

FILM
CULTURE

IN TRANSITION

Films that Work Harder

The Circulation of
Industrial Film

EDITED BY

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Amsterdam
University
Press

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*Edited by
Vinzenz Hediger,
Florian Hoof,
Yvonne Zimmermann,
with Scott Anthony*

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15 We Must Know More Than We Can See

Images for Vocational Training and the Emergence of Cognitive Ergonomics

Guilherme Machado

Abstract

When labour moves out of the visible realm, new visual techniques for transmitting labour-related knowledge appear to keep production systems running. This chapter examines some corporate practices of knowledge transmission in the era of post-industrial labour in France. The emergence of cognitive ergonomics in the last decades of the twentieth century led to a reconfiguration of visual techniques for vocational education, which have gradually replaced systems of education based on visual prescriptions. Henceforth, learners no longer stand before the images of labour to endure the constraint of their truth. Educational and organisational images of labour now frequently have the function of *situating* workers in learning environments with carefully planned aesthetic affordances, so that the design of efficiency becomes the workers' own daily concern. The chapter presents a few examples of such dispositives for transmitting labour-related knowledge since the 1990s, particularly in the French energy production company Électricité de France.

Keywords: knowledge; transmission; film; vocational education; post-industrial discipline

The Inscription of Labour

The emblematic project of the European Enlightenment, Denis Diderot's *Encyclopédie*, includes an early visual and literary collection of artisanal knowledge. The books lay out hundreds of texts and engravings depicting the procedures, tools and gestures of various trades. Along with the Royal

Academy of Sciences' *Description des arts et métiers*, a similar project initiated at the end of the seventeenth century and published nearly at the same time as the *Encyclopédie* in the 1760s,¹ Diderot's enterprise was among the first significant scientific programmes against the secrets of artisanal expertise: a successful attempt to collect and store labour-related knowledge on easily transportable and technically reproducible media. Through the methodical analysis and transcription of aspects of labour that were worthy of interest, the *Encyclopédie* aimed to provide an educated audience with a didactic means of understanding labour.

Diderot's endeavour to record the knowledge involved in the procedures, machines and performance of artisanal trades stands at the threshold of the industrial age. It was not exempt of political intent. The forces that led to the completion of the *Dictionary of Arts and Crafts* were not unlike those behind Adam Smith's plea for the release of artisanal knowledge from the custody of guilds. Smith extolled the importance of knowledge circulation beyond the associations of artisans. Such corporate hogging of knowledge, he contended, restricted access to the labour market, promoted idleness and slowed down innovation within the trades.² A great admirer of the *Encyclopédie*, Smith shared the conviction that the secrets of labour should be revealed in lightweight materials which could make the rounds of the reading rooms of enlightened nations.

In fact, the methods of technical instruction that sprang up from the early days of industrialisation are seen by historians of education as the institutional heirs to the first encyclopaedic projects. The Conservatoire National des Arts et Métiers, for instance, a French establishment for the promotion of education and research into industrial technical innovation, was inaugurated in 1794 by Abbé Grégoire as a bank of tool and machinery models, with a collection of 3,335 drawings and replicas related to a profusion of trades.³ As in other engineering schools emerging in the period, instruction in industrial activities was carried out with collections of reliable depictions

1 On the controversial relationship between the plates of the *Encyclopédie* and those of the Academy of Sciences, see Huard, Georges. "Les planches de l'*Encyclopédie* et celles de la *Description des Arts et Métiers* de l'Académie des Sciences." *Revue d'histoire des sciences*, vol. 4, no. 3-4, 1951, pp. 238-49. See also Proust, Jacques. *Diderot et l'Encyclopédie*. Armand Colin, 1967, especially the second chapter.

2 See Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nations* [1776]. The Modern Library, 1937, especially pp. 118-23.

3 Picon, Antoine. "Connaissances techniques sous les Lumières." *Le conservatoire national des arts et métiers au cœur de Paris: 1794-1994*, edited by Claudine Fontanon et al. CNAM, 1994, pp. 69-73.

of good labour practices and machines, the *dictionnaires raisonnés* that made labour explicit through textual and visual inscriptions.⁴

In the twentieth century, with the generalisation of vocational education, such stable depictions of labour became crucial in the institution of industrial discipline. The work efficiency engineer Frederick W. Taylor became known for paving the way for teams of non-skilled outsiders to acquire theoretical control over the practical knowledge needed to keep industrial production running. His management system still relied on paper inscriptions for assembling, storing and communicating labour-related knowledge: “The managers assume [...] the burden of gathering together all of the traditional knowledge which in the past has been possessed by the workmen and then of classifying, tabulating, and reducing this knowledge to rules, laws, and formulae which are immensely helpful to the workmen in doing their daily work.”⁵ For Taylor, the production of educational material was essential to palliate the scarcity (and the cost) of expertise, as it provided a pedagogical control over the workforce renewal process. Current lean strategies of industrial organisation continue to use visual “labour standards” in vocational training, i.e. collections of photographic and textual depictions of tasks, including gestures, tool positioning and machine handling. In order to make production levels programmable, such detailed depictions of the *modi operandi* of industrial work have proved to be effective and sustainable tools of management.⁶

Throughout most of the last century, textual and visual inscriptions remained sites where good labour practice was made explicit for apprentices in industrial work. They required from trainees mimetic adaptation to repeat the displayed truth of safe and efficient performance. Indeed, the evolution of visual technologies since the eighteenth century has enabled an ever-more comprehensive *visual display* of labour. When, in 1750, Diderot justified the methods of his titanic enterprise, saying, “one would never finish

