitment practices.

Like other employees, VIN was assigned to work in one particular production department where he would usually stay as long as he worked in the foundry. In VIN's case, this was the Finishing Department. Counting 150 employees at the time of my fieldwork, who worked in three different eight-hour shifts, this was the largest production department. At the time, there were 88 temporary employment agency workers (hereafter: agency workers) like VIN in the Finishing Department, making 59% of the staff.[3]

Most agency workers in the Finishing Department (66−70 workers, or 75−80%), including VIN, had a so-called "stage A contract" (Dutch: "fase A-contract") in August 2017. "Stage A" means that an employee had been working via an agency for less than 78 weeks (uitzendbureau.nl 2018). During this stage, he could do hourly work for an unlimited number of employers through the agency, but neither the employer nor the agency had to guarantee any number of working hours (uitzendbureau.nl 2018).[4] The remaining 18−22 agency workers (20−25%) had a "stage B contract," which means that they had worked via an agency for more than 78 weeks, and were now working on the basis of temporary contracts from this agency (uitzendbureau.nl 2018).

During my fieldwork in 2017, the economy was doing very well and the demand for the foundry's products was very high. In contrast, following the global financial crisis of 2008, the foundry narrowly escaped bankruptcy and had to lay off more than 100 employees. Since then, the foundry's management had been cautious with handing out new permanent contracts, as the CFO explained to me in an interview.[5] Using agency workers instead, the foundry was able to adapt more easily to (sudden) changes in the demand for its products, which primarily included metal components of trucks, luxury cars, and central heating boilers.

When the economy was blooming again as in 2017, the foundry had a hard time finding enough agency workers to keep up with the rising demand for its products. Therefore, the agency that worked for the foundry had started looking for labor beyond the Dutch border, which was facilitated by the European Union's free movement of people. Consequently, people like VIN gained an opportunity to work in the foundry.

In the Finishing Department, people with Dutch citizenship (including first-generation migrants who had obtained Dutch citizenship) made up less than half (48%) of the workforce, although they were still the largest national group. People with German citizenship were the second largest group (25%), which can be explained by the foundry's proximity to the Dutch-German border. The third largest group (11%) consisted of people with Polish citizenship, including VIN, which is in line with the observation that there are many labor migrants from Poland who work

for agencies in the Netherlands (Berkhout, Bisschop, and Volkerink 2014). The remaining workers (16%) included citizens from EU countries like Greece, Hungary, and the Czech Republic, as well as citizens from non-EU countries like Morocco, Syria, and Turkey.

Furthermore, in the Finishing Department, most employees with Dutch citizenship (67%) worked on permanent contracts from the foundry, while most employees with German citizenship (84%), Polish citizenship (100%), and others (67%) worked for an agency. The reasons for these differences are partly historical. As many older employees and one former CEO explained to me, most production workers up until, approximately, the 1990s could speak Dutch.[6] Ever since that time, the need for more labor gradually opened up the production departments for, first, German-speaking employees and, since January 2017, employees who spoke neither Dutch nor German (but, in most cases, some English). Recently recruited employees, especially since the financial crisis of 2008, tended to work for agencies.

VIN started work for the foundry in mid-2017. Apart from his first language, Polish, I mostly heard him speak English in the workplace. He did not speak Dutch or German, although he occasionally blended in a German word in an otherwise English sentence. That newcomers like VIN did not (or did hardly) speak Dutch or German was considered a problem by many of the older, Dutch and German-speaking employees, who often felt uncomfortable speaking English. VIN, on the other hand, told me (in English) that he did not consider language diversity a problem, as long as his coworkers showed him what to do: "it is about how to show me how make it—dat-dat-dat—I can do that." I will explore how VIN did, indeed, manage to develop some relevant expertise during a work shift in the Finishing Department, but first I will explain my theoretical approach to the joint negotiation of work practices.

A Posthumanist Approach to Workplace Learning in the Finishing Department

What distinguishes practices from other repeated social and material acts is that they "have gained sufficient stability over time to reproduce themselves" (Pennycook 2018, 53). "Communities of practice" (Lave and Wenger 1991; Wenger 1998) is a well-known framework that helps to describe how specific acts gain such stability, as it offers a set of technical terms or tools that can capture the joint negotiation of particular practices over time. In the current section, I discuss how this framework can be applied in VIN's work environment, the Finishing Department.

Following Wenger (1998, 73), a "community of practice" consists of participants who engage with each other due to a joint enterprise, and who build up a shared repertoire while doing so. Joint enterprises that I observed in the Finishing Department included specific work practices such as the sawing, grinding, blasting, welding, and quality-checking of hardened metal products. Specialized employees always did the welding tasks, and these welders did not do other tasks. Other employees could be assigned to do any of the remaining tasks, either alone or in pairs, and which task they did could vary per work shift. Therefore, I consider all employees in the Finishing Department who were participating in any of the remaining tasks as potential members of one community of practice. The overarching, joint enterprise of this community would be to finish the production process of particular metal products.

