

THE END OF WORKING LIFE: QUESTIONS FOR ERGONOMICS

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Abstract

We propose to show how an ergonomics approach can be used in the scientific and social debate about the end of working life. Demographic changes are at the root of our concerns about the financing of retired workers. This has led, in turn, to questions about the duration of working life. These demographic changes likewise entail the ageing of the workforce. Using an analytical model of the relationship between age and work, a model which combines functional decline and skill construction, it is possible to examine, on the one hand, the mechanisms due to bodily "overuse" at the end of a career and, on the other, the adjustment between the transformation of age structures and certain changes in work organization. The latter include the increase of non-standard working hours, the reinforcement of temporal pressure in work, and the increased frequency of situational changes. This examination suggests a few possible avenues for ergonomic interventions, namely the outlook for ageing in companies, the more general debate about socially acceptable work conditions, and, with much discretion, a discussion of retirement ages.

Key words: ageing at work, retirement, career path

Retirement, by definition, is the state of a person who no longer has a job and can draw a pension. A retired person, if we put aside his or her volunteer activities or particular combination of work and retirement, is no longer an "operator". The contribution of ergonomists to the social debate about retirement is thus not particularly obvious. It is not their calling to intervene in decisions about the financing of social protection, nor in arbitration between systems founded on redistribution or capitalization. Likewise, they are not often asked to examine the future of retired workers once the latter have left the workforce. They must cautiously approach the question of the "right" retirement age, given that the issues are numerous and mostly outside of their expertise.

However, the debate over age and retirement possibilities is evolving and we might imagine that it will not remain polarized around solely financial considerations. This evolution is particularly evident in France. In a recent report on voluntary and progressive early retirements, the economist Dominique Taddei explicitly stated that, "the debate about social choices comes first, which does not in anyway diminish the need for discussions about the financial balance of pension plans, though it does put them in their right place, that is second" (Taddei, 2000). The president of COR (the council for the orientation of senior citizens), created last year indicated that, "the social pact is at the heart of this debate, because for pensioners, retirement conditions are largely determined before retirement." She added that, "we are fooling ourselves if we think that we can increase the length of careers in companies and institutions if the management of human resources does not radically change" (Moreau, 2000). This council, which brings together elected representatives, social partners, administrative managers and several experts, has unanimously decided to create a permanent internal work group dedicated to "age and work".

This change in direction can be explained. The demographic structure is undergoing major changes. The proportion of the oldest age brackets is continuously growing among both the active population and the whole society. Indeed, as Robert Rochefort (2001) explained, "arithmetic has its rules: everything points towards the fact that we will have to get used to the idea of working longer in the future", for both economic reasons and "social equilibrium: the hypothesis of an extended family in which, if nothing changes, a 40-year old man will normally be the only working family member out of four generations, caught between his son who is still at school and his 62-year-old father and 85-year-old grandfather, is very difficult to imagine."

Are longer working lives always possible, whatever the profession, the career path followed and the work conditions endured, especially those of the last years of a career? And if the question is inverted, what professions, paths and work conditions could accommodate the lengthening of working lives without being harmful to the workers' health, neither during or after work, while ensuring that the production system is as efficient as possible? The question, when restated in this way, deserves the attention of ergonomists. Furthermore, they might also ask what can they contribute to this "restatement"? This is the discussion we would like to nurture here with this paper.

Demographic Transition and the Three Types of Ageing

Demographic predictions indicate that, in most industrialized countries, for instance those in Europe, (Calot, Chesnais, 1997), there will be historic changes in age structures. These structures show, and will do so for a long time, the mark of a period of "demographic transition", that began with a decrease in adult mortality, infant mortality already being quite low, followed by a decrease in the birth rate after a long baby-boom. There has been a narrowing of the base and a widening of the top of the age pyramid, which, in fact, is becoming less and less pyramidal. One measurement of this evolution, eloquent though overly simple, is provided by the predicted variation of the average age which, by 2020, should increase by three to four years depending on the country. However, more is revealed when three aspects of this ageing are described (Volkoff et al., 2000), each one of them having something to say about the relationship between work and retirement.