4 The term “explicit” must be understood here not only as “explained,” but also in a phenomenological sense, as the enlightened appearance of labour. For a recent definition of this term (“*Explizit*”) with a critical focus on phenomenology, see Sloterdijk, Peter. *Sphères III: Écumes*. Maren Sell, 2005, esp. pp. 57–78, 184–202, with a focus on Bruno Latour’s concept of *articulation*. Bruno Latour took up Sloterdijk’s concept of *Explication* (hereafter translated as *explication*) in his essay “A Plea for Earthly Sciences.” *New Social Connections: Sociology’s Subjects and Objects*, edited by Judith Burnett, Syd Jeffers, and Graham Thomas. Palgrave Macmillan, 2010, pp. 72–84.

5 Taylor, Frederick W. *The Principles of Scientific Management*. Harper & Brothers, 1911, p. 36.

6 On the application of the lean manufacturing system at the Peugeot-Citroën group and the place of the “pictorial ranges” (“*gammes imagées*”) in this system, see Morais, Alexandre, and Raynald Aubineau. “Articulation entre l’ergonomie et le lean manufacturing chez PSA.” *Activités*, vol. 9, no. 2, 2012, pp. 179–97.

if one proposed to render in figures all the states through which a piece of iron passes before being transformed into a needle,”⁷ he was certainly not trying to convince an audience acquainted with image technologies operating at a rate of twenty-four “figures” per second. The evolution of labour inscription technologies would culminate with the appearance of film media, a set of advanced techniques which greatly facilitated the recording of and access to significant amounts of data at a time when even the subtlest details of labour – understood as bodily performance in tandem with machines – had to be made visually explicit in some way, if they were to be effectively communicated as collective references of performance.

In the following pages, the eventual erosion of the encyclopaedic system to enhance the transmission of labour-related knowledge by using collections of enlightening inscriptions will be tackled in the context of the emergence of cognitive ergonomics and its impact on vocational education. The recent obsolescence of the body and its muscles as means of production due to the generalisation of cybernetic systems in industry has rendered the encyclopaedic didactics ineffective for transmitting knowledge that cannot be recorded through descriptive geometry or photosensitive apparatuses. As industrial productivity began to demand cognitive rather than physical performance, knowledge transfer techniques were adapted to ensure new flows of skills and innovation. The circulation of labour-related knowledge in the cybernetic age is beginning to rely on collections of images that are quite different from those of the vocational schools of previous centuries. These images are part of a diverse, otherwise effective strategy for making labour explicit, another educational solution for administering the skills that keep industrial production running.

Thermodynamic Labour vs Activity in Situation

The encyclopaedic method of making labour explicit is characterised by the extent of its presence in the visible field. For the encyclopaedist, explaining labour means opening it up to sight. There is no explication that is not at the same time an assent that truth can fit on paper (later on celluloid or electronic screens) to be exposed to the intelligent eyes of readers. For Roland Barthes, the picture in the *Encyclopédie* is “a sort of rational synopsis: it not only illustrates the object or its path [in the production process], but also

7 Qtd. in Pannabecker, John R. “Representing Mechanical Arts in Diderot’s ‘Encyclopédie.’” *Technology and Culture*, vol. 39, no. 1, 1998, pp. 33–73.

the very mind that conceives it.”⁸ In the spirit of the encyclopaedia, the ideal reader is the one whose mind espouses visual information. Similarly, in the twentieth-century workshop, apprentices are successful when they reproduce predetermined labour standards with minimal deviation. In other words, workshop apprentices, like the readers of the *Encyclopédie*, are engaged in the practice of acquiring knowledge that is complete in the inscription. Readers and apprentices are expected to see real practice as a field of faithful reproduction of the intelligible systems they have previously observed on paper or other stable, authentic inscription.⁹

Encyclopaedic didactics aligned well with the thermodynamic conception of labour as the transformation of energy into visible performance. This has been a predominant conception since the generalisation of the combustion engine in industrial processes in the nineteenth century. As Anson Rabinbach has shown, the thermodynamic conceptualisation of energy as an abstract universal force, which explained the functioning of the motor as well as that of the planets and the human body, led the sciences and politics of the nineteenth and twentieth centuries to a “transcendental materialism,”¹⁰ according to which labour denoted any material manifestation of the universal substance that is energy. Labour is based on the fundamental laws of energy conservation and dissipation; it can therefore be calculated and managed independently of contextual idiosyncrasies, social situations or political issues, insofar as it is considered a physical, “natural” event.

Since the 1950s, however, the effects of automation on industrial production have considerably extended the category of labour beyond the visible spectrum. The generalisation of robots and computers in industrial processes resulted in the replacement of physical performance in production by abstract systems. Rabinbach concludes his essay by recalling the various accounts on the disappearance of human labour as conceived by thermodynamics:

Organized around the substantiality of the muscles and nerves, and around the material objects that the body in tandem with machines

8 Barthes, Roland. “Image, raison, déraison.” *L’univers de l’Encyclopédie*, edited by idem et al. Les libraires associés, 1964, pp. 10–16. My trans.

9 In Foucault’s words, in the *épistémè* of the classical age, “l’être du sens est tout entier du côté du signe.” Foucault, Michel. *Les mots et les choses. Une archéologie des sciences humaines*. Gallimard, 1966, p. 80.

