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Perception of job security in a process of technological change: its influence on psychological well-being

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Abstract. The main objective of this study was to investigate the perception that workers have of technological change and its relation with psychological variables. The hypotheses investigated are based on the existence of the perception of technological change as a threat to job security and how this affects levels of anxiety, general stress and depression. The study was carried out in two departments of a car component factory: Engine Dept.-1 and Engine Dept.-2, outstanding for the different degrees to which technological innovation had been implemented. As procedure, a questionnaire made up of different scales was administered to a sample of 148 workers. Analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) was used as the fundamental statistical instrument. The results indicate that some variables (studies, department type, occupational category, technology type) significantly affect the perception that workers have of technology in relation to job security. The significant relation between technological perception and psychological well-being is also confirmed (F (4, 124) = 0.17, p = 0.00) although no significant differences were found in stress. In conclusion, the results indicate the importance of modifying workers' perceptions of technology in order to prevent problems of psychological well-being.

1. Introduction

It would not be venturing too far to state that, within various frameworks of reference (sociological, economic, philosophical, political), and with very diverse conceptual perspectives, new technologies have occupied a key position in the current debate and scientific research carried out in social sciences. Within this sphere of thought much of the effort made in this direction has focused on technological change and the general tendency has been to consider the effects on workers of the introduction of technology in organizations in terms of either 'black' or 'white', that is, as being positive or negative for the quality of their work life (Child and Loveridge 1990, Hammer and Champy 1993, Wastell and Cooper 1996).

More specifically, in literature on the influence of technology within the labour context, in our opinion, a dual perspective can be identified which divides the conceptual contributions into two groups. On one hand, we find the study of the consequences that technological development has on employment, which gives rise to controversial debate regarding the cause of unemployment/generation of new jobs and contributions from different standpoints: technology seen as a generator of new jobs and technological backwardness as the real threat to employment (Castells 1986, 1989, 1997, Kaplinsky 1988, 1989), technological innovation seen as the direct cause of the destruction of employment (Kern and Schumann 1987, 1988, Rifkin 1996, Hotz-Hart 1993), and other intermediate positions, all of which underline the fact that analysis must take into consideration different mechanisms of compensation and time adjustment (Agut 1995).

On the other hand, we find the concern to restructure the work population around the need for new professional skills of the workers, which gives rise to extensive discussion on skilled/unskilled labour. Here we have equally varied positions: technology is seen as introducing phenomena of polarization in the levels of qualification, with 'advanced' services companies of highly skilled personnel together with 'mini companies' of non-skilled labour serving as suppliers of the former, and whose role it is to carry out simple, repetitive and

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monotonous tasks, all of which, in turn, leads to the lack of qualification of the greater part of the work force (Braverman 1974, Gordon and Kimbal 1985, Rumbereger *et al*. 1987); the 'optimistic' view, which paints technology in a different light, where it is seen as being responsible for paving the way for the disappearance of burdensome tasks and for favouring the development of more complex activities, thus replacing physical-muscular force with more satisfying cognitive abilities and developing workers' autonomy and creativity (Hyer and Wemmerlor 1984, Kern and Schumann 1987, Rosanvallon 1987, Zuboff 1988).

In the present study we have adopted a different perspective: the way to link technology to organization—in its design, implementation and development—is seen as the result of a process of 'social construction' in which various external factors—technical, economic, rules/labour—combine with the subjective dimension of the actors/workers themselves—perceptions, beliefs, interests—to influence the introduction of technological development (Buchanan and Boddy 1984, Eason *et al*. 1996, Carayon 1997, De la Torre and Conde 1997). In this sense, there are two issues which cannot be ignored: the fact that the probability of unemployment perceived by the workers as a consequence of technological innovation will emerge as a decisive factor in their degree of acceptance of this new technology (Rifkin 1996), as well as the fact that, secondly (and speaking more positively), the productive development achieved as a consequence of the transition from 'mechanical technology' to 'cybernetic technology' has made possible new levels of competence, knowledge and work behaviour (Kern and Schumann 1987, Hirschhorn 1988, Ozaki 1993, Castells 1997).

Although various studies have shown that new technological systems can lead to important increases in productivity, cost reduction and greater competitiveness, the introduction of such systems has come up against serious resistance in many organizations. Literature suggests that computer resources are significantly underused and that this is due largely to users' anxiety (Gardner *et al*. 1989, Aranson *et al*. 1994, Seppaelae 1995). Resistance can be considered from different standpoints: sociological-based on people's fear of being replaced by machines and losing their jobs, and psychological-fear of not possessing the skills necessary for learning and carrying out the required work (Fariña y Arce 1993, Jaevenpaeae 1997).

Thus, we might hold the following proposition: with the introduction of new technology, will experience a threat to (their) job security. This, in turn, would pave the way for the development of unadapted behaviours and a worsening of the worker's health. Moreover, research on job insecurity has emphasized that workers experience a high degree of anxiety and stress when their jobs are unstable, all of which is tied in with the ambiguity and uncertainty of possible lay-offs and speculation as to whom will be affected in the event that they do occur (Jacobson 1987, 1991, Greenhalgh and Jick 1989, Heaney *et al*. 1994, Carayon *et al*. 1996, Lim 1996).