In order to achieve the different purposes of their joint enterprise, employees in the Finishing Department worked with "reifications" (Wenger 1998, 58–61) as diverse as tools, words, machines, and printed work instructions. According to Wenger (1998, 61), reifications typically create shortcuts for the participants of a joint enterprise, which can help certain actions to take less effort and become more effective. The introduction of hoists in the Finishing Department, for example, had probably once made it easier to lift heavy products. Similarly, the introduction of the commonly used, English abbreviation "FD" had probably once made it easier to refer to this department.

Wenger (1998, 88) further underlines that reifications are "open to reinterpretation and to multiple interpretations." At the same time, Latour (1992, 225–227) and Holland et al. (1998, 60–63) have pointed out that reifications—which they call "artifacts"—can encourage and discourage certain ways of use by certain participants. In other words, reifications "afford" (Gibson 2015, 119–120) certain meanings or practices. The hoists in the Finishing Department, for example, were attached to rails in the ceiling, which afforded employees with diverse body types to lift heavy products in specific areas of the workplace, and not in others. Similarly, the abbreviation "FD" afforded quick communication between employees with diverse language repertoires at particular moments in particular areas of the foundry, depending on the sound level. If intentionality is not assumed to be a requirement for agency, as in actor-network theory (Latour 2005) and posthumanism (Pennycook 2018), these observations problematize the distinction between "participants" and "reifications" (hereafter: artifacts) in a community of practice.

Problematizing the distinction between participants and artifacts has implications for the "shared repertoire" of a community of practice as well. Wenger (1998, 84) argues that a community's shared repertoire should not be thought of as a container of "literally shared meaning" between all members of a community of practice, but as "a resource for the negotiation of meaning" between these members. Considering that the artifacts that make up such a "resource" play an active role as participants in the negotiation of meaning or practices, however, the community's shared repertoire may be better thought of as a "spatial repertoire" (Pennycook 2018, 47–51). This spatial repertoire consists of all interacting participants-and-artifacts then—in other words, all "actants" (Latour 2005, 53–55)—during the pursuit of a joint enterprise in a particular time and space.

Problematizing the distinction between participants and artifacts does not preclude any differences between different types of actants. According to Wenger (1998, 88), participants and artifacts act as "distinct forms of memory and distinct forms of forgetting." Although a distinction between participants and artifacts on the basis of memory may be problematic as well, it is plausible that the accumulation of memories of past experiences matters for the degree in which actants participate in the practices of a community. Therefore, I keep the distinction between "masters" and "apprentices" (hereafter: "experts" and "newcomers"), which Lave and Wenger (1991, 56) have constructed to make a relative distinction between different actants in a community of practice based on their degree of participation.

In the Finishing Department, certain experienced employees (experts) were able to do any of the nonwelding tasks, while others could only do some of them. Newcomers were usually not able to do any of these tasks on their own yet, as they lacked the expertise to interact with human coworkers and nonhuman artifacts in a meaningful way for the pursuit of their joint enterprise. Lave and Wenger (1991) have shown how such newcomers typically start their involvement in a community's practices through "legitimate peripheral participation" by doing simple aspects of a task, and how their involvement becomes more complex as they gradually move toward "full participation" in the community's practices. Wenger (1998, 99–101) underlines how newcomers typically depend on mutual engagement with more experienced human coworkers (experts), which would explain why it is important that these experts consider the participation of newcomers legitimate. In the next sections, I discuss how this framework can be applied to the work situation which VIN, a newcomer to the Finishing Department, found himself in upon our first meeting.

Human-Machine Interaction as a Means to Distinguish Newcomers from Experts

Initially, it was a challenge for me to distinguish newcomers from experts in the Finishing Department. As may be expected in an industrial work environment, the department's joint enterprise was "Taylorized," i.e., segmented into "standardized,

repeatable tasks in order to maximize efficient production" (Urciuoli and LaDousa 2013, 177). Moreover, many work tasks were delegated to machines (mechanization) and employees' work largely consisted of enabling these machines to do such tasks (e.g., by feeding them certain materials).

However, during the delegation of tasks, I noticed that human expertise was still considered relevant here. This task delegation was done at the start of a work shift by a team manager, who had an overview of the available labor and the particular needs of a given moment. As discussed in the previous section, welding tasks were only done by specialized welders (human experts). Other production workers were assigned to do the remaining tasks, which mostly involved interactions with a particular machine. Such machines were usually operated by one or two employees, which means that production workers typically worked alone or in pairs. During my fieldwork, the question whether an employee was considered capable of working alone with a machine turned out to be an important indicator of whether he was still considered a newcomer.

In the Finishing Department, where many employees had temporary contracts and diverse language backgrounds, team managers did not seem to take language skills into account when they asked two people to work together, as I frequently saw people working together who did not share a lot of language resources. Two team managers from this department whom I spoke to about my observation, confirmed that they did not take language skills into account.[7] Considering that many of the more experienced workers were older men from the Netherlands or Germany, unlike many newcomers, I could see the challenge for the managers to find "linguistic matches." As a consequence, mutual engagement between newcomers and experts often constituted a challenge.