10 Rabinbach, Anson. *The Human Motor: Energy, Fatigue, and the Origins of Modernity*. University of California Press, 1990, see especially the first two chapters.

transformed into products, nineteenth-century labour was being rapidly superseded by the work of technologies operating on and proliferating through abstract systems of knowledge. Technology was making corporal work obsolete.¹¹

In his analysis of two corporate films where the visual representation of labour as data-processing seemed to have been a real problem, Vinzenz Hediger showed in the first volume of *Films That Work* how the persistence of traditional instruments of corporate communication in the cybernetic age might be condemned to the reproduction of “thermodynamic kitsch”. Since the computer introduced a new paradigm of productivity, according to which labour and its outputs can no longer be seized in the visible realm, the typical thermodynamic rhetoric based on light, motion, volume and other photographic attractions lost its relevance. As Hediger says, “[t]he emergence of information technology provokes a shift in what you might call the visual rhetoric of industrial production.”¹²

That shift affected vocational training practices and industrial disciplinary systems. When labour is essentially the transformation of energy into visible performance according to laws that not everybody can know, one can still count on visual standards of efficiency and the endurance of workers to coordinate labour. But what happens when labour leaves the province of the observable? How to prescribe and monitor operations that lurk in the inner reaches of the brain and the hardware? What is the use of training techniques such as photography and film when they cannot capture and open up to the sight of novices the performances that ensure productivity?

One of the alternatives that emerged at the turn of the century in an attempt to avoid the thermodynamic kitsch in vocational education is the reconfiguration of audiovisual-based training methods, and the consequent shift of sites where labour is made explicit in the knowledge transmission process. For the sake of instructional efficiency, visual inscriptions have been denied the onto-administrative role of revealing to workers what good labour is. Instead, they have been assigned the role of stimulants in

11 Ibid., p. 297.

12 Hediger, Vinzenz. “Thermodynamic Kitsch: Computing in German Industrial Films, 1928/1963.” *Films That Work: Industrial Film and the Productivity of Media*, edited by Vinzenz Hediger and Patrick Vonderau. Amsterdam University Press, 2009, p. 128. For another account on the obsolescence of the body as the visible vehicle of labour, see Vinzenz Hediger. “Body Rebuilding. Körper und Arbeit an der Schwelle zum kybernetischen Zeitalter.” *Promethische Kultur. Wo kommen unsere Energien her?*, edited by Claus Leggewie et al. Wilhelm Fink Verlag, 2013, pp. 195–222.

endless processes in which the workers themselves are committed to design effective cognitive performance.

The attention paid to the invisible realm of mind in contemporary practices of vocational training in France stems from recent labour sciences, especially ergonomics and work psychology. To understand the role of visual inscriptions in vocational education today, it is therefore necessary to take into consideration the advance of the concept of *activity* over that of *behaviour* in labour analysis. Since the 1970s, Western psychologists have lifted the embargo on Soviet theories of activity. Authors such as Lev Vygotsky and Alexei Leontiev became common references among work psychologists in Europe and America. Their theories offered relevant analytical frameworks for the problems posed by the invasion of information technology in all industrial sectors. Regarding the problem under consideration here, suffice it to say that activity, according to these theories, is not a phenomenon devoid of situational idiosyncrasies. The activity of a supervisor in a nuclear power plant monitoring screens and light indicators is hardly comparable to that of an accountant updating her files in a private company. Instead of manifestations of the same universal laws, activities are always the result of subjective interpretations of singular situations. In the terms of a French work psychologist, it is not enough to think of activity as observable behaviour, for it is also “a field of possibilities and impossibilities, where what one cannot do, what one would have liked to do, what one wishes to do, counts as much as what one actually does.”¹³ Ergonomists like to define activity as what is *subjectively put into play* in order to perform tasks. The analysis of activity must then be carried out on the “actual work situations,” where the analyst is able to pinpoint the specific interactions that operators have with technical objects and colleagues – so as to identify through the visible aspects of activity “the unobservable mechanisms”¹⁴ of behavioural regulation.

Analyses of activity do not, in any way, lead to behavioural prescriptions. Where the latter exist, they are part of the object of analysis, given that activities are nexuses of objects, prescribed procedures and goals, assigned values, motives, inhibitions, worries and patterns of attention in the arena

13 Clot, Yves. “Qu’est-ce que l’activité dans l’analyse du travail?” *Performances humaines et techniques* [special issue], 1995, pp. 2–6. My trans.; see also idem. *La fonction psychologique du travail*. Presses Universitaires de France, 1999, pp. 119–29.

14 Leplat, Jacques. “A propos des compétences incorporées.” *Education permanente*, no. 123, 1995, pp. 101–14; on the ergonomic approach to activity, see also idem, and Jean-Michel Hoc. “Tâche et activité dans l’analyse psychologique des situations.” *Cahiers de psychologie cognitive*, vol. 3, no. 1, 1983, pp. 49–63.

of work in which actors are physically as well as psychologically situated. The analyst of activity takes any workplace as a setting of precepts, assumptions and sensations. This setting includes most of the conditions for the accomplishment of productive labour.¹⁵ Accordingly, activity theory has led mainstream labour analysis to consider that labour-related knowledge is distributed in the specific play of interactions one maintains in a given milieu, which is in constant variation, but which also has its generic features for each specific occupation. For ergonomists and psychologists, the study of the observable part of these interactions is central to the diagnosis of work problems and deficiencies, as it provides access to the knowledge that is “encapsulated in action,”¹⁶ i.e. tacit and context-related knowledge incorporated by experience. Whether one calls it skill, expertise, know-how or aptitude-to-do-the-job is at this level just a matter of terminological taste. The fact that the psychological analysis of activity has defined *situations* as means of access to the control rooms of cognitive performance should be hailed as an important inaugural act of post-industrial labour governance. Instead of making labour instruction and control viable through the production of behavioural standards, these theories opened the way to the production of *situational standards* for transmitting cognitive performance as individual adaptations to well-designed labour environments.