2. Hypotheses

According to the studies reviewed the thesis that we have taken as a basis here is : that technological change cannot be understood in a deterministic fashion but rather quite the contrary, as a consequence of new systems of work management and organization that new market conditions demand. These systems lead to changes that will be experienced in a particular way by workers depending on the personal and situational variables that make up the process of technological change.

More precisely, the first hypothesis of our research focuses on verifying the existence among the work population of a perception of threat from technological innovation. The introduction of new technologies would be perceived as being associated with an increase in unemployment and in work instability. This critical perception of technological change will vary depending on certain socio-demographic and work variables. Many studies describe these variables as being relevant to the process of modulating the effects of technological change.

As to our second hypothesis, we suggest that the perception of new technological change as the cause of job insecurity could have consequences and, therefore, be linked to certain behaviours related to the individual's health and well-being, such as depression, anxiety and stress. In other words, that the critical perception of the effects of technological change on job security could be negatively influencing these behaviours if we bear in mind the literature reviewed.

3. Explanatory model

Based on the proposed hypotheses, we offer the following explanatory model (figure 1) for the relations between the different variables of our study in line with the trends shown in other studies on the dynamics of technological change and its relation to work behaviour. Particularly noteworthy is the role of perception of technology as an associated factor to job insecurity. This variable is based—in accordance with the review made by Slem (1986) and Fernández (1990) and other

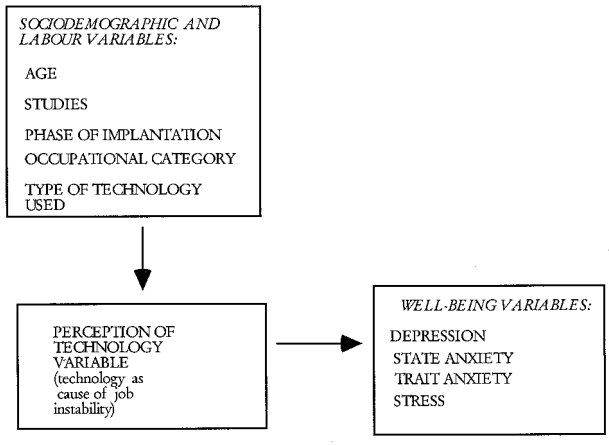

Figure 1. Explanatory model of labour behaviour in a process of technological change.

authors—on the fact that technological change in the organizational sphere, despite its positive aspects, acts as an agent causing social inadaptation and as a potential source of resistance in employees by arousing diverse fears. These include 'uncertainty' owing to the complexity that any change entails and to the lack of information on the consequences often accompanying it (European Foundation for the Improvement of Life and Labour Conditions 1991), the fear of being moved from one's workplace and being required to learn new or higher skills for which one may not always feel prepared for (Tezanos and Santos 1987, OIT 1987, Korunka *et al.* 1996).

A second type of variables used in the model and mediating in the perception of the introduction of New Technologies is that of socio-demographic and labour variables. As systematically shown in the literature, these variables have an important effect on the workers' attitudes, behaviours and, in short, their work behaviour in relation to technological change. One of these variables is the age of the employees, since attitudes towards technology and even anxiety have been found to vary considerably with age, being worse in older people (Breackwell 1988, Isla Díaz and Díaz Cabrera 1993, Birdi and Zape 1997). 'Studies' is another significant variable that is related to the effects of technological change: the employees with a higher qualification and level of training are the ones who tend to perceive technological change in a more positive light (Argote 1983, OIT 1987, Fariña and Arce 1993). The effects of technological change also seem to vary significantly depending on the phase or moment in time in which the new technology is introduced, the fears and resistance being greater during the initial stages (Ettlie and Rubenstein 1980, Markus and Robey 1988, Korunka *et al.* 1995, Carayon 1997). Another discriminating variable is that of professional or occupational category. Generally speaking, employees with a higher category are associated with more positive attitudes (Marquie 1994, Seppaelae 1995). Also related to the moment in time is the variable referring to type of technology used—mechanical or microelectronic. Here we start from the assumption that the workers' attitudes will vary considerably depending on the level of contact or experience that they have had with technology, this being another factor that may shed light on the research.

The third type of variables included in our model refers to dependent variables encompassing health-related behaviours which would be affected by the workers' negative perception of technological change on job security. We believe that certain health and well-being sensitive variables such as depression, state anxiety, strait anxiety and stress could be somehow affected as a consequence of the critical experience that the workers perceive when new technology is introduced, as seems to be gathered from different studies that show how certain stressors – in this case, technological change—are critical with serious repercussions on health (Heaney *et al.* 1994, Carayon 1995, 1997, Korunka *et al.* 1997).

The model constructed is thus based on the implicit assumption derived from our belief that technological change, in its role as a stressor, affects health at different levels, as has been described in literature on stress and anxiety.

Within this conceptual framework, we chose an automobile manufacturing company which, as is typical of the whole of this sector of production, has been characterized by intense technological renovation in its production lines and, in a parallel way, accompanied by a significant and important reduction in jobs. Therefore, this research context combines two significant characteristics: it is both an authentic setting and an ideal place to study the subjective experience of workers in relation to the process of technological change taking place in the organization.