The current article's case study is an example of such a challenging situation. When VIN and I met for the first time, he was assigned to work with a blasting machine. This artifact was introduced to the spatial repertoire of the Finishing Department's community of practice, because it could help clean metal products by blasting a special kind of sand. VIN was not familiar with this artifact yet, so he still had to figure out how to interact with it. He was accompanied by a more experienced worker (a human expert) who could show him how to do this. This was PER, an older, permanent contract worker from Limburg, the Netherlands, who had worked in the metal foundry for over 20 years. After 2.5 hours, PER would leave the workplace and VIN would have to be able to work with the blasting machine on his own then, which implies that he had to develop a certain degree of expertise in a short period of time.

The main task of people working with the blasting machine was to hang metal products on hooks, which would go through a blasting cabin like a "merry-go-round." After this "ride," the workers had to take the products off the hooks again and remove any remaining sand from them, for example by putting the products on a vibrating table. Afterward, the workers had to check the products for possible flaws. They would do this partly with their naked eye, and partly by using certain tools. Possible flaws would be marked with a crayon. Finally, "flawless" products were placed on a pallet, while "flawed" products were placed on another pallet. A forklift truck would come and bring the "flawless" products to the next stage of the production process, while the "flawed" products were brought to a welder.

The quality check clearly involved some degree of human expertise. To facilitate this task, the spatial repertoire was usually enriched with written work instructions (a literacy artifact) that explicated what to pay attention to when checking the quality of a particular product type. These instructions were always written in Dutch only, and they were always accompanied with photos and illustrations. Despite the latter, a newcomer without any knowledge of Dutch would probably not be able to understand the instructions, as they often contained specific explanations such as "hier mag een braam van max. 2 mm blijven staan" ("a burr of max. 2 mm may remain here"). Literacy artifacts like this required some human expertise before they

could afford a meaningful interaction with an employee for the pursuit of a joint enterprise in the Finishing Department, in other words.

When I met VIN and PER at the blasting machine, PER told me that someone else would afterward perform a quality check this time. Possibly, this explains why VIN was thought to be able to work alone later that day. If you want to perform a quality check, PER told me in Limburgish, "den mos-se wete was-se 'nt doon bös" ("then you have to know what you are doing"). Since VIN was not involved in the quality-check practice this way, he did not develop his expertise in this respect, which could have turned him into a fuller participant in the work practices with the blasting machine. He did, however, need to develop his expertise with regard to the interactions with the blasting machine. At the start of the work shift, it was this expertise that distinguished PER from VIN, and VIN's learning process can be considered a means to enable the blasting machine to perform its cleaning task.

Yet, PER did not seem particularly motivated to support this cause, because he did not expect VIN to stay very long in the foundry anyway—or, in his words: "euver twieje-en-'n-half oor bön ik weg, morge steit dae heej nimmer" ("in two-and-a-half hours I am gone, tomorrow he is not here anymore"). Moreover, PER did not agree with his employer's policy to recruit migrant workers like VIN, as "hae ken auk Nederlanders pakke, we hebbe namelijk viefhonderddoezend werkloze" ("he could also take Dutch people, we have five-hundred-thousand jobless people after all"). For PER, not investing in VIN's learning process was a way to resist this policy, and he did not consider VIN's role as a newcomer in the foundry legitimate, in other words.

Furthermore, this refusal to invest in VIN's learning process might have been a way for PER to maintain the distinction between himself as an expert, and VIN as a newcomer. It is possible to understand PER's apparent desire to underline this expert identity against the background of Taylorization (which could make employees more easily replaceable by others), the idea that permanent workers like PER might get laid off during a crisis (as happened after the financial crisis of 2008), and the idea that blue-collar jobs are often considered "low-status" (Lønsmann and Kraft 2017, 138). Moreover, PER's reluctance confirms the idea that transience may not only pose a challenge to workplace learning due to a lack of time, but also due to a lack of motivation to invest in the learning process of newcomers. Despite his apparent reluctance, however, the next section shows how PER still helped VIN to develop his expertise in human-machine interaction during the analyzed work shift.

Human-Machine Interaction as a Communicative Mode

The case examined in this article shows what can happen when various obstacles, which challenge the development of jointly negotiated work practices, come together during one event. The current section focuses on the interactions between PER and VIN and explores the question whether and how this mutual engagement contributed to the development of jointly negotiated work practices, which primarily involved interacting with a blasting machine (a nonhuman artifact).

The first obstacle concerns the limited overlap between PER and VIN's individual language repertoires. As discussed earlier, I only heard VIN speak Polish (his first language) and English (his second language) in the foundry, although he occasionally blended in a German word in an otherwise English sentence. I heard PER speak Dutch and Limburgish (his first languages), as well as German and English (his second languages). In theory, this meant that they could employ the communicative mode of English as a lingua franca, but PER told me that he had hardly spoken any English since high school. Similar to most other, older production workers from Limburg I met in the foundry, he preferred using German over English with his colleagues.