From the point of view of vocational training, this means that efficient knowledge transfer techniques can be conceived as systems of *mise en situation*. Occupations have been envisaged by occupational didacticians in France as classes of generic situations, while competent professionals are those capable of calculating relevant, safe and efficient actions autonomously for as many situational variants as possible within their trades.¹⁷ The more situations shop sellers experience – in terms of sales targets, clients’ moods and demands, environmental sets, stress conditions etc. – the more resourceful they are in their activity. Expertise grows as one develops cognitive and even emotional means of managing increasingly rich and complex labour situations.

In this context, one important reason why film techniques have been assigned to capture and communicate situational standards of labour is

15 Activity’s situation as a “setting” is conceptualised by Jean Lave in *Cognition and Practice: Mind, Mathematics and Culture in Everyday Life*. Cambridge University Press, 1988, pp. 149–52. Lave’s concept has been used in work psychology; see, for example, Clot. *La fonction psychologique du travail*.

16 Leplat. “A propos des compétences incorporées.”

17 See Pastré, Pierre, et al. “La didactique professionnelle.” *Revue française de pédagogie*, no. 154, 2006, pp. 145–98.

the fact that they provide access to *actual* labour situations. While for work psychologists film techniques are used to analyse “real activity,”¹⁸ for trainers, they help to reduce the mismatch between actual occupations and training. They satisfy corporate requirements for the design of vocational training in authentic work environments. It would be wrong, however, to assert that the current effectiveness of audiovisual techniques in transmitting labour-related knowledge relies essentially on the situations they depict. While collectively displaying common situations of production, they demonstrate their virtuosity rather by regulating dynamics of verbal enunciation.

Labour, from the Horse’s Mouth

One of the major sponsors of the audiovisual avant-garde of vocational education in France is the country’s largest electricity supplier. Since the 1990s, when the mass retirement of the baby-boomer generation posed the problem of the transfer of highly qualified workers’ knowledge, Électricité de France (EDF) commissioned research into techniques of analysis of its activities.¹⁹ The challenge of preserving and communicating experts’ “intangible cultural heritage,”²⁰ which started within the company, has since been stimulating a group of international researchers.²¹ Outlining a successful method of labour analysis developed in this context should help give a clear idea of the role played by audiovisual techniques in some contemporary training practices.

EDF’s investment in new instruments and protocols for the capture and transmission of labour-related knowledge can be understood as an example of the above-mentioned shift in the visual rhetoric of industrial

18 One of the principles of cognitive ergonomics and post-behaviourist work psychology is the attitude of starting the analysis from “real activities,” instead of observing the effects of *stimuli* introduced by the analysts in the work process. Video cameras are then often used as tools for capturing “real activity,” as it occurs before any intervention by the analyst. See, for instance, Clot et al. “Entretiens en autoconfrontation croisée: une méthode en clinique de l’activité.” *Education permanente*, no. 146, 2001, pp. 17–25.

19 See Lahlou, Saadi. “Observing Cognitive Work in Offices.” *Cooperative Buildings: Integrating Information, Organizations and Architecture*, edited by Norbert A. Streitz et al. Springer, 1999, pp. 150–63.

20 Le Bellu, Sophie, et al. “Studying Activity in Manual Work: A Framework for Analysis and Training.” *Le travail humain*, vol. 79, no. 1, 2016, pp. 7–30.

21 The research on dispositives developed in EDF was later carried out by a group of researchers at the London School of Economics under the title Subjective Evidence Based Ethnography (SEBE).

production. As one of the researchers engaged in the project to collect, study and transfer expert know-how asserted: “The classic observation of behaviours is not enough anymore. It becomes necessary to come up with new techniques to analyse the flow of activities.”²² In the research project, the goal was to succeed in “externaliz[ing] both tacit and explicit know-how” while giving a “suitable educational format”²³ to the results of the research. The analysis of activity runs through the entire educational dispositif set up by the researchers. It even enters the training rooms, where activities find their final analysts in those looking to make their way into the labour arena, i.e. the trainees themselves.

The chief instrument of activity analysis developed in EDF is the subcam, a miniature subjective-camera with a wide-angle lens and a stereo microphone. It is designed to capture the perceptual situation of expert operators, who do not shy away from recording their own activities when it comes to aiding in the education of young apprentices. The researchers and designers of the educational dispositif assert that contemplating an operational milieu from an expert’s point of view is an experience with a high referential identification value: “empathy occurs based on *sharing similar phenomenological experience*.”²⁴ To ensure accuracy, the camera is usually placed next to the expert’s eyes (normally attached to a pair of spectacles), so that the resulting images provide an optical and auditory point of view as close as possible to that of the expert operator.²⁵

Subcam images provide a sensorial immersion in actual labour situations. In contrast to the classic prescriptive display of tasks to be performed, they reveal in detail the operators’ spatial and temporal organisation, their solutions to problems that are not covered by formal instructions, and especially their attentional dynamics at work.²⁶ When expert operators follow a procedure, subcam images display not only the buttons, levers

22 Le Bellu, Sophie. *Capitalisation des savoir-faire et des gestes professionnels dans le milieu industriel. Mise en place d’une aide numérique au compagnonnage métier dans le secteur de l’énergie*. PhD thesis, Université Bordeaux 2, 2011, p. 104. My trans.