Hence, our research was carried out in the manufacturing factory of an important automobile company. Our study concentrated on two Departments: Engine Dept-1 and Engine Dept-2 with the differential factor between the two departments residing in the development of technological innovation in each one: in Engine Dept-1 the application of Advanced Manufacturing Technology (AMT) was complete, with all of the production lines totally automated, a new management design with the incorporation of programmable automation and computerized management as the procedure for control of productivity. Engine Department-2, however, maintained a technological design with mechanical technology production lines and, while this

study was being carried out, was beginning to install its first AMT production lines and was, therefore, in the initial stage of technological rationalization, as opposed to Engine Department-1, where the level of technological development was fully consolidated.

4. Method

4.1. *Sample*

The sample for our study was made up of 148 male workers, 101 belonged to Engine Dept-1 and 47 to Engine Dept-2. The minimum size for the Engine-1 workers' sample to be considered representative was 22 employees for a population of 445 subjects. In the case of Engine-2 the minimum size necessary was 31 subjects for a population of 636 employees. It was found that for a confidence level of 95.5% the sample error was 0.08, which indicates its representativeness. The sample of workers ranged from 30 to 55 years of age—the average age being 51—, with an average of 20 years experience in the company, and belonged to the active work force of Renault-España's factory of ENGINE Manufacture in Valladolid.

4.2. *Measures*

4.2.1. *Depressive behaviour*: This instrument measures the employees' levels of depression, taking as a basis the fact that those who have a negative internal attributional style are more likely to become depressed when faced with adverse events and situations according to the empirical evidence (Scheier and Carver 1992, Myers 1995). This variable was evaluated using Beck's Self-Applied Depression Inventory BDI (Beck 1983). The scale comprises 21 statements describing the feelings experienced by the subject during the last week. The reply categories used were: I'm not sad (0); I feel sad (1); I'm always sad and can't help feeling that way (2); I'm so sad and miserable that I can't bear it (3). The high scores on the scale indicate a greater degree of depression. The reliability of this scale (Cronbach's alpha) in the study is 0.79, with the mean of the items being 0.43 (and that of the scale 8.95) and the standard deviation 0.66 (and that of the scale 6.12).

4.2.2. *Stress level*: This variable refers to the workers' general level of stress resulting from their worries and what occurs in their lives and was considered insofar as something which occurs in the workplace – the workers' discontent deriving from technological innovation – may influence other areas of their lives (Peiró 1992, Rodríguez Marín 1995, Wastell and Cooper 1996). The General Stress Level Scale (Conde López and Franch Valverde 1984) was used to measure this variable. This scale comprises 27 different events that, over the last 12 months, worried him although they did not actually happen, or worried him and did happen. The worker has two alternative replies to choose from: it neither happened nor worried me (0); it worried me and it did happen (1). The stress level was calculated taking into account the times that the subject had been worried or that something negative had happened to him. Evidence of the reliability and validity of the scale can be found in Barrio *et al*. (1986). The distribution of the variable is characterized by a mean of 14.12 and a standard deviation of 10.31.

4.2.3 *Anxiety level*: The Spielberger State-Trait Anxiety Inventory (STAI) (Spielberger *et al*. 1988) was used to measure this variable. In the face of a novel situation, such as the possibility of being required to operate with new technology and experiencing uncertainty as to one's knowledge and ability to do so, anxiety is likely to be much more pronounced: defined in greater demands—recycling, acquiring new skills and knowledge—, which the worker does not want (Dohrenwend and Dohrenwend 1981). References regarding the suitable reliability and validity of these two scales can be found in the study by Barrio *et al*. (1986).

State anxiety is conceived as a transitory emotional state of the organism characterized by consciously perceived subjective sentiments of tension and apprehension, as well as by hyperactivity of the autonomous nervous system. It can vary over time and fluctuate in intensity. This scale comprises 20 items in Likert format (0: none, 1: some, 2: a fair amount, 3: a lot) through which the subject describes how he/she feels at a particular moment. The scale has a reliability of 0.62 (M = 22.19, SD = 6.18); the mean of the items was 1.11 and the deviation 0.88.

Trait anxiety indicates a relatively stable propensity to anxiety, as a result of which the subjects differ in their tendency to perceive situations as threatening and, consequently, raise their state anxiety. The individual indicates how he generally feels. This variable was measured with a set of 20 items in which the individual had to give the frequency with which he experienced each aspect, using the following reply pattern: hardly ever (0); sometimes (1); often (2); almost always (3). The mean of the scale was 21.53 and the standard deviation 9.62.

4.2.4. *Perception of technology*: This refers to the extent to which the employees perceive advanced manufacturing technology as a cause of an increase in

unemployment and of job insecurity, by believing that technological change is associated with a loss of skills and job opportunities, i.e. this refers to technological change as a threat to work stability perceived by the workers. To measure this variable we used the Perception of New Technology Scale recorder by Chao and Kozlowski (1986) comprising 10 sentences on a Likert-type scale graded from 1 to 5 (from strong agreement to strong disagreement). Low scores indicate that the workers perceive technology as a cause of job insecurity. Cronbach's alpha was 0.76 (M = 24,31, SD = 6.63), the mean of the items was 2.43 and the deviation 1.38.