A first type of retirement is characterized by the growing proportion of 60-to-65-year olds. In many countries, this threshold constitutes the usual limit between activity and retirement. This evolution is determining the main concerns about the financing of pensions. It is also encouraging the delaying of retirement so as to increase the number of active workers cum pension plan members and decrease the number of pensioners. A complementary objective is to increase the employment rate in the years preceding the retirement age, especially in countries where this rate is very low. In France, for instance, it falls below 50% from the age of 57 and up. However, related questions to these social policy decisions concern the very nature of this retirement threshold, that is: should it be founded only on age? should it be related to the duration of working life? should we also consider the type of work, its inherent risks and difficulty? and, in the latter case, how can we evaluate this difficulty? These issues are starting to be raised, in particular by occupational health specialists.

A second aspect of ageing is the rapid increase of very old people, for instance, those above 80. On the one hand, the need to take care of these people influences the employment choices of their fifty- and sixty-year-old children, for reasons of revenue and scheduling. Moreover, life expectancy and the state of health at this advanced age are themselves partially determined by the career path. We will come back to this subject later.

Finally, a third type of ageing concerns the active working population, in which the proportion of the younger age brackets is tending to decrease. The numerous people born in the 50s and 60s are reaching and surpassing the middle of their working lives. Those born in later decades are not only less numerous, they were in school longer and entered the workforce later. These phenomena have been partially offset by public and private policies that encouraged people to retire earlier. This has resulted in a decreased workforce participation rate among men over 55 years old, but not among women because of generation effects, since female employment is more developed in the younger generations. In total, there has been a narrowing in the age structures of active workers and a dominant tendency towards ageing, since the numerous personnel in the middle of their working lives are still progressing in age. From this point of view, a raising of the employment rates among those over 50 would only amplify the ageing tendency that is already well under way in the workforce. Questions about occupational health and the efficiency of ageing workers thus need to be examined attentively.

A Schematic Analysis of Age versus Work Relationships

The concerns of companies with respect to an ageing workforce vary over time (Teiger, 1995, [1998]). They are often difficult to clearly identify and structure (Pueyo, Gaudart, 1997). They can be quietly expressed, indicating a serene attitude towards the changes in age structures. Or, on the contrary, they can be strongly stated and reflect an alarmist reading of these same changes. However, the idea that an ageing workforce poses a problem which can, nonetheless, be addressed by focusing on work methods and means, does not seem to be very widespread. In a French survey of employers, only one out of eight agreed with this viewpoint (Le Minez, 1995). When this was the case, however, the initiatives fell into two main groups (Volkoff, 1996), namely an overall policy to improve work conditions or specific attention given to personnel having considerable deficiencies, their number increasing with age.

In truth, the range of possible initiatives can be enlarged by specifying and improving the approach to human ageing and its relationship with work (Volkoff, Laville, 1998). It is well known that growing older is associated with a greater probability of functional decline. This decline is generally moderate in extent in the common ages of working life. Its circumstances and moment of arrival vary considerably from one person to another. However, work conditions play a huge role in the acceleration or delay of this decline's arrival. Furthermore, they affect not only this decline but also the difficulties that it brings with it. The light involution of a function may not pose a problem if the task requirements are not excessive and the workstation is well designed.

Overtime, based on their experience, working men and women "learn", more or less consciously, to manage their own ageing. They can try to change the kind of work they do if they think this is necessary. Or, they can also do the same work in a different way. They rearrange their work practices by developing individual and collective strategies that can make up for possible deficiencies and make difficult situations less frequent. This then becomes a question of whether or not work conditions and organization, performance evaluation criteria, and career path and learning management will foster the development and success of these strategies. The establishment of work practices in which experience is an asset and which make it possible to soften the effect of declining functions is all the more necessary given that career paths are getting longer and the effects of age are likely to be more present.

The Question of Wear and Tear

Given this analytical framework, what can we say about the marks left by a career path on the health of a pensioner? The first way of looking at this relation consists in examining the links between work conditions and longevity? Many relationships between work and health are multifactorial, deferred and laced with selection mechanisms. Given this context, life expectancy has the advantage of being an objective comprehensive indicator. There are marked differences in mortality between social categories. In France, they are even more obvious than in neighbouring countries (Kunst et al., 2000). Interestingly, there are rare but convincing studies that attribute part of this difference to work characteristics. Teiger and her colleagues (1981) established, using the pension fund files of 1,500 printing plant workers, clear differences in life expectancy between proofreaders, typesetters, platemakers and rotary printer operators. A relationship was established between these differences and work conditions, in particular night work. Likewise, a long-term, 22-year study of 300 pulp and paper workers (Astrand et al., 1989) demonstrated that workers who disposed of a greater latitude in the organization of their work were less at risk of cardiovascular disease and lived longer than their colleagues.