The second obstacle concerns the transience of the work relation between PER and VIN. They had never worked together before, so they could not rely on memories of

any jointly negotiated work or communication practices from the past. The third obstacle concerns the limited opportunities for human-human interaction, as PER had to leave the workplace after 2.5 hours, and VIN would have to be able to work with the blasting machine on his own then.

Moreover, PER's unwillingness to spend much time and effort on VIN's learning process can be considered another obstacle. The same is valid for the impact of my presence on the analyzed event. Without being present, I would not have been able to make sense of the audio-recorded interactions between PER and VIN. At the same time, my presence meant that I became part of these interactions. As the current section shows, this probably frustrated the mutual engagement between PER and VIN.

When I first met PER and VIN, I introduced myself and my research project and asked for their permission to make an audio recording. To ensure that I was being understood and to establish an informal, nonthreatening atmosphere, I decided to use Limburgish when I talked with PER. As I could not do something similar by speaking Polish with VIN, I decided to use English when I talked with him. Hence, my introductory talks with PER and VIN were more or less separate conversations: one in a monolingual Limburgish mode, and one in an English lingua franca mode. However, based on some of PER's utterances I could tell that he overheard and understood some content from the English conversation between VIN and me. VIN did not seem to understand the Limburgish conversation between PER and me.

My introductory conversation with PER took quite a bit longer than the one with VIN. PER shared many opinions about the foundry with me during this conversation, which I possibly allowed or even encouraged him to do by verbally acknowledging that I was listening to him (e.g., by saying "jao-jao," which means "yeah-yeah" in Limburgish). I have discussed some of these opinions, such as PER's view on the recruitment of labor migrants, in the previous section. Clearly, conversations like these were useful for me to develop an understanding of the environment that I found myself in.

At the same time, my initial decisions had a noticeable effect on the interactions that I became part of. When PER spoke to me, he would use Limburgish. When VIN spoke to me, he would use English. Furthermore, PER continued to share many opinions about the foundry with me, which is an investment in mutual engagement that he might have spent differently without my presence. Moreover, as PER noticed that I did not mind speaking English with VIN, he tried to use me as an interpreter once.

Extract 1 shows the interactions between PER and VIN that occurred after PER asked me to interpret for him, which I politely refused. Before asking me, he had just explained to me (in Limburgish) how the situation at the blasting machine was rather exceptional at that moment. Of the five hooks that were going through the blasting machine, four had to remain empty. The reason was that one particular type of product had to be blasted as fast as possible, because another employee urgently needed it. Unfortunately, there was only one hook that matched this product type. To speed up the process, the team manager had asked PER to only use this hook for now, and to leave the other four empty. As the blasting time could be adjusted for each individual hook (via the machine's control panel), the blasting time for each empty hook could be reduced to the minimum (three seconds). The amount of 'wasted time' would then be reduced to a minimum as well.

Due to this exceptional situation, VIN could develop new expertise that would turn him into a fuller participant in the work practices. As long as PER and VIN were working together, PER could adjust the blasting time himself—which he also did. Once he would leave, however, VIN had to perform this task on his own, but explaining how to do this was a challenge for PER. Therefore, after telling me how difficult it would be for him to explain everything in English, PER asked me if I could explain the task to VIN. After I refused, PER made an effort himself, as extract 1 shows.

Extract 1

Italics = original transcription

Bold italics = English transcription (not translated)

Bold italics underlined = English transcription (translated from Dutch)

****Bold italics underlined with asterisks**** = English transcription (translated from Limburgish)

Participant	Verbal transcription	Other interactions
01 PER:	*do you have see what I have done? (.) do you have see what I have done?* ***do you have see what I have done? (.) do you have see what I have done?***	
02 VIN:	*e:h what (is)* ***e:h what (is)***	
03 PER:	*[clock] you zet the clock a(xxx) e:h on three seconds (.1) four times (.1) on one (.) on eh (dreej) three minutes (.1) on a big one (.) three minutes (.) re(verse) (.) and four times (.) three seconds (.7) ja? (.1) one minute (.1) two minutes (.1) three minutes (.) when I* ***[clock] you set the clock a(xxx) e:h on three seconds (.1) four times (.1) on one (.) on eh (*three*) three minutes (.1) on a big one (.) three minutes (.) re(verse) (.) and four times (.) three seconds (.7) yes? (.1) one minute (.1) two minutes (.1) three minutes (.) when I***	PER shows VIN how to adjust the blasting time, using a relay. Above the relay, there is a plate with the Dutch words *"relais straaltijd"* ("relay blasting time"). The relay shows the numbers "0," "0.5," "1," "1.5,", "2," and "2.5."
04 VIN:	*[a:h yeah=yeah=yeah=yeah=yeah]* ***[a:h yeah=yeah=yeah=yeah=yeah]***	
05 PER:	*(I set him on drives) eh=u:h three se=eh=seconds then (.) then we faster* ***(I set him on drives) eh=u:h three se=eh=seconds then (.) then we faster***	
06 VIN:	*[a:h eh alright]* ***[a:h eh alright]***	
07 PER:	*(.2) we we do that umdat e:h die (.) eh that young man must have a panel with this (.2) (xxx) and he can no work* ***(.2) we we do that *because* e:h that (.) eh that young man must have a panel with this (.2) (xxx) and he can no work***	
08 VIN:	*why don't make it before?* ***why don't make it before?***	
09 PER:	*we don't e:h wə=we don't (.2) that e:h that robot en=e:h that side (.2) is not e:h proGRAMMED (.1) on that side (.2) dat is that's idioticness in my e:h in MY EYES is that idiotic (.1) we must say how a man the man stands (.1) en dan (.) heb je 'm heel (.) in=e:h in de (.) in de takel (.) (the time to go) (xxx) in the one (.) here*	