4.3. *Procedure*

The data were collected directly in the firm through a self-report in accordance with the following two phases:

- the researchers requested the support of the management and the works committee in order to guarantee that as many people as possible answer the questionnaire.
- before handing out the questionnaire the researcher explained the purpose, the aims of the study and how to answer. They were also informed that the questionnaires had to be completed and handed in within a month.

These explanations were given during working hours to groups of 15–20 employees. They were subsequently given the questionnaires and a letter briefly explaining the basic reasons for their collaboration, thanking them for it, and reminding them that all information given would be confidential and used appropriately. Treatment and information given to the subjects was in accordance with the rules established by the code of ethics of the APA (1992).

The completed questionnaires were handed in to the works committee and those responsible for training in the two departments. The questionnaire had two parts. The first covered sociodemographic and work data on the worker: age (graded in categories younger to older), studies (graded from basic to higher), as well as which department he/she belonged to (Engine-1: where AMT was firmly established, or, Engine-2: where mechanical technology was predominant and new technology was beginning to be introduced), occupational category within the firm (graded from the lowest position - specialist – to the highest – craftsman) and the line type, which refers to one of the two types of technology used directly by the worker (automated or microelectronic technology and mechanical technology). The second part gave the items of measurement for the variables specified in the previous section.

4.4. *Statistical analyses*

To test our first hypothesis, one-way analyses of variance were performed, since the distribution of the variable approaches normality and the assumption of homegeneity of variance is fulfilled. Scheffé tests were carried out *a posteriori* in order to determine the differences between the groups. Additional analyses (chi-square test) were performed to examine the association effect between the socio-demographic and work variables. One-way analyses of variance were also performed to find out whether the means of the factors of psychological well-being varied with socio-demographic and work aspects.

To test the second hypothesis, we used the multivariate analysis of variance (MANOVA), a procedure which enables us to take into account the interrelation among the dependent variables, when correlated, and which gives us information on the omnibus and univariate relation between technological perception and psychological well-being.

5. Results

After examining the concomitant effect of socio-demographic and work variables given in table 1, an association was found between age and studies in the sense that the older workers were those with the lowest

Table 1. Chi-square test of association within and between socio-demographic and work variables.

Variable	Age	Studies	Department	Category
Age	—			
Studies	32.43*(20)	—		
Department	1.53 (4)	3.20 (5)	—	
Category	31.39**(12)	73.44**(15)	10.58*(3)	—
Line type	2.59 (4)	6.24 (5)	45.31**(1)	20.29**(3)

Note: Degree of liberty in parenthesis. *$p = 0.05$ **$p = 0.001$.

level of studies. These differences were found on comparing the distribution of percentages between workers belonging to the 41 – 45 age group and to the 46 – 50 age group. For example, 66.7% of those aged 41 – 45 had three years of university studies as opposed to 33.3% of those aged 46 – 50.

Occupational category was the variable most related to the others. Thus, a relation was found between age and occupational category: 56% of those aged 46 – 50 were craftsmen whereas only 12% of those aged 41 – 45 were craftsmen. In the latter age group 51.1% were specialists versus 23.4% in the 46 – 50 age group. The occupational category also showed a significant association with the worker's level of studies. Hence, those with primary studies were more likely to belong to the categories of specialist (60%) and 2nd Officer (31.8%) than those with first level vocational training, who belonged to the category of 1st Officer (46.2%) and those of second level vocational training who belonged to the category of craftsmen (44%). It was also associated with the type of department, there being a predominance of 2nd Officers (77.3%), specialists (74.5%) and craftsmen (68%) in the department where new technology had been introduced, whereas there was a predominance of 1st officers (57.7%) in the department with traditional technology. Occupational category was found to be related to the type of technology used. In the case of the automated line, there was a greater percentage of craftsmen (88%), 2nd Officers (72.7%) and specialists (61.7%), whereas in the mechanical technology line there were more 1st Officers (69.2%).

The type of department was related to the type of technology used. The workers in the department using new technology were those that used a type of automated technology (82.2% as opposed to 23.4%) and those that were in the department that had not introduced new technology were those following procedures of mechanical production (76.6% as opposed to 17.8%).

After examining the concomitant effects between the variables, the next step was to analyse the relation between the perception of technology and the socio-demographic and work factors. The results shown in table 2 clearly indicate that the perception of technology as a factor of threat to work security is not significant in relation to workers' ages. However, as can be observed, formal training of workers, the type of department in which they work, their professional category and the type of technology used influenced how workers perceive the direct relation between the introduction of new technologies and job insecurity.

Table 2. Variance analysis of the perception of technology according to socio-demographic and work variables.