Should life expectancy be taken into account when setting the retirement age? Ergonomists cannot easily answer this delicate question. It brings into play the numerous determinants of disability-free life expectancy and of mortality differential, such as the considerable differences between the two sexes. This question also raises the problem of the debatable choice between prevention and compensation. This problem is not so different from that posed by danger pay.

These studies help demonstrate that the workers' state of health, near the end and after their working lives, strongly depends on their work history. This idea is also found in equally rare studies devoted to post-occupational health. For example, retired clothing industry workers who had been paid on a piece basis were in worse health than those who had been paid hourly (Vézina et al. 1989). In the follow-up of a pensioner cohort by Cassou et al. (2001), people who stated that they had been exposed to nuisances during their working life such as heavy loads, tiring positions, noise or dust had more disabilities at the time of their retirement as well as ten years after retiring.

"Ill health", "disabilities", these terms show us that we do not necessarily need to refer to diagnosable pathologies to describe the long-term relationship among age, work and health. Work conditions influence the appearance of health problems that are not always serious and must not necessarily be seen as "signs" of diagnosable diseases. Tiredness, pain or sleep problems all contribute to lessening the quality of life, before and after retirement. Their link to work is instinctively established by various company members such as managers, occupational physicians (see Maurice Amphoux's analysis of "sudden ageing" (1998)) and the workers themselves who describe their own "wear and tear" (Loriol, 2000). Thanks to ESTEV, an inter-professional survey of health, work and ageing conducted in France in 1990 and 1995 by several hundred occupational physicians, there are now precious assessments of these forms of impairments caused by work (Derriennic et al., 1996 ; Symposium, 2001).

Indeed, ESTEV supports the idea that functional degradation follows a different "calendar" from one person to another and from one function to another, and that work characteristics play a role in this "differential ageing". For example, 10 years of exposure to noise increases the proportion of workers with deficits to the same degree as does a 15-year age difference. What is said here for noise has also been confirmed in the study for such constraints as

carrying heavy loads, working in difficult positions or doing repetitive work with severe time limits. The same duration of active working life will therefore have very different effects depending on the quality of life at work.

The results also confirm the appeal of a long-term analytical framework. A study of links between sleep and shift work showed that there were more problems as age increased and even more problems among workers on shifts. From 47 years old and up, problems appear just as often among those who formerly did shift work as among those who were on shift work at the time. This shows that these problems are not entirely reversible when workers return to the day shift. It also points to a selection mechanism, namely that it is those who were having problems that tried to change their schedules. It is thus the whole career path that has to be taken into account to assess a person's state of health at the end of a working life.

Intergenerational differences are apparent when this point of view is taken (Molinié, 2001a and b). Workers who are now reaching 60 began their working life at a young age. For instance, half of the men born in 1938 in France had already started working by the age of 14. The differences in this matter between generations are greater than the differences between social categories of the same age group. Moreover, the older generations followed quite demanding career paths, with a sustained exposure to the constraints and nuisances of agricultural or industrial work with, in particular, very long hours and intense physical demands. Finally, changes in work organization, which we will come back to further on, transformed their environment at an age when they could seek a certain stability. This might explain the often noted yearning of older workers for a "well-deserved rest" as well as the success of early retirement programs. It is difficult, however, to predict how subsequent generations will react when they reach the same age.

Which Work Shall We Grow Old in?

As was said above, if early retirements become less common or the retirement age is raised, the evolution of the relative weight of age brackets in the workforce, which started 10 to 15 years ago, will speed up. However, before they began contributing to the ageing of the workforce, those born between 1945 and 1965 began by making it younger, both because of their number and an economic context that was favourable to hiring. Production systems "got into the habit" of running with a certain proportion of young workers. Certain work situations were given to them first. Ergonomic knowledge has since helped us to interpret these selection mechanisms and to understand why these situations are especially difficult for at least some older workers. If these situations were rarer than is actually the case, the management of the age - work relationship would be less delicate. The evolution of work would have generally compensated, as it were, for the potential difficulties stemming from demographic ageing.

However, this happy scenario is not what is currently happening (David et al., 2001). At the same time as ageing is occurring and the pushing back of the retirement age is being considered, several work characteristics that are known to be age selective are also becoming more common. There are "arithmetic contradictions" that work demographics can analyze (Molinié, Volkoff, 2001) and ergonomics can strive to treat. We will examine these potential contradictions and their possible outcomes in three areas, namely shift work, temporal work pressure, and changes to work (versatility, mobility, technological modernization and learning situations).