23 Le Bellu et al. “Studying Activity in Manual Work,” p. 8.

24 Lahlou, Saadi. “Digitization and Transmission of Human Experience.” *Social Science Information*, vol. 49 [special issue: “Digitize and Transfer”], 2010, pp. 291–327. Author’s emphasis.

25 Since the 1990s, there have been several variants of this type of apparatus, as well as a number of uses in industrial, sporting and military contexts. See, for instance, the studies in decision-making in medical environments: Omodei, Mary M., and Jim McLennan. “Studying Complex Decision Making in Natural Settings: Using a Head-Mounted Video Camera to Study Competitive Orienteering.” *Perceptual and Motor Skills*, vol. 79, no. 3, 1994, pp. 1411–25.

26 Sophie Le Bellu says that for research on manual work, subcam images provide sufficient information on the user’s focus of attention. However, when it comes to record interactions with



Fig. 15.1. Example of a subcam user's point of view. Image provided by Saadi Lahlou.



Fig. 15.2. Example of a subcam user's point of view. Image provided by Saadi Lahlou.

and valves that have to be pushed, pulled and turned, but also secondary elements of the operational milieu, which help operators to find their gestural bearings. While the prescribed procedure is limited to stating which files must be opened and which modifications made, the subcam captures in real-time the difficulties posed by inopportune phone calls, the accumulation of files, and the unexpected behaviour of software. Crucially, subcam images reveal the experts' tricks to get around the problems, their inventiveness in coping with the unexpected, and their time management strategies to accomplish their tasks. In a word, subcam images provide access to what work psychologists call "real activity," which differs from

computer screens, the eye-tracker may be necessary. See Le Bellu. *Capitalisation des savoir-faire et des gestes professionnels dans le milieu industriel*, p. 123.

procedural formulae in that it refers to a series of contingent, conscious and unconscious phenomena in the work environment that contribute to the subjective organisation of activity.

But the virtue of this labour archiving tool is not only that it gives the unique opportunity to experience workplaces through the eyes of experts. What makes it so valuable to researchers seeking to solve the problem of post-industrial knowledge transmission appears in a second stage of the analysis, after the first data collection. The “replay interview” is a phase in which a first cut of the subcam’s footage – retaining only “the best moments” of one or several days of recorded activities for future instruction – is screened to the expert whose activities were recorded. Here, subcam images bring operators face to face with their own operations in progress, and are deemed to manifest a “remarkable capacity [to remind the experts of their] actual mental states during activity.”²⁷

Audiovisual self-confrontation is a technique for providing awareness of the streams of consciousness during activity, too subtle for the operators to consciously be aware of when immersed in their labour routines. Generally, it is claimed, workers are “unaware of the amazing psycho-motor expertise they display.”²⁸ In the course of activity, they deploy complex networks of goals and cognitive processes to deal with sequences of tasks conducted often simultaneously. These networks of goals and cognitive processes result from the memory of past experiences and the ability to predict situations; they do not always have a reference in the visible field, although they play a major role in supporting action: “The aircraft pilot is aware of the position of the undercarriage; the train driver is aware of his passengers – even though he does not see them; and in fact, these are important elements in their decisions.”²⁹

The replay interview is therefore a moment of detachment from the pressing concerns of being-at-work. It offers an occasion for self-examination. It is designed to induce verbal enunciation of “the various layers of goals and motives that lie behind the observed action.”³⁰ The key role of the interviewer in this phase is to shift the focus of the expert operators’ attention and prompt them to use their words to exhaust the meanings and affects behind their actions on screen. The interview is recorded by a fixed camera focusing

27 Lahlou. “Digitization and Transmission of Human Experience,” p. 308.

28 Idem. “How Can We Capture the Subject’s Perspective? An Evidence-Based Approach for the Social Scientist.” *Social Science Information*, no. 50, 2011, p. 633.

29 Idem. “Digitization and Transmission of Human Experience,” p. 304.

30 Idem. “How Can We Capture the Subject’s Perspective?” p. 621.



Fig. 15.3. The replay interview. Image provided by Saadi Lahlou.

the expert operator and the screen as the first describe their reasoning, or by a subcam carried by the interviewed expert. This record is intended to help the researchers retrospectively identify the visible actions referred to by the operators while they were reporting their streams of consciousness. New editing of the video may follow, with the operators' voice-over taken from the interviews as additional sound layers – adding to the explication of their labour.

Replay interviews, as subcam footage, can be assembled and disassembled, gathered in a single multi-layered audiovisual document showing the entire deployment of a complex procedure, or isolated in short scenes to form different stages of instruction. Images coming from the record of different expert operators' activities can be compared or combined, so one scene can complete another. The Multimedia Platform for Apprenticeship is a digital platform developed for an organised storage of data from this image production system. It aims to facilitate access by apprentices to large amounts of pedagogical data in nuclear power plants, where the platform was originally launched. A digital interface allows the users to navigate the platform. Ordinary operations in the plants are broken down into goals and subgoals, as they were made explicit by experts, with detailed comments “from the horse's mouth”³¹ on how different sorts of events were interpreted and the emotions they provoked. Users interested in specific operations can compare different qualified operating modes, time-saving and stress management strategies and other expert tips stored in the platform. The abundance of operating