Factor	Group	*n*	*M*	*SD*	*F*	*gl*	*p*
Socio-demographic							
Age					1.29	4.145	0.275
	< 30	2	2.83	0.82			
	36–40	24	2.52	0.78			
	41–45	51	2.52	0.61			
	46–50	48	2.59	0.67			
	51–55	21	2.21	0.62			
Studies					6.68	5.144	0.000
	No studies	8	2.10	0.53			
	Elementary	50	2.20	0.60			
	Vocational 1	25	2.70	0.63			
	Vocational 2	21	2.98	0.62			
	High school	35	2.55	0.62			
	3 year Univ	6	2.73	0.72			
Work							
Department					8.71	1.146	0.003
	Engine- 1	100	2.60	0.69			
	Engine- 2	47	2.26	0.57			
Category					7.27	3.140	0.000
	Specialist	47	2.20	0.59			
	1st officer	44	2.58	0.71			
	2nd officer	25	2.44	0.53			
	Craftsman	25	2.90	0.60			
Line type					7.24	1.146	0.007
	Mechanical	53	2.30	0.64			
	Automated	94	2.61	0.66			

More specifically, workers without studies or with only an elementary education perceived new technology as posing a greater threat to job security than did those workers with a higher education. Identically, workers belonging to the more automated department perceived a lesser degree of threat to job security than those workers belonging to the department that was still undergoing its initial stage of automation (see table 2 for means).

With regard to work category, results showed that people who held positions of lower professional level (specialists) had a more negative perception of the introduction of technology in their work place than did those who held positions of higher levels of qualification (craftsman). Lastly, workers who used non-computerized technology (mechanics) considered the introduction of new technology to be more threatening than did those workers who employed a computer-based technology.

As to the psychological well-being of the workers and its effects concomitant with socio-demographic and work variables, the one-way analyses performed, the results of which can be seen in table 3, show only one significant relation between occupational category and trait anxiety. The *a posteriori* means difference test carried out established, a significant difference, the fact that specialist workers felt greater anxiety ($M = 1.2$) than 2[a] Officers ($M = 0.92$).

In agreement with the last hypothesis posed, the analysis of the correlations of the variables of well-being and their relation to the perception of technology reveal that, on the one hand, there is a significant relation between the measures of psychological well-being, stressing the fact that the workers with greater trait anxiety also have greater state anxiety, and that in both cases these variables are significantly related to depression (see table 4). On the other hand, the less threat the workers perceive from the introduction of new technology the less trait anxiety they experience.

Corroboration of the hypothesis that critical perception of the effects of technological change on job security could be negatively affecting the psychological well-being of the workers is shown the MANOVA carried out. The omnibus test shows the existence of a significant association between the psychological well-being construct and perception of technology (Hotellings: F (4, 124) = 0.17, $p = 0.00$), the multivariate effect size being 0.15, hence the perception of technology accounts for 15% of the psychological well-being experienced by the employees. The univariate regression analyses shown in table 5 corroborate that perception of the threat of technology has a strong influence on workers' strongly influences all well-being indicators except for stress level. The greatest impact of the perception of technology can be seen in the workers' experiencing of trait-anxiety, as was revealed on examination of the correlation between the variables.

Table 3. Variance analysis of the socio-demographic, work and psychological well-being variables.

	Anx. trait		Anx. state		Stress		Depression	
Factor	*F*	*gl*	*F*	*gl*	*F*	*gl*	*F*	*gl*
Socio-demographic								
Age	1.21	4,141	0.52	4,142	0.48	4,125	0.69	4,142
Studies	2.06	5,139	1.10	5,140	0.14	5,123	0.76	5,140
Work								
Department	0.00	1,145	0.22	1,146	0.00	1,129	0.03	1,146
Category	3.03*	3,137	1.84	3,138	0.88	3,122	1.44	3,138
Line type	1.30	1,145	0.02	1,146	0.00	1,129	0.24	1,146

*$p < 0.05$.

Table 4. Correlations between perception of technology and psychological well-being variables.

Variable	1	2	3	4	5
1. Tech. perception	—				
2. State anxiety	−0.18*	—			
3. Trait anxiety	−0.31**	0.67**	—		
4. Stress	0.02	0.17	0.30**	—	
5. Depression	−0.18*	0.49**	0.52**	0.20*	—

*$p < 0.05$ **$p < 0.001$.

Table 5. Univariate regression between perception of technology and psychological well-being variables (df: 1, 127).

Variable	Beta	Sq. mul. R	Adj R-sq.	F	p
State anxiety	—0.24	0.06	0.05	7.89	0.00
Trait anxiety	—0.36	0.13	0.12	19.09	0.00
Stress	—0.02	0.00	0.00	0.05	0.82
Depression	—0.24	0.06	0.05	7.67	0.00

6. Discussion

The results of this study support the assumption defended in our research on the importance of what we call 'process of technological change'. This means that the introduction of new technologies cannot be understood from a deterministic view as homogeneous and standardizing consequences and effects, but rather as a dynamic and variable process, as can be seen from the results relating to the first hypothesis.

In the light of these results, it can be concluded that the images formed of technology and the attitudes towards it encompass many dimensions. Outstanding among these is the perception of threat for job security from technological change, which seems to be very influenced by personal and situational characteristics. This largely confirms the line of studies attributing great importance to contextual and psychosocial factors for the understanding of employees' reactions (Markus and Robey 1988, Marquie 1994, Clegg and Frese 1996, Carayon 1997). More precisely, the results indicate that it is particularly those workers (some of whom are young workers) whose occupational category and level of studies are lowest and who belong to the least automated department who experience most intensely the perception of technology as a threat to their job security. In short, these results could be interpreted from the following perspective: the different levels of status/social position, training and experience or competence acquired by having worked with new technology influence differently the type of beliefs developed by the workers regarding the effects of technological change within the organization.