Schedules and Their Effects

Atypical schedules, in particular late work hours, night or very early morning work are growing in industrialized countries around the world, a change that has been confirmed in France (Bué and Rougerie, 1999) and in Canada (Shields, 2000). Indeed, many studies have demonstrated that age selection exists, as a certain proportion of shift workers move towards day hours in the middle of working life. These same studies have underlined the role played by health problems in these re-assignments and the persistence of part of these problems after returning to a normal schedule (Bourdouxhe et al., 1997; Derriennic et al., 1999).

We know the main reasons behind these selective processes and these particular difficulties of ageing workers (Quéinnec et col., 1995, [1998]). On the one hand, sleep and its regulation change with age. There is an increase in nocturnal waking, a decrease in deep sleep, a tendency to go to bed and get up earlier, and a more difficult adjustment to temporal changes with, in particular, a very short diurnal sleep. On the other hand, disturbances in family and social life can have an increasingly greater impact over the years. Sophie Prunier-Poulmaire (1997) has shown, for instance, that the opinion of customs officers and their spouses about the effects of shift work on their personal lives became increasingly negative as they grew older. Timothy Monk (1991) insists on the "social alienation and lack of status" that ageing shift workers are more likely to feel, stating that "shift workers tend to see themselves as being on the fringe of the social groups to which they belong. At 20, this might not have posed a problem, but at a more mature age, the desire for a better social status can become much more intense."

This question of status also plays a role in the work itself. Shift work can limit career possibilities and access to training. However, the atmosphere of night work can be seen as warmer and more serene, with less interruptions and orders, which can be flattering for more experienced workers, even if this relative isolation is also the source of uncertainties and concerns.

The confrontation between demographic ageing and increased shift work thus calls for an examination of how to set up schedules that take into account, as much as possible, the diversity of people, be it differences in age or between people of the same age. The levers are well-known moreover, and include team rotation systems, length of breaks, starting time, number of teams, number of employees, distribution of tasks during the workday and among groups, etc.

Perhaps we have a poorer understanding – and this could be a subject for research – of the possible role played by experience in the prevention of drowsiness during the night. The scientific literature does not indicate a noticeable rise in these troubles before 65 years of age. According to a recent French survey (Laurent et al., 2001) problems of sleepiness would even seem to be negatively correlated with age, whereas sleep problems are positively correlated. We can thus ask if these operators develop individual and collective preventive strategies in and outside of work that are based on their own knowledge of how they function in shift work or irregular schedules.

Managing Temporal Pressure

A notable characteristic of recent changes in work organization is the accumulation of time constraints (Dhondt, 1998; Gollac and Volkoff, 2000). The typical constraints of the industrial sector (automatic rhythm, standards, deadlines) are increasingly intermingling with those of

the tertiary sector (quick response to client or public demands). The combined obligation to meet production quantities and qualitative standards, and to react to situations and outside requests multiplies the number of urgent situations and on-the-spot choices between sometimes contradictory objectives. Inter-occupational surveys (Molinié, 2001a) and demographic analyses conducted by ergonomists (Teiger, 1989) have often demonstrated a relationship between age selection and temporal pressure. These selection mechanisms reflect and nourish a mental representation of the adjustment between speed and ageing, namely that quickness and "reactability" are normally associated with youth.

Certain findings in work physiology and psychology support the idea of a progressive slowing down in the execution of precise and rapid tasks and even in certain decision-making processes with marked time constraints (Welford, 1958; Salthouse, 1985). This deceleration is even greater after the ages of 60 and 70. What are the main causes? Sensorial impairments and signal/noise detection capacity are evoked, as are caution and verification strategies that older workers tend to use. However, these findings are based on test situations which are only partially valid with respect to real work situations, since the test material and actions to be carried out were not familiar to the workers and the appraisal of experience, difficult to measure.