(Continued)

Participant	Verbal transcription	Other interactions
	we don't e:h wə=we don't (.2) that e:h that robot and=e:h that side (.2) is not e:h proGRAMMED (.1) on that side (.2) that is that's idioticness in my e:h in MY EYES is that idiotic (.1) we must say how a man the man stands (.1) and then (.) have you him entirely (.) in=e:h in the (.) in the hoist (.) (the time to go) (xxx) in the one (.) here	
10 VIN:	*[yeah=yeah=yeah=yeah]* ***[yeah=yeah=yeah=yeah]***	
11 PER:	*(.3) in=e:h in the year=e:h=e:h thirty=fourty (.1) (xxx) (mensen on) e: h=eh=eh (.1) people go to the moon (.) en weej werke weej werke nog op die manier* ***(.3) in=e:h in the year=e:h=e:h thirty=fourty (.1) (xxx) (people on) e: h=eh=eh (.1) people go to the moon (.) *and we work we work still in this way******	

Considering PER's reluctance to spend any effort on VIN's learning process and his modest appraisal of his own English speaking skills, it is rather surprising that he still decided to enrich the spatial repertoire with English language resources when explaining the practice of adjusting the blasting time to VIN. Typical of the communicative mode of English as a lingua franca, he combined these English resources with other verbal and nonverbal resources. Examples of verbal resources that he used are the Limburgish words "dreej" ("three," in line 3) and "umdat" ("because," in line 7), and the Dutch phrase "en dan heb je 'm heel in de takel" ("and then you have him entirely in the hoist," line 9). In line 11, PER completely switched to a Limburgish mode again, when saying "en weej werke nog op die manier" ("and we still work in this way"). With regard to nonverbal communicative modes, PER performed the adjustment of the blasting time for VIN (line 3), while the relay (a literacy artifact in the spatial repertoire) afforded meaning-making through the numbers that it showed.

PER's opening question ("do you have see what I have done?" in line 1) immediately constructed PER as the more resourceful expert (who did something that VIN apparently needed to pay attention to), while it constructed VIN as the less resourceful newcomer. This way, the purpose or discourse type (Redder 2008, 140) of the interaction—instruction—was immediately established as well. Besides, this question might have helped to turn the situation into a "memorable event" (Gherardi and Nicolini 2002, 206–208). Considering the purpose, line 3 is of central importance. After all, this is where PER gave the instruction that was supposed to teach VIN how to adjust the blasting time. Moreover, line 4 ("a:h yeah=yeah=yeah=yeah=yeah") indicates that VIN understood the explanation, which means that the purpose seemed to be achieved.

Whether VIN really knew how to adjust the blasting time by himself remained unclear as long as PER was still with him, because PER did not let VIN try to do the adjustment himself. When after 2.5 hours PER left the workplace, I stayed behind with VIN for approximately two more hours. During this time, it was confirmed to me that VIN had, indeed, understood PER's explanation, as he showed that he was

able to adjust the blasting time by himself. He also knew which times to set the machine to. Thus, VIN had become a fuller participant in the work practices with the blasting machine.

However, PER could not know for certain whether VIN had actually understood his explanation. When PER was about to leave the workplace, this realization urged him to check once more whether VIN would be able to perform the given tasks on his own. This second interaction between PER and VIN was similar to the first one (extract 1) in several ways. Again, the interaction started with PER asking a question ("do you know how the system works?"), which immediately constructed PER as the expert and VIN as the newcomer. And again, PER gave a verbal explanation in English while at the same time performing the human-machine interaction, but he still did not let VIN try to perform this interaction by himself. Apart from these two interactions, PER and VIN hardly talked with each other at all.

Finally, PER's switch from English as a lingua franca to a monolingual Limburgish mode (line 11) is worth some consideration. It is unlikely that PER would have made such a full switch without my presence, which raises the question who was the main addressee in line 9 and line 11: VIN or me?