The fact that in our study we did not find any significant relation between age and the perception of technology, leads us to think that age, as a biological factor, hardly explains in itself the perception of, and attitude towards, technology. The concomitant effects existing between age and both occupational category and studies makes us think that the critical perception of technology is a problem of socially constructed mentality rather than a problem of a biological nature.

Our interpretations are strengthened by the results referring to the second hypothesis. We think that the influence of the perception of technology on the variables of psychological welfare could be explained by the importance of the workers' beliefs concerning the consequences that technological change will have in their lives and personal expectations—career development, job stability—and how these beliefs and perceptions are highly conditioned by social-labour factors. We believe that negative perceptions of the effects of technology could be linked to the low level of self-efficacy or perceived control over the technology experienced by the worker which together with the exclusion policies applied by the management would be altering the levels of psychological welfare of those workers with less social support: workers with low status – the specialists in our study – with little or no experience in working with new technology and who have a low level of studies. These groups of workers would be more vulnerable emotionally as a consequence of being more likely to develop negative beliefs and having a lower technological self-efficacy since they do not feel capable of coping with technical changes, as the results of other studies have suggested (Henry and Stone 1995, Korunka *et al.* 1995).

In our opinion the non-confirmation of the relation between critical perception of technology and the stress variable in our study may be due to the fact that this factor was measured by the General Stress Inventory scale, which refers to critical episodes over a person's entire life, which can hardly be affected or influenced by critical perceptions of technology.

From a practical standpoint, the results obtained suggest how important and necessary it is to offer training and information to workers when new technology is to be introduced, with a view both to their successfully coping with the transformation of their jobs and to creating an appropriate work atmosphere. If we observe the strategies used by organizations, we see that this training, when it is provided, is given immediately prior to technological implantation and is selective, being offered only to upper and middle management members, excluding precisely those work groups that most need it, that is, production line workers with lower levels of professional qualification, of lower professional category and with less training. These employees frequently acquire the meaning, nature and technical comprehension of technology through the specific instructions and information they receive from their technical superiors, a situation which, consequently, leads to uncertainty and disorientation as to the scope of technology and its effects on job security and professional expectations.

However, practical solutions are not the only objectives to be sought. The results obtained in this study must also contribute to encouraging further

research on the triangle formed by technology, job security, and well-being. We must concern ourselves not only with the planning of technological innovation but also with carrying out research on the development of cognitive strategies and skills that workers can employ to help cope with new technology and attenuate anxiety and tension, all of which, in the last analysis, should favour the worker's participation and achieve greater effectiveness of technological change (Boonstra and Vink 1996).

Finally, we would like to discuss the potential impact that some limitations may cause in the data and conclusions derived from this study. As regards the research design, it is important to bear in mind that we are dealing here with a correlational, cross-sectional method. One of the drawbacks of this method is the impossibility of establishing causal effects between the perception of the threat of new technology and the well-being of the employees since it is diffiuclt to control variables that may be intervening in and determining this relation.

Another limitation refers to the number of workers who answered the self-report. Despite being representative of the population, the answer rate might be considered to be low and there may have been a self-selection effect that could have affected the results and conclusion of the research. For example, it might be thought that the lack of differences between the department and the health and well-being variables might have been due to the fact that only those subjects with greater well-being answered the questionnaire.

Moreover, only one organization participated in the study and this organization had very particular characteristics such as being a multinational that, a year before, had offered a social plan negotiated with the unions guaranteeing voluntary early retirement for older employees, as well as the management's commitment to apply a policy to offer massive training courses for the workers in both departments. This shows the difficulty there is and the care that must be taken when extrapolating the conclusions here to other types of organizations.

Another limitation was that in both departments there was a certain mixture of new and old technology (automated and mechanical). That is, although the Engine-1 department was characterized by the predominance of automated production lines, there was still some mechanical production. Likewise, in Engine-2 department, although mechanical production lines were still predominant, automated production was beginning to be introduced. This may have caused some bias in some of the results.

Despite these limitations that characterized the correlational designs we think that this study will help us to better understand that the introduction of new technologies does not respond to unforeseeable forces but rather to potentially controllable factors and processes that may enable us to avoid the undesired effects of technological change.

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References

Agut, S., 1995, Incidencia de las nuevas tecnologías en el empleo y la formación de las mujeres. In L. González., A de la Torre and J. de Elena (eds), *Psicologia del trabajo y de las oganizaciones. Gestión de recursos humanos y nuevas tecnologias* (Madrid: Eudema), 737–748.

Argote, L., 1983, The human side of robotics: how workers react to a robot. *Sloan Management Review*, **24,** 31–41.

Aronsson, G., Dallner, M. and Aborg, C., 1994, Winners and losers from computerization: a study of the psychosocial work conditions and health of Swedish state employees. *International Journal of Human–Computer Interaction*, **6,** 17–36.

Beck, T., 1983, *Terapia cognitiva de la depresión* (Bilbao: Desclée de Brouwer).

Birdi, K. and Zapf, B., 1997, Age differences in reactions to errors in computer based work. *Behaviour and Information Technology*, **16,** 309–319.

Boonstra, J. and Vink, M., 1996, Technological and organizational innovation: A dilemma of fundamental change and participation. *European Journal of Work and Organizational Psychology*, **5,** 351–375.