This is the appeal of numerous field studies which have shown how experienced workers manage time constraints. Older carpenters nail rafters and window frames just as quickly as younger workers, but spread their legs wider for more stability (Marcelin, Millanvoye, 1983). Workers on assembly lines develop sensorimotor abilities that help them reduce the duration of their movements (Gaudart, 1996). Experienced drivers of overhead travelling cranes develop driving methods and intermediary storage systems in order to keep pace with the process rate more easily (Gaudart, Pondaven, 1998). Experienced quality controllers on a rolling mill contact up-stream colleagues to correct a process as soon as inaccuracies occur and thereby avoid the need to urgently correct errors later on (Pueyo, 2000). Older air traffic controllers take more advantage of down time in airplane traffic to update their analysis of the situation than do their younger colleagues (Paumès, 1995, [1998]). Collective strategies are also developed. For example, assembly teams in aeronautic construction distribute tasks between younger and older workers to help the latter avoid the tightest deadlines (Millanvoye, Colombel, 1996). The coordination between a driver and loader and a good knowledge of the clients plays an essential role in the time management of garbage men (Cloutier, 1994). Likewise, among in-home nursing aids, a co-activity appears between the patient and experienced aids (Cloutier, David, Teiger, Prevost, 1999).

When they can be implemented, these strategies allow experienced workers to remain healthy and effective when faced with temporal pressure. However this possibility depends on design choices, work conditions and organization, including the degree of temporal pressure. If the latter is too pronounced, individual and collective latitude is reduced and the increase in urgent situations will prove to be a greater penalty for ageing workers.

Changing Jobs at Any Age

The search for flexibility in company organization and the growing frequency of technical changes and reorganization have brought about forms of instability in career paths, notably an increased versatility and mobility, and, more generally, situations involving change or learning. For example, in French surveys, the need to change workstations because of regular rotations or company needs involved 21% of workers in 1987 and 30% in 1998. However, ageing workers are seen to be "less adaptable" than their younger colleagues. This

opinion would seem to be shared by employers (Le Minez, 1995) and workers (Marquié, Baracat, 1995), and is seen in such company practices as training (Molinié, Volkoff, 2001).

A certain variety in tasks, over a given period or even a career, can entail certain positive aspects for an ageing worker. Task variation can limit health deterioration related to repetitive work. For instance, it can provide possibilities for retraining when physical problems arise. It can also favour the development of skills and keep the idea of a career project alive, which has beneficial consequences on one's personality right up to the end of working life. But ageing workers can also be afraid that the new tasks might be more physically and mentally difficult than those that they already know, especially if the efficiency strategies that they have developed through their experience are not easily transferable (Gaudart, 1996). On the other hand, their stability and lack of versatility can be indicative of a well-recognized expertise (Gaudart, Pondaven, 1998). Even learning situations can be seen as trials and can be a source of concern for the future, creating an unhealthy competition with younger workers.

Once again, our knowledge of functional involution with ageing is not sufficient enough to explain the difficulties, nor the successes, of older workers. This is because, in work situations, the essential issue resides in the familiarity that workers have, identify or develop with new tasks (Paumès, Pélegrin, 1993). When a company chose to technically modernize a composite material workshop in which older workers were already employed, rather than searching for younger, more educated workers, the company chose to take into account the older workers in the way it conducted the changes. This approach led to some happy surprises for the company (Doppler, 1995 [1998]). It has been noted that when younger and older workers take training sessions together, they try to use different learning strategies (Delgoulet, 2000). When older assembly line workers are learning a new workstation, they attempt, very early on, to develop their own efficiency strategies (Gaudart, 1996).

The possibility of successfully changing jobs, even in the final years of working life, thus depends on numerous factors, most of which are manageable. They include the following: a clear statement of the objectives of the change, training methods that take the older workers' characteristics into account (e.g. diversity of career paths, connection between old and new knowledge, and rebuilding of confidence when necessary), a calendar that makes it possible to spread out and correctly reinforce learning, particular care taken in the organization of the initial training and the starting of new situations, as well as more regular use of continuing training over the whole career path.

Because of this increase in the proportion of 50-and-over workers, these concerns should be more openly discussed in companies, especially if the idea is developed that a strong change in direction in a career path can be successful at any age and can resolve many problems. The well-being and effectiveness of older workers is not the only issue. Even as they become more numerous every year, they are also more likely to leave. We might also notice that the right conditions for skill development at the end of a working life are also those that facilitate the communication and transfer of knowledge and know-how to younger workers.

An Ergonomics Viewpoint of Retirement Age

As we draw close to the end of this discussion, we can once again ask what role the ergonomics approach might justifiably play in the social and scientific debate about the age at which a working life should come to an end.