Although I underlined in my self-introduction that I worked independently from the foundry's and the agency's management, it is possible that PER suspected that my observations would reach his employer. Concerning the observation that PER did not let VIN try to perform the human-machine interaction by himself, this leads to at least three possible interpretations. First, PER might simply not have thought about letting VIN try himself. Second, PER might have wanted to maintain some power distance between himself (the expert) and VIN by not letting VIN handle the machine. Third, PER's attempt to instruct VIN might not have been very genuine, and extract 1 might primarily have been a way for PER to show me how difficult it was to achieve a work-related purpose with an English-speaking agency worker like VIN. Possibly, PER thought that I might report such a finding to his employer afterward.

No matter what PER's intention was, however, and despite all the odds, the purpose of PER's instruction was still achieved. By observing PER's human-machine interaction while listening to PER's English utterances, and through the affordances of the control panel, VIN managed to figure out how he could adjust the blasting time by himself. Whether VIN performed this task exactly in the way envisioned by PER in the end is irrelevant. VIN's potential influence on this task—his agency—is exactly what made it a jointly negotiated work practice, and although the total amount of jointly negotiated practices was minimal, this practice still contributed to the development of VIN's expertise, or professional vision (Goodwin 1994), with regard to the interactions with the blasting machine.

Human-Machine Interaction as a Joint Negotiation of Work Practices

Whereas the previous sections explored the function of human-machine interaction as a valuable outcome of jointly negotiating work practices, and the function of human-machine interaction as an additional resource for human-human interaction during the negotiation process, the current section centers its attention on human-machine interaction as a joint negotiation process in itself. Specifically, the section focuses on the interactions between VIN and the blasting machine that occurred after PER had left the workplace.

Although VIN had learned how to adjust the blasting time by himself, this did not mean that everything went well. In fact, approximately 15 minutes after PER had left, VIN and I were already confronted with a problem. All of a sudden, the blasting machine stopped working, and neither of us understood why this had happened. Fortunately, the machine 'spoke' to us about the apparent problem by enriching the spatial repertoire with a Dutch message that it displayed on a screen: a literacy

artifact (Figure 1). The only difficulty was that we did not understand this message, which was "ongeoorloofde doorloop laadplaats" ("illegal passage of loading-point").

VIN's first reaction upon noticing that we had a seemingly unsolvable problem, was to go find the team manager (an older worker from Limburg who also spoke a bit of English). PER was not an option, since he had left the foundry. VIN was not able to find the team manager, however. Therefore, he turned to another colleague — a younger Polish-speaking agency worker—but he could not help us.

Shortly afterward, another older worker from the Netherlands approached our workstation. Without saying a word, he walked toward the blasting machine and pressed the start button. The machine started working again. Once VIN and I realized what had happened, we laughed about this simple solution and continued our work. In the presence of his Polish-speaking colleague, VIN also expressed his relief to the machine in Polish by saying "zapierdala, zapierdala, bierz to kurwa" ("it works fucking well, it works fucking well, take this, fuck").[8]

After this incident, we did not encounter any problems anymore. Although the older worker from the Netherlands had not explained anything, it became clear to me that someone must have stood or walked somewhere where we were not supposed to stand or walk, and that an automatic safety measure must have turned off the machine. The words "ongeoorloofde doorloop laadplaats" made sense to me now, and as the safety measure was not activated anymore during the remaining 90 minutes I spent with VIN, I assumed that he had understood the main point as well.

The blasting machine's influence on where VIN and I could stand and walk during the work practices reminds me of Latour's (1992) argument that the role of "mundane" artifacts should not be overlooked in sociological studies that try to explain people's behavior. Moreover, the way in which the blasting machine