Braverman, H., 1974, *Trabajo y capital monopolista. La degradación del trabajo en el siglo XX* (México: Nuestro Tiempo).

Breakwell, G. M. and Fife-Schaw, C. H., 1988, Ageing and the impact of new technology. *Social Behavior*, **3,** 396–424.

Buchanan, D. and Boddy, D., 1984, Skills, motivation and interdependencies: the effective use of new computing technology. *Journal of Organizational Behavior Management*, **6,** 99–107.

Burnes, B. and Fitter, M., 1987, Control of advanced manufacturing technology: supervision without supervisors? In T. Wall., C. Clegg., and N. Kemp (eds), *The Human Side of Advanced Manufacturing Technology* (Chichester: Wiley), 83–100.

Carayon, P., 1995, Work pressure as a determinant of job stress and cumulative trauma disorders en automated offices. In *Proceedings of PREMUS'95-Second International Science Conference on Prevention of Work-Related Musculoskeletal Disorders*, Montreal, Canada.

Carayon, P., 1997, Temporal issues of quality of working life and stress in human-computer interaction. *International Journal of Human–Computer Interaction*, **9,** 325–342.

Carayon, P., Haims, M. C. and Lim, S. Y., 1996, Longitudinal study of ergonomic and psychosocial work stressors and musculoskeletal discomfort among computer users. In O. J. Brown and H. W. Hendricks (eds), *Human Factors in Organizational Design and Management* (Amsterdam: Elsevier), 273–278.

Castells, M., 1986, *Nuevas tecnologías, economía y sociedad* (Madrid: Alianza).

Castells, M., 1989, *Transición tecnológica, política económica y política social: Escenarios y opciones* (Madrid: Universidad Autónoma).

Castells, M., 1997, *La sociedad red* (Madrid: Alianza).

Chao, G. and Kozlowski, S., 1986, Employee perceptions of the implementation of robotic manufacturing technologies. *Journal of Applied Psychology*, **71,** 70–76.

Child, J. and Loveridge, R., 1990, *Information Technology in European Service: Towards a Micro-electronic Future* (Oxford: Basil Blackwell).

Clegg, C. and Frese, M., 1996, Integrating organizational and cognitive approaches towards computer-based systems. *Behaviour and Information Technology*, **15,** 203–204.

Conde, V. and Franch Valverde, J., 1984, Escalas de evaluación contractual para la cuantificación de la sintomatología psicopatológica en los trastornos ansiosos y depresivos. In D. González (ed.), *Salud mental y factores psicosociales* (Madrid: Fundamentos), 181–213.

De La Torre, A. and Conde, J., 1997, Cambio tecnológico: factores críticos y preventivos en el comportamiento laboral. *Revista de Psicología del Trabajo y de las Organizaciones*, **13,** 51–64.

Dohrenwend, B. P. and Dohrenwend, B. S., 1981, Socio-environmental factors, stress and psychopathology. *American Journal of Community Psychology*, **9,** 128–164.

Eason, K., Harker, S. and Olphert, W., 1996, Representing socio-technical systems options in the development of new forms of work organization. *European Journal of Work and Organizational Psychology*, **5,** 399–420.

Ettlie, J. E. and Rubenstein, A. H., 1980, Social learning theory and the implementation of production innovation. *Decision Sciences*, **11,** 648–668.

Fariña, F. and Arce, R., 1993, *Ansiedad ante los ordenadores* (Madrid: Eudema).

Fernández, E., 1990, *El nuevo marco socio-industrial del siglo XXI* (Madrid: Narcea).

European Foundation for the Improvement of Life and Labour Conditions, 19911, Automatización de oficina: Una revolución técnica y sus efectos. *Capital Humano*, **37,** 43–58.

Gardner, E., Young, P. and Ruth, S., 1989, Evolution of attitudes toward computers: a retrospective view. *Behaviour & Information Technology*, **8,** 89–98.

Greenhalgh, L. and Jick, T., 1989, Survivor sense making and reactions to organizational decline: the effects of individual differences. *Management Communication Quarterly*, **2,** 305–329.

Gordon, R. and Kimbal, L., 1985, *High Technology, Employment and the Challenges to Education* (Santa Cruz, CA: Silicon Research Group).

Hammer, M. and Champy, J., 1993, *Reengineering the Corporation: a Manifesto for Business Revolution* (New York: Harper).

Heaney, C. A., Israel, B. A. and House, J. S., 1994, Chronic job insecurity among automobile workers: effects on job satisfaction and health. *Social Science Medicine*, **38,** 1431–1437.

Henry J. and Stone, R., 1995, A structural equation model of job performance using a computer-based order entry system. *Behaviour & Information Technology*, **14,** 163–173.

Hirschhorn, L., 1988, *La superación de la mecanización* (Madrid: Ministerio de Trabajo y Seguridad Social).

Hotz-Hart, B., 1993, Investigación comparada y nuevas tecnologías: La modernización en tres sistemas de relaciones industriales. In R. Hyman and W. Streeck (eds), *Nuevas tecnologías y relaciones industriales* (Madrid: Ministerio de Trabajo y Seguridad Social), 83–98.

Hyer, N. and Wemmerlov, U., 1984, Group technology and productivity. *Harvard Business Review*, **62,** 140–149.