The first type of ergonomics intervention would not seem to pose any problems in terms of positioning. It consists in suggesting to companies that they look ahead to the deformation of their age structure, as this deformation will be more or less pronounced depending on the retirement age options. They might then identify, as early as possible, the ways of ensuring the workers' health and work efficiency with a new demographic distribution of the workforce. An early and precise investigation would enable companies to pay the issue of ageing the attention that it deserves, without going so far as to see it as an unsolvable problem. In many cases, the examination of work activities and learning strategies makes it possible to propose numerous avenues in this area, be they equipment, schedules, group functioning, training options or others.

In the same vein, ergonomics would be justified in questioning the organization of the whole production system. The predicted ageing might then serve as leverage for new organizational requirements in companies. For instance, one question might concern the proportion of night work that is really indispensable? Can the management of time constraints free up more breathing room with respect to tight deadlines? Can career paths and changes within companies be better, more progressively managed? These options will affect the employment rate for workers in their fifties and sixties. They will also influence how the career paths of workers of all ages will unfold: if we want to keep today's young workers from being "used up" too quickly, the answer to demographic changes does not consist in always giving them more difficult work.

This leaves the question of the actual retirement age of each worker, or rather the age at which retirement in good financial conditions should become possible. Ergonomics can add its viewpoint to the many out there, particularly those that prone the financial balance of pension plans. This viewpoint would consider the state of health before and after retirement and the difficulties encountered in the last years of working life. It would remind all involved of the diversity of career paths, of the current situation of a given worker age bracket, of the different work "histories" from one generation to another. The future is, nonetheless, difficult to predict. Indeed, the aspirations of today's young workers in twenty or thirty years are obviously unknown?

Delicate compromises will have to be worked out. By insisting on the potential benefits of work designed to take older workers into account, we can give credence to the idea that prolonging active working life is easily achievable, though this is not yet the case. On the contrary, by underlining the difficulty of the career paths followed by many workers, we tend to promote forms of compensation such as early retirement, which in itself can serve as an alternative to a work policy.

We do not believe that the complexity of this debate justifies that ergonomics abstain from taking part. Nonetheless, its contribution to this discussion, however cautious, implies the development and dissemination of our current knowledge of ageing workers and their work. We hope that we have contributed to this task today.

Bibliography

- Amphoux M. (1988). Un médecin du travail face au vieillissement de ses salariés. *Gérontologie et Société*, 45, pp46-55
- Astrand N.E., Hanson B.S., Isacson S.O. (1989). Job Demands, Job Decision Latitude, Job Support, and Social Network Factors as Predictors of Mortality in a Swedish Pulp and Paper Company. *British Journal of Industrial Medicine*.