31 Idem. “Digitization and Transmission of Human Experience,” p. 309.

modes suggests that behind the same task, singular subjective activities, distinct sets of subgoals and personal feelings may come up that reflect the way each expert deals with information and manages to accomplish the task. The accumulation of data allows a thorough investigation of work situations, with the aim of raising awareness about effective ways to organise action: “We extracted and analysed systematically 101 interruptions during office work by a visitor or by phone, retrieved from fifty hours of subfilms. This allowed us to better understand how being interrupted was handled by the subjects and how it affected their subsequent activity.”³²

The educational potential of this audiovisual pedagogy is praised by its designers, who state their ambition to reform traditional training methods: “The aim of [the Multimedia Platform for Apprenticeship] is not to offer a single, correct way of performing an action, but to provide a new way of representing the professional experience by enabling a novice to share the real-time experience of an expert through the first-person perspective [...] and accompanying explanations.”³³ In this way, the project brings the good news that workers have moved from their unpleasant status of pure research objects to that of participants in labour analysis and design: “[Participants] intensely contribute to the interpretation of collected data”; as “research collaborators,” they are “given the choice of staying anonymous or being credited” in the scientific publications.³⁴ This cooperative knowledge-building principle, closely akin to contemporary management practices, bears witness to a conception of labour analysis that no longer leads to fixed behavioural inscriptions, hierarchical structures of power, and traditional media of knowledge communication: “Indeed the construction, maintenance and use process of the new information tools seem to involve inputs from all the stake-holders [sic] in continuous work in progress, in sharp contrast to the former ‘book-publication’ mode.”³⁵

Moreover, in such educational systems of image production and visualisation, not only do expert workers state what good labour is in the process of knowledge transmission, but apprentices are also actively involved in the labour design process via the accumulation and comparison of audiovisual content. The exploration of image databases for training, whether in video, game, or other digital formats, is usually accompanied by debriefing

32 Idem. “How Can We Capture the Subject’s Perspective?” p. 631.

33 Le Bellu et al. “Studying Activity in Manual Work,” p. 25.

34 Quotes from Lahlou, Le Bellu, and Sabine Boesen-Mariani. “Subjective Evidence Based Ethnography: Method and Applications.” *Integrative Psychological and Behavioural Science*, vol. 49, no. 2, 2015, p. 218.

35 Lahlou. “Digitization and Transmission of Human Experience,” p. 298.

interviews designed to encourage apprentices to formulate their own alternatives for dealing with common labour situations. Indeed, watching images of labour appears to be an opportunity for personal expression, for making judgments in the light of extraneous experiences, and for proposing potentially better alternatives for action. Occupational trainers are familiar today with methods of “conceptualisation of action”³⁶ drawn from clinical psychology, which advocate the verbalisation of lived situations – whether real or simulated – in order to facilitate collective understanding, assessment, insight, and commitment to the development of original forms of action and decision-making. Since situations involving “subjective mechanisms” and the processing of information are never exactly the same, it becomes convenient that labour as cognitive performance evolves according to continuous analyses to make it explicit, i.e. intelligible, negotiable, and amenable to change. Regular updates of situational-images databases for frequent analyses of activities and collective accounts of good labour have thus proved to be effective systems of performance improvement and self-regulation.

Images Make People Talk

The fact that contemporary systems for transmitting labour-related knowledge have assumed the form of chat rooms facilitated by audiovisual input is not trivial. For a long time, the secrets of intimacy, the tricky machinery of mind, the emotions and other hidden “subjective mechanisms” have found in speech a trusted means of revelation. In the history of the psychological analysis of activity, visual inscriptions have sometimes played the role of auxiliaries to men and women who were called on to make their thoughts explicit by speaking. Yves Clot, an influential labour psychologist in France, designed his so-called clinic of activity based on “self-confrontational interviews”. His use of video sequences to confront workers with their own activities aims to modify labour situations thanks to the dynamics of verbal interactions that the videos provoke between workers in the context of collective interviews. For Clot, when interviews are facilitated by the screening of “real activities³⁷” carried out by the interviewees, cognitive

36 Pastré, Pierre. “L’analyse du travail en didactique professionnelle.” *Revue française de pédagogie*, no. 138, 2002, pp. 9–17.

37 Clot asserts that the analysis of real activity explains the intrinsic relation that cognitive mechanisms maintain with emotions: “By posing the problem from the point of view of real

and emotional processes tend to surface by way of speech. The activity then becomes transformative, insofar as its actors get verbally involved in its analysis: “The intersubjective exchange sets in motion the existing activity.”³⁸

It is thus not surprising that the moment when the sciences of subjectivity began to devise techniques to stimulate workers to verbalise their mental states and to help them articulate their implicit affects and know-how coincided with the moment when managers began to claim the status of “engineers of discussion”.³⁹ Managers in the post-industrial era have realised that the best way to increase efficiency at work is to let it be formulated by those who do the work. Therefore, any process aimed at making good labour explicit is likely to take the form of a personal conclusion based on the analysis of reliable data. The “spaces for discussion” that have proliferated in contemporary organisations are spaces where groups of workers engage in analyses of their own situations in order to come up with credible solutions for their transformation. These spaces require “management tools of a new kind, less geared towards conforming behaviour than towards supporting the discursive exploration of novelties.”⁴⁰ Managerial intervention must focus, according to the expert manager Mathieu Detchessahar, on the configuration of frameworks of exchange through formal, infrastructural investments: “These formal investments must allow, mainly, to inform the opinion of the operators (distribution and geography of information) and to support discursive mechanisms.” Feeding spaces for discussion with constantly new problematic situations and soliciting workers to interpret and classify data in order to achieve together regulatory solutions for their own activities have thus become common practices for creating contexts of exchange in which, as Detchessahar says, “saying’ is the essential framework for ‘doing.’”⁴¹

This may partly explain why, in today’s organisations, educational images are not confined to training rooms. More than just a means of controlling

activity [...] we can avoid the ruinous dualism of the cognitive and the emotional.” Clot. *Travail et pouvoir d'agir*. Presses Universitaires de France, 2008, p. 4. My trans.