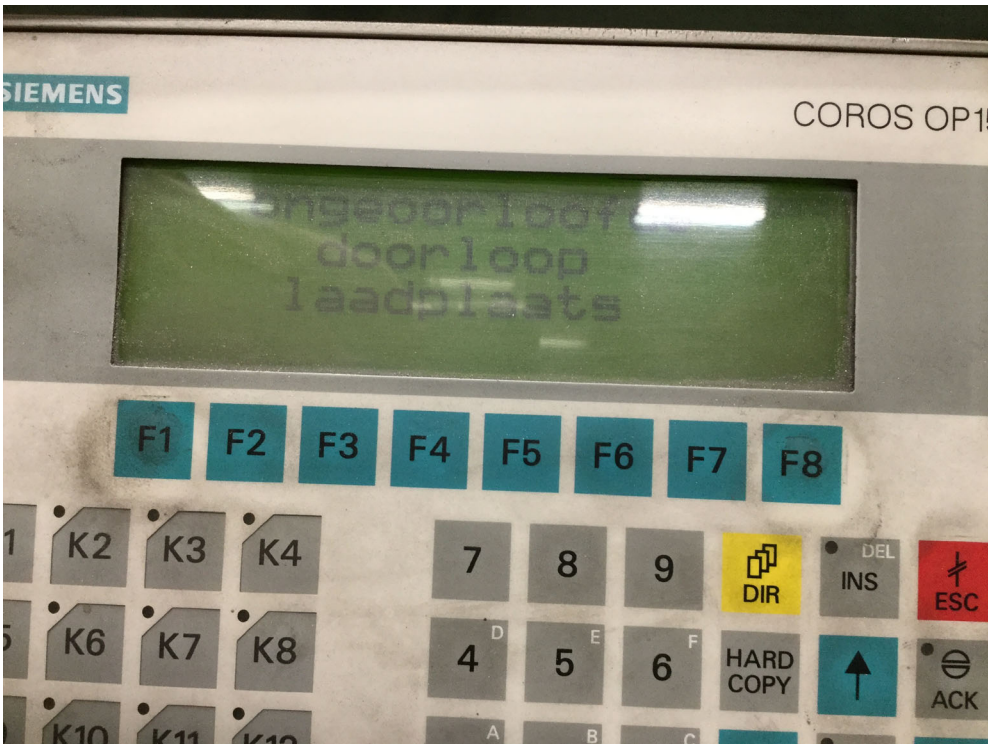

Figure 1. The blasting machine "speaking" Dutch through a displayed message, and English through various buttons in the right bottom corner of the photograph. [This figure appears in color in the online issue.]

influenced our behavior can be understood in terms of communicative modes as well. In fact, the machine employed both a monolingual Dutch mode by displaying a Dutch message on a screen, and a nonverbal communicative mode by turning itself off. The combination of these modes had the purpose of instructing us that we were doing something that, apparently, was unsafe. In the end, we both seemed to understand that we were not supposed to stand/walk in certain areas. Thus, apart from an artifact that afforded certain ways of being used, the blasting machine functioned as a "nonhuman expert" in relation to both our workplace learning processes.

In terms of affordances, the written texts on and around various buttons—mostly in Dutch, but occasionally in English—informed employees which buttons they should press in which situations. Interestingly, the emergency stop button had an English text ("emergency stop") around it, and it showed a clearly visible, symbolic indication of its function as well, as the button was bright red while being placed against a bright yellow background (Figure 2). The button that employees needed to press to restart the machine, on the other hand, only had a Dutch text on top of it ("start stralen," which means "start blasting"), and its nonverbal indication was arguably less clear, as it was one out of several buttons that could lit up a warm yellow light once the blasting process had started (this button is highlighted by me through a red circle in Figure 2). Apparently, the blasting machine (as a literacy artifact in the spatial repertoire of the Finishing Department's community of practice) afforded the development of safe work practices more than it afforded the development of expertise (in human-machine interaction) in case an employee could not read Dutch.

Despite the important role played by the blasting machine as a "nonhuman expert," the role of the older, nonspeaking employee from the Netherlands should not be overlooked either. If this person would not have intervened by pressing the start button (a basic human-machine interaction), then VIN and I might not have realized what caused the blasting machine to stop working, and what we could have done to start the machine again. The purpose of the instruction that the blasting machine had started to construct was achieved in the end thanks to the affordances of this man's intervention. In this way, the "human, nonspeaking expert" played an important role in both VIN's and my workplace learning process too.

Yet, why did this "human, nonspeaking expert" not share any verbal explanations with us? By only relying on a nonverbal mode (pressing the start button), he could not know whether we understood why the blasting machine had turned itself off. Possibly, he considered this self-evident, as the machine displayed a message that explained the reason after all. Another possibility is that he, like PER, did not want to spend any effort on the learning process of two newcomers who might not stay in the foundry for long, and who might not speak the same language(s) as he did.

However, the purpose of the blasting machine's instruction was achieved nonetheless. Furthermore, it is possible to see VIN's and my actions, the machine's reactions, and the subsequent reactions from the human participants as a continuous negotiation process that led to a jointly negotiated work practice. Although the machine set certain apparent boundaries to the negotiated work practice, the exact outcome of these negotiations was not predetermined, and in theory, VIN or I could have tried to bypass these boundaries. Moreover, VIN's Polish utterances toward the blasting machine ("take this, fuck") show that he constructed the interactions with this machine as a type of negotiation process (a power struggle) as well. Together with the practice of adjusting the blasting time, this development of a work practice contributed to the process of VIN becoming a fuller participant in the Finishing Department's community of practice during the analyzed work shift.

Figure 2. The control panel of the blasting machine. The "emergency stop" button is in the right bottom corner. The "start stralen" button is circled in red. [This figure appears in color in the online issue.]

Conclusion and Discussion

The previous sections have shown how jointly negotiated work practices emerged in the Finishing Department of a metal foundry in the Dutch-German borderland—a blue-collar work environment characterized by transience, language diversity, and

limited opportunities for mutual engagement between human coworkers. This final section discusses three findings.

The first finding is that human-machine interaction functioned as an effective, additional nonverbal communicative mode between a human newcomer (VIN) and a human expert (PER) whose individual language repertoires did not overlap much. In fact, they did not need to enrich the spatial repertoire with many verbal resources to achieve the purpose of the observed work instruction. This purpose was to teach VIN how to perform a specific task, and VIN's ability to observe and hypothesize could be considered at least as important for the achievement of this purpose as his individual language repertoire. In the analyzed case, the full potential of human-machine interaction as a communicative mode was not reached, however, as PER did not let VIN try to perform the interactions with the machine by himself. Furthermore, the study did not find very strong evidence for the achievement of other possible purposes of the work instruction, such as making VIN understand why things had to be done in a certain way, or establishing harmonious relations between colleagues at work.