- Bourdouxhe M., Quéinnec Y., Granger D., Baril R., Guertin S., Massicotte P., Levy M., Simard M., Lemay F., Casanova C. (1997). *Effets de l'horaire rotatif de 12 heures sur la santé et la sécurité des opérateurs d'une raffinerie de produits pétroliers - Phase I : enquête, diagnostic, pistes de réflexion pour des aménagements*. Études et Recherches, IRSST, R-162, 281p. http://www.irsst.qc.ca/htmfr/pdf_txt/r-162.pdf
- Bué J., Rougerie C. (1999). L'organisation des horaires : un état des lieux en mars 1998. *Premières Synthèses*, n°30-1, ministère de l'Emploi, Paris, 6p.
- Calot G., Chesnais J.-C. (1997). *Le vieillissement démographique dans l'union européenne à l'horizon 2050*. Futuribles International, collection Travaux et Recherches de Prospective, 173p.
- Cassou B., Derriennic F., Monfort C., Iwatsubo Y., Amphoux M. (2001). Evolution de la santé après la retraite et conditions de travail durant la vie active : à propos d'une cohorte de retraités parisiens suivis 10 ans. In *Travail, Santé, Vieillesse. Relations et évolutions*, pp115-123, Editions Octarès, Toulouse
- Cloutier E., (1994). The effect of age on safety and work practices among domestic trash collectors in Québec. *Safety Science*, vol.17, pp291-308
- Cloutier E., David H., Teiger C., Prevost J. (1998). Les compétences des auxiliaires familiales et sociales expérimentées dans la gestion des contraintes de temps et des risques à leur santé. *Formation Emploi*, n°67, pp63-75
- Colloque *Travail, Santé, Vieillesse. Relations et évolutions*. Editions Octarès, Toulouse, 244p.
- Conseil consultatif national sur le troisième âge (1999). *1999 et après : les défis d'une société canadienne vieillissante*. Travaux publics et services gouvernementaux, Ottawa.
- David H., Volkoff S., Cloutier E., Derriennic F. (2001). Vieillesse, organisation du travail et santé. *Pistes*, n°3 (à paraître)
- Delgoulet C. (2000). *La formation professionnelle des travailleurs vieillissants : composantes motivationnelles et modes d'apprentissage d'une technique de maintenance ferroviaire*. Thèse de Doctorat en ergonomie, Université Toulouse II, 244p.
- Derriennic F., Touranchet A., Volkoff S. eds (1996). *Age, travail, santé. Etudes sur les salariés âgés de 37 à 52 ans. Enquête ESTEV 1990*. Les éditions INSERM, Paris, 440p
- Derriennic F., Ribet C., Volkoff S. (1999). Troubles du sommeil chez les salariés vieillissants : les effets de l'âge et des horaires de travail. *Premières Synthèses*, n°23-2, ministère de l'Emploi, 7p.
- Dhondt S. (1998). *Time constraints and autonomy at work in the European Union*. Report to the European Foundation for improving of living and working conditions, Dublin, 74p.
- Doppler F. (1995). Evolution de la population avec l'âge et transformation ou conception des situations de travail. In *Le travail au fil de l'âge*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp.411-427. Editions Octarès, Toulouse. [English : Doppler F. (1998). Changes of the workforce and the transformation or the design of work. In *Working with age*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp313-326. Taylor & Francis, London]
- Gaudart C. (1996). Vieillir, mais « tenir » la cadence. *Gérontologie et Société*, n°77, pp84-100
- Gaudart C., Pondaven S. (1998). Polyvalence, vieillissement et expérience dans deux métiers de la sidérurgie. In *Temps et travail*, Actes du XXXIIIe Congrès de la SELF, Paris, pp599-609
- Gollac M., Volkoff S. (2000). *Les conditions de travail*. Editions La Découverte, collection Repères, 122p.
- Kunst A., Groenhof F., Mackenbach J. (2000). Inégalités sociales de mortalité prématurée : la France comparée aux autres pays européens. In *les inégalités sociales de santé*, eds A.Leclerc, D.Fassin, H.Grandjean, M.Kaminski, T.Lang, pp53-68, Editions INSERM et La Découverte, Paris