Isla Diaz, M. R. and Diaz Cabrera, D., 1993, Actitudes y opiniones sobre las nuevas tecnologías y procedimiento de introducción en la organización. In L. Munduate (ed.), *Gestión de recursos Humanos y Calidad de Vida Laboral* (Madrid: Eudema), 89–99.

Jacobson, D., 1987, A personality study of the job insecurity experience. *Social Behavior*, **2,** 143–155.

Jacobson, D., 1991, The conceptual approach to job insecurity. In J. Harthley., D. Jacobson., B. Klandermans and T. Van Vuuren (eds), *Job Insecurity: Coping with Jobs at Risk* (London: Sage Publications), 23–29.

Jaevenpaeae, F., 1997, Implementation of office automation and its effects on job characteristics and strain in a district court. *International Journal of Human–Computer Interaction*, **9,** 425–442.

Kaplinsky, E., 1988, *Microelectrónica y empleo* (Madrid: Ministerio de Trabajo y Seguridad Social).

Kaplinsky, E., 1989, *Efectos de la microelectrónica en el empleo* (Madrid: Universidad Autónoma).

Kern, H. and Schumann, M., 1987, Hacia una reprofesionalización del trabajo industrial. *Sociología del Trabajo*, **1,** 11–21.

Kern, H. and Schumann, M., 1988, *El fin de la división del trabajo. Racionalización en la producción industrial* (Madrid: Ministerio de Trabajo y Seguridad Social).

Korunka, C., Weiss, A., Huemer, K. H. and Karetta, B., 1995, The effect of new technologies on job satisfaction and psychosomatic complaints. *Applied Psychology: an International Review*, **44,** 123–142.

Korunka, C., Weiss A. and Karetta, B., 1996, Effects of new technologies with special regard for the implementation process per se. *Journal of Organizational Behavior*, **14,** 331–348.

Korunka, C., Zauchner, S. and Weis, A., 1997, New information technologies, job profiles, and external workload as predictors of subjectively experienced stress and dissatisfaction at work. *International Journal of Human–Computer Interaction*, **9,** 407–424.

Lim, V., 1996, Job insecurity and its outcomes: moderating effects of work-based and nonwork-based social support. *Human Relations*, **49,** 171–194.

Markus, M. L. and Robey, D., 1988, Information technology and organizational change: causal structure in theory and research. *Management Science*, **34,** 583–597.

Marquie, C., 1994, Age influence on attitudes of office workers faced with new computerized technologies: a questionnaire analysis. *Applied Ergonomics*, **25,** 130–142.

Myers, D., 1995, *Psicología Social* (Mexico: McGraw-Hill).

OIT, 1987, *Automatización, Organizacion y tensión en el trabajo* (Madrid: Ministerio de Trabajo y Seguridad Social).

Ozaki, M., 1983, Cambios tecnológicos y relaciones laborales. Un examen general internacional. In M. Ozaki (ed.) *Cambios tecnológicos y relaciones laborales* (Madrid: Ministerio de Trabajo y Seguridad Social).

Peiró, J. M., 1992, *Desencadenantes del estrés laboral* (Madrid: Eudema).

Report FAST, 1987, *Europa 1995. Nuevas tecnologías y cambio social* (Madrid: Fundesco).

Rifkin, J., 1996, *El fin del trabajo* (Buenos Aires: Paidós).

Rodríguez Marín, J., 1995, *Psicología Social de la Salud* (Madrid: Síntesis).

Rosanvallon, A., 1987, Los sistemas flexibles de fabricación y la organización del trabajo. *Sociología del Trabajo*, **1,** 65–88.

Rumberger, R. and Levine, H., 1984, *Forecasting the Impact of New Technologies on the Future Job Market* (Stanford, CA: Stanford University Press).

Scheier, M. and Carver, C., 1992, Effects of optimism on psychological and physical well-being: theoretical overview and empirical up-date. *Cognitive Therapy and Research*, **43,** 221–246.

Seppaelae, P., 1995, Experiences on computerization in different occupational groups. *International Journal of Human–Computer Interaction*, **7,** 315–327.

Slem, C. M., 1986, The effects of technological change on the psychosocial characteristics of organizations. In O. Brown and H. W. Hendrick (eds) *Human Factors in Organizational Design and Management* (Amsterdam: North-Holland/Elsevier Science), 567–579.

Spielberg, I., Gorsuch, P. and Lushene, M., 1988, *Cuestionario de Ansiedad Estado-Rasgo* (Madrid: TEA).

Tezanos F. and Santos, A., 1987, *Los trabajadores industriales ante las nuevas tecnologías* (Madrid: Centro de Investigaciones Sociológicas).

Toffler, A., 1988, *El shock del futuro* (Barcelona: Plaza y Janès).

Wall, T. and Clegg, D., 1987, Advanced manufacturing technology and work simplification: an empirical study. *Journal of Occupational Behaviour*, **8,** 233–250.

Wastell, D. and Cooper, C., 1996, Stress and technological innovation: a comparative study of design practices and implementation strategies. *European Journal of Work and Organizational Psychology*, **5,** 377–397.

Zuboff, S., 1988, *In the Age of the Smart Machine. The Future of Work and Power* (Oxford: Heinemann).