The second finding is that human-machine interaction could partly compensate for the absence of human-human interaction in the workplace. In line with Latour (1992), I observed how a machine functioned as an "expert" in the Finishing Department's community of practice, by guiding and facilitating VIN's learning process after PER had left the workplace. At the same time, the interactions between VIN and the machine were not sufficient to manage his learning process entirely, and the observed verbal utterances of VIN toward the machine ("take this, fuck") indicate that the machine's instruction failed to establish a harmonious relation between the human and the nonhuman coworker as well. One reason for this was the minimal adaptation of the machine (as a literacy artifact in the community's spatial repertoire) to the language diversity in this work environment. Even for a newcomer who could read Dutch, however, it may not have been possible to interact with the machine in a productive way without any intervention from a human expert, as my personal experience has shown. In line with Suchman (2007), it is possible to explain this finding with the circumstantial details that the human expert had access to, as opposed to the machine.

The third finding is that human-machine interaction could not compensate for the challenges posed to workplace learning by transience. Arguably, the often-temporary work relations between human newcomers and human experts in the Finishing Department constituted the largest obstacle for workplace learning. To begin with, this is because newcomers did not have much time to build up memories that could help them become fuller participants in the department's work practices. Perhaps more importantly, however, this article has shown how transience can demotivate human experts to invest much effort in the learning process of newcomers. Possibly, this helps explain why the full potential of human-machine interaction as a communicative mode was not reached in the interaction between PER and VIN, and why, in the interaction that occurred after PER had left, another human expert did not combine the communicative mode of human-machine interaction with any verbal resources.

Taken together, these two interactions underline once more the vital role of the newcomer's ability to observe and hypothesize. The importance of this is already amplified when the overlap between the individual language repertoires of a human newcomer and a human expert is limited (see above), but it becomes even greater when the expert worker is not motivated to invest much effort in the learning process of the newcomer. Therefore, it may not be surprising that the main participant in this case study (VIN) was well aware of what mattered for the success of his learning process, as he told me that he would be fine as long as someone showed him what to do. VIN was a newcomer from Poland who had worked in three different workplaces in the Netherlands in one year, and who may be considered an "expert newcomer" for that reason. Unlike many expert workers from the Netherlands and Germany in

the Finishing Department, he did not consider language diversity a problem. In the end, understanding why his perceptions differed so much from these other workers' might be key to understanding the deeper challenges for workplace learning in contemporary blue-collar work environments (of which this particular Finishing Department is but one example).

Finally, the findings of this study imply that under less challenging circumstances, with more opportunities for additional human-human interaction between motivated coworkers who have time to build up a shared history of mutual engagement, the potential of human-machine interaction for workplace learning processes will be greater than in the analyzed case. Whereas it is of course possible to consider the mechanization of work environments primarily as a potential replacement of human workers, this implication shows that it might be wiser to (re)consider mechanization as a potential means to support these workers during the process of developing productive, safe, and satisfying work practices.

Notes

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1. I make use of pseudonyms in an attempt to protect the individual workers' privacy.
2. When I write "younger" in this article, I mean "younger than 40 years old." When I write "older," I mean "older than 40 years old."
3. I have received the data about the agency workers directly from one of the agency's recruiters as an anonymized Microsoft Excel file. I have gathered the data about the metal foundry workers through email communication with an HR manager from the foundry. As the HR manager filled in some gaps in the data from 2017 with data from 2018, there might be small differences between the actual figures and the data presented here.
4. I use masculine forms in this article, since all production workers in the metal foundry were male.
5. The (Limburgish) interview with the CFO took place in the CFO's office on December 4, 2017.
6. Among the older workers to tell me about this development were an employee from Limburg whom I spoke to (in Limburgish) during a work shift in the Casting Department on July 24, 2017, an employee from Limburg whom I spoke to (in Limburgish) during a work shift in the Finishing Department on August 28, 2017, and an employee from Germany whom I spoke to (in Limburgish) during a work shift in the Finishing Department on September 26, 2017. The (Limburgish) interview with the former CEO took place in the former CEO's home on October 18, 2017.
7. The (Limburgish) conversation with the first team manager from the Finishing Department took place during a work shift on August 25, 2017. The (Limburgish) conversation with the second (interim) team manager from the Finishing Department took place during a work shift on August 28, 2017.
8. I do not understand Polish myself. The credits for this translation go to Justyna Piotrowska and Zofia Sagnowska.

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Appendix

Transcription conventions

Pause in seconds	(.1)
Micro pause (shorter than one second)	(.)
Overlapping speech	[clock]
Transcriber unsure	(is)
Unintelligible speech	(xxx)
Contiguous utterance	=
Sound lengthening	:
Emphasis	proGRAMMED
Questioning intonation	?