38 Idem. “La formation par l’analyse du travail: pour une troisième voie.” *Manières de penser, manières d'agir en éducation et en formation*, edited by Bruno Maggi. Presses Universitaires de France, 2000, pp. 133–56. My trans.

39 See Detchessahar, Mathieu. “Santé au travail. Quand le management n’est pas le problème, mais la solution....” *Revue française de gestion*, vol. 5, no. 214, 2011, pp. 89–105; see also idem. “Quand discuter, c’est produire. Pour une théorie de l’espace de discussion en situation de gestion.” *Revue française de gestion*, no. 132, 2001, pp. 32–43.

40 Idem. “Santé au travail.” My translation.

41 The last quotes of this paragraph are from idem. “Quand discuter, c’est produire.” My translation.

the renewal of the workforce, the production of educational content became a key means of constantly regulating activities and ensuring innovation. Weekly meetings in the screening room – while expressly motivated by the fact that they place the workers' subjectivities at the centre of organisational design⁴² – could be defined as dispositifs for the permanent solicitation of verbal formulations of attitudes that commit their authors. As discussion engineering products, these meeting rooms equipped with inquiring moderators and screens showing new labour situations every week are powerful dispositifs that prompt workers' to voice their views on core organisational issues, which usually revolve around safety, productivity and efficiency. The images that animate these meetings have the function of steering the debates towards context-related themes and problems of daily work, often too circumstantial and conjunctural to constitute a theme for conversation in the absence of a visual reference, or an audiovisual support bringing specific, unresolved or perfectible situations back into focus.

Audiovisual techniques have been increasingly mobilised to fight against "organizational silence."⁴³ In the same French company where, as noted above, labour has been made explicit through the discourse of workers seeking to report more than what images can show, management methods have been developed which use audiovisual inscriptions to support exchanges between workers with the aim of having them regulate their own activities. In EDF's distribution sector, a group of ergonomists has implemented a knowledge-sharing system in the early 2010s to create an efficient "safety culture". Field operators are asked to record, photographically or on video, abnormal situations in their daily activities that force them to deviate from established safety conventions. The images are collected by line managers who select the most relevant ones for weekly discussions with the workers. Procedures are then developed collectively to deal safely with situations such as those depicted in the images.⁴⁴ Here too, images are thus used to pass the tiny world of everyday life through the endless mill of verbal expression, engaging workers in a revision of their own limits, prodding them to reframe their action within new norms of performance, new conditions and criteria for assessing risk, identifying hazards, and making decisions.

42 "Unlike the shaping of the Taylorist organisation, which aimed to exclude the subjectivity of the operators from the production system, the shaping of the discussion space aims to place it at the heart of the system." *Ibid.*, p. 37. My trans.

43 Rocha, Raoni. *Du silence organisationnel au développement du débat structuré sur le travail: les effets sur la sécurité et sur l'organisation*. PhD thesis, Université de Bordeaux, 2014.

44 On the implementation of this procedure, see Rocha et al. "Work Debate Spaces: A Tool for Developing a Participatory Safety Management." *Applied Ergonomics*, no. 46, 2015, pp. 107–14.

The use of images as agents in a dispositif of explication of labour by the workers themselves, which relies on the ability of images to situate observers within a given framework of enunciation endowed with controllable aesthetic affordances, was also extensively practiced in France, even before EDF's research experiments, by the French *ovnimaker* René Baratta, a labour documentarist specialised in ergonomic sciences.⁴⁵ What Baratta calls his OVNI (*objets vidéo non-identifiés*)⁴⁶ are moving pictures which lack the status of "films" because they are devoid of "personal narrative construction." He claims that his video records of labour situations, which he uses to confront teams of workers with their own activities in order "to create the conditions for the emergence of a collective speech," are not the "expression of [his] personal point of view," but impersonal testimonies of real activities conveying the details of their specific milieux and with a remarkable power to interpellate workers on the forms of their activities.⁴⁷ Indeed, pictures of real work situations present the advantage of not carrying any scent of purpose, authorial creation, or hierarchical instruction. In contrast to prescriptive labour standards, audiovisual testimonies of everyday activity demonstrate significant capacity to stimulate those who find in the pictures motives for self-justification, transient events that cause difficulties, daily challenges of unstable interactions with the social and material environment, and opportunities to promote personal experiences as solutions for collective problems. These "unidentified" images (i.e. images that do not "express" any point of view or intentional conception) do not reveal the truth of labour on their readable, illuminating surface. Rather, they evidence problematic situations capable of triggering discursive acts of enlightenment.