- Laurent P., Buisset C., Guieu J.D., Lenne X., Lebrun T. (2001). Troubles de la vigilance au travail, âge et caractéristiques temporelles du travail. Enquête sur 5008 salariés de la région de Lille. In *Travail, Santé, Vieillesse. Relations et évolutions*, pp217-231, Editions Octarès, Toulouse
- Le Minez S. (1995). Les entreprises et le vieillissement de leur personnel : faits et opinions. *Travail et Emploi*, n°63, pp23-40
- Loriol M. (2000). *Le temps de la fatigue. La gestion du mal-être social au travail*. Editions Anthropos, Collection « Sociologiques » Paris, 293p.
- Marcelin J., Millanvoye M. (1983). Vieillesse et travail en hauteur. *Travail et Emploi*, n°15, pp75-84
- Marquié J.C., Baracat B. (1995). Les plus de 45 ans dans un contexte technologique mouvant. In *Le travail au fil de l'âge*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp359-375. Editions Octarès, Toulouse. [English : Marquié J.C., Baracat B. (1998). Being over forty-five in a ever-changing technological context. In *Working with age*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp273-284. Taylor & Francis, London]
- Millanvoye M., Colombel J. (1996). Age et activité des opérateurs dans une entreprise de construction aéronautique. In *Intervenir par l'ergonomie, XXXIe Congrès de la SELF*, éd. R.Patesson, vol2, pp39-46
- Molinié A.F. (2001a). Evolution des exigences du travail et itinéraires des salariés vieillissants. In *Travail, Santé, Vieillesse. Relations et évolutions*, pp13-29, Editions Octarès, Toulouse
- Molinié A.F. (2001b). *Parcours de travail et fins de vie active dans différentes générations*. Quatre Pages (du Centre d'Etudes de l'Emploi), n°45, 4p.
- Molinié A.F., Volkoff S. (2001, à paraître). *Méthodes en démographie du travail : une approche du vieillissement dans les entreprises (titre provisoire)*. Editions de l'ANACT, collection Outils et Méthodes, Lyon.
- Monk T.H. (1991). Does shiftwork produce differential consequences for young and older workers ? In *Shiftwork and job demands*, pp26-31, Eds SELF, International society of chronobiology, Paris, 11-12 juillet.
- Moreau Y. (2000). *Les missions du Conseil d'Orientation des Retraites*. Intervention aux huitièmes rencontres parlementaires sur la protection sociale, Paris, 6 juin 2000
- Paumès D. (1995). L'expression du vieillissement au travail : présentation de deux études menées auprès de contrôleurs aériens. In *Le travail au fil de l'âge*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp.305-327. Editions Octarès, Toulouse. [English : Paumès D., Volkoff S. (1998). Manifestations of ageing at work : presentation of two studies carried out on air traffic controllers. In *Working with age*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp231-248. Taylor & Francis, London]
- Paumès D., Pélegrin C. (1993). Apprendre...est-ce une aptitude réservée aux jeunes ? *Formation Emploi*, n°41, pp43-54
- Prunier-Poulmaire S. (1997). *Contraintes des horaires et exigences des tâches : la double détermination des effets du travail posté. Santé et vie familiale des agents des Douanes*. Thèse de Doctorat en Ergonomie, Ecole Pratique des Hautes Etudes, 306p.
- Pueyo V. (2000). La « traque des dérives » : expérience et maîtrise du temps, les atouts des « anciens » dans une tâche d'autocontrôle. *Travail et Emploi* n°84, pp63-73
- Pueyo V., Gaudart C. (1997). Construire une intervention ergonomique sur la question de l'âge. In *Recherche, pratique, formation en ergonomie*, pp147-157 Actes du XXXIIème congrès de la SELF, Lyon
- Quéinnec Y., Gadbois C., Prêteur V. (1995). Souffrir de ses horaires de travail : poids de l'âge et histoires de vie. In *Le travail au fil de l'âge*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp277-304. Editions Octarès, Toulouse. [English : Quéinnec Y., Gadbois C., Prêteur V.

- (1998). Suffering from work schedules : the burden of age and life history. In *Working with age*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp209-230. Taylor & Francis, London]
- Rochefort R. (2000). *Vive le papy-boom*. Editions Odile Jacob, Paris, 291p.
- Salthouse T.A., 1985. *A theory of cognitive aging*. Amsterdam, North-Holland, 454p.
- Shields M. (2000). Long Working Hours and Health. *Perspectives on Labour and Income*, Statistique Canada vol.12, pp49-56
- Taddei D. (2000). *Retraites choisies et progressives*. Rapport du Conseil d'Analyse Economique. La Documentation Française, Paris, 266p.
- Teiger C. (1989). Le vieillissement différentiel dans et par le travail : un vieux problème dans un contexte récent. *Le Travail Humain*, 52-1, pp21-56
- Teiger C. (1995). Penser les relations âge/travail au cours du temps. In *Le travail au fil de l'âge*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp13-72. Editions Octarès, Toulouse. [English : Teiger C. (1998). Ways of thinking out the age-work relationship in the course of time. In *Working with age*, eds J.C.Marquié, D.Paumès, S.Volkoff, pp1-50. Taylor & Francis, London]
- Teiger C., Laville A., Lortie M. Binder E., Boutin J. (1981). Travailleurs de nuit permanents, rythmes circadiens et mortalité. *Le Travail Humain*, 44-1, pp73-92
- Vézina M., Vinet A., Brisson C. (1989). Le vieillissement prématuré associé à la rémunération au rendement dans l'industrie du vêtement. *Le Travail Humain*, 52-3, pp203-212
- Volkoff S. (1996). Des « politiques du travail » pour tenir compte du vieillissement. Quelques exemples en France et en Allemagne. *Travail et Emploi*, n°69, pp71-82
- Volkoff S., Laville A. (1998). Le vieillissement au travail. In *Le monde du travail*, eds J.Kergoat, J.Boutet, H.Jacot, D.Linhart, pp 198-205. Editions La Découverte, Paris.
- Volkoff S., Molinié A.F., Jolivet A. (2000). *Efficaces à tout âge ? Vieillesse démographique et activités de travail*. Dossiers du Centre d'Etudes de l'Emploi, n°16. La Documentation Française, Paris, 127p.
- Welford A.T. *Ageing and human skill*. Nuffield Foundation, Oxford university Press, 300p