The Adventure of Making Labour Explicit

Labour entered a modern era when the activities that belonged to this category were put into circulation in the form of inscriptions to disseminate, beyond the associations of artisans and other restricted clusters, the knowledge involved in the production of wealth. One can speak of labour

45 See *Aucun risque! Parole de compagnons* (René Baratta, 1992), winner of the European Club of Health award in 1993.

46 The term "OVNI" (*objet volant non-identifié*), in the usual sense of the term, is French for UFO.

47 Quotes from Baratta, René. "Du film à l'Ovni en passant par le travail." *Communications*, no. 80, 2006, pp. 235–54. My trans.

modernity by referring to the end of a period – which lasted roughly until the eighteenth century – in which the body was the exclusive medium for the transmission of labour-related knowledge. Projects such as the *Encyclopédie*, which have sought to make this knowledge accessible in the form of iconographic and scriptural collections, attempted to place it in the category of *explicit knowledge*. Their aim was to replace the contingent, obstinate bodily movements of master craftsmen with stable and reproducible signs, thanks to scientific methods for analysing the fleeting, thoughtless, and spontaneous nature of the productive exercise. The new material conditions of labour-related knowledge greatly contributed to the institutional organisation of apprenticeship and the consequent new rhythm of circulation and innovation of production techniques.⁴⁸ Explicit knowledge must here be understood as opposed to implicit knowledge, which prevailed in craft apprenticeship until the late eighteenth century (and beyond) in Western Europe, when it was not uncommon for training practices to last – as Adam Smith decried – up to ten years, during which time apprentices were supposed to assimilate through observation and practice the intuitive knowledge of master craftsmen.⁴⁹

Modern instruction, by contrast, refuted the tacit dimension of labour. Institutional techniques of knowledge communication in the industrial age have always been linked to procedures to display healthy and productive labour practice such as truths of which a significant characteristic is the lack of discretion. The modern pedagogy of work consists of adapting elusive and erratic aspects of labour practice – previously subject to the contingency of the body at work – into short episodes of explicitness, which can be brought to the attention of apprentices in orderly fashion as information that makes a real difference. This is what makes modern workplaces to be animated by *movements of explication*, i.e. programmes of controlled manifestation, by waves of attractional evidence, of knowledge previously slumbered in the tacit domain and held by only a select few.

Offices and control rooms in the cybernetic age do not escape this modern dynamics of labour explication. In the present-day organisations, however, cognitive performance and procedural knowledge became key factors of productivity. Retirement and the increasing mobility of experts might be

48 See Simondon's remarks on this matter. Simondon, Gilbert. *On the Mode of Existence of Technical Objects*. Univocal Publishing, 2017 [1958], pp. 103–121.

49 See Smith. *An Inquiry*; on apprenticeship in craft guilds, see also Epstein, S.R. "Craft Guilds, Apprenticeship, and Technological Change in Preindustrial Europe." *Journal of Economic History*, vol. 58, no. 3, 1998, pp. 684–713.

economically threatening for the organisations devoid of tools to externalise experts' "intangible cultural heritage," as it was put by EDF's ergonomic researchers. The risk of a loss of knowledge and innovation capacity and the urgency of organisations' independence from knowledge holders maintain the relevance of knowledge transmission techniques.⁵⁰ In this light, the emergence of cognitive ergonomics can be seen as the condition for an update of the modern dispositives of labour explication, so that they are adapted to the formalisation and communication of performance currently required by post-industrial activities.

The real novelty in the post-industrial systems of knowledge transmission seems to be the successful involvement of workers in the frenzy of labour explication. Their innovation consists in making appear as spontaneous and expedient the obligation for workers to establish a permanent attitude of self-exposure; an attitude of unveiling by way of speech their cognitive performance and the intimate conditions of their daily exercise. This happens in part when images have ceased to be vehicles of explicit labour; when they have been released from the sporadic role of coercive announcers of good labour in the educational process in order to be employed systematically as informers of decision-makers; when they have lost their utility as capturers of productive performance and have been reconfigured into techniques of *mise en situation*; when they have stopped composing a machine of control functioning on the idea of prescription and obedience to be part of a more fashionable engine operating "spaces of discussion," where each worker commits to respecting the discipline they are stating for themselves.

All this points to a somewhat new mode of labour governance through labour explication, which continually dictates to workers – but without really saying it, so as not to disrupt the magic of its operation – that *they must know more than they can see*. This formula reflects a specific reading of Michael Polanyi's famous statement: "we can know more than we can tell."⁵¹ Polanyi summarised in this sentence the result of his humanistic study of a realm of tacit knowledge underlying human experience and communication practice. He thus stated the existence of a pervasive implicit, prelinguistic, and discrete effort indispensable to all human action and understanding.

50 See for instance the plea by organisational theorists Ikujiro Nonaka and Hirotaka Takeuchi for the externalisation of knowledge in the "knowledge-creating company": "externalization [...] holds the key to knowledge creation. It is in this mode that tacit knowledge, which is personal, context-specific, and therefore hard to formalize and communicate to others, is converted into knowledge that is transmittable and articulable," Nonaka, Ikujiro, and Hirotaka Takeuchi. *The Knowledge-Creating Company*. Oxford University Press, 1995, pp. 237–38.

51 Polanyi, Michael. *The Tacit Dimension* [1966]. Peter Smith, 1983, p. 4.

Contemporary apprentices of labour, however, are virtually compelled to read Polanyi's statement as an epistemological challenge involving the struggling verbalisation of personal knowledge that is *circumstantially not yet* formulated; as if the fate of being able to know more than one is able to speak could be redeemed by an additional effort of spectatorial speech. This is the additional effort required from workers in their contemporary environments densely populated with images. An effort that has been widely celebrated along with their recent opportunity to participate in the modern adventure of making labour explicit.

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