Age influence on attitudes of office workers faced with new computerized technologies

A questionnaire analysis

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The study of Bué and Gollac (1988) provided evidence that a significantly lower proportion of workers aged 45 years and over make use of computer technology compared with younger ones. The aim of the present survey was to explain this fact by a more intensive analysis of the older workers' attitude with respect to the computerization of work situations in relation to other individual and organizational factors. Six hundred and twenty office workers from 18 to 70 years old, either users or non-users of computerized devices, were asked to complete a questionnaire. The questions allowed the assessment of various aspects of the workers' current situation, such as the computer training they had received, the degree of consultation they were subjected to during the computerization process, their representation of the effects of these new technologies on working conditions and employment, the rate of use of new technologies outside the work context, and the perceived usefulness of computers for their own work. The analysis of the questionnaire revealed that as long as the step towards using computer tools, even minimally, has not been taken, then attitudes with respect to computerization are on the whole not very positive and are a source of anxiety for many workers. Age, and even more, seniority in the department, increase such negative representations. The effects of age and seniority were also found among users, as well as the effects of other factors such as qualification, education level, type and rate of computer use, and size of the firm. For the older workers, the expectation of less positive consequences for their career, or even the fear that computerization might be accompanied by threats to their own employment and the less clear knowledge of how computers operate, appeared to account for a significant part of the observed age and seniority differences in attitudes. Although the difference in the amount of computer training between age groups was smaller than expected, the study revealed that one third of the users never received any specific training, and that many of those who benefited from it were trained for only a few days. Consultation of the staff during the computerization process also appeared to be poor, to apply mostly to the best trained and qualified workers, and to be more highly developed in small companies. The results are discussed in the light of more qualitative data recorded during the survey. They suggest the need to increase information, training and involvement of all personnel from the very first stages of computerization (or other technical changes) in order to lessen fears and the feeling of disruption, which are particularly obvious among the oldest workers.

Rapid and profound changes, particularly computerization, affect work methods in professional situations. They require many people to adapt their skills and practices to a greater or lesser extent, and have consequences on the nature and conditions of work, sometimes even on the employment of personnel. Depending on the individual and his or her situation, these changes may be more or less well assimilated, but they most often constitute a critical phase involving the risk of failure. Among populations the most exposed to

this risk are older workers, who are often perceived as a population less capable of undertaking and succeeding in such transformations.

The problem appears clearly in studies by the National Institute of Statistics and Economic Studies performed in France on 20 000 people (Bué and Gollac, 1988; Cezard *et al*, 1992). The studies revealed a clear under-representation of workers aged 45 and over in the use of computers, and in approximately equal proportions for male and female. The same phenomenon was reported by Huuhtanen (1988).

The present work is an attempt to explain this phenomenon. What are the specific difficulties that the oldest workers might encounter when confronted with such technological changes in their familiar work environment? Why do new computerized technologies lead to the marginalization of some worker categories, particular older ones (Marquié and Gollac, 1988)? The reply to these questions is crucial at a time when computer processing has invaded all sectors of professional and private life, especially if one accepts that the explanations expressed in terms of generation effects do not satisfactorily account for the whole phenomenon.

Rather than too quickly dismissing this phenomenon as transient and due to a pivotal generation being poorly prepared to deal with switching from an older system of work towards a radically new system, it seems preferable to focus on what could be the more lasting aspects of this phenomenon. Such more lasting aspects would be due to the rapidity of changes that establish themselves as a continuing phenomenon and which consequently risk introducing differences between the successive phases of computerization that are as great as the recognized differences between traditional and computerized workstations.

A more intensive survey than that of Bué and Gollac (1988) was designed to shed light on the problem. By exploring certain objective and subjective aspects of the workers' situation in their professional context and in particular with respect to computerized work, it is possible to reveal certain factors that play an important role in the possible difficulties faced by the older workers when confronted with the introduction of new computer technologies in their work environment.

Motivation and resistance to change as an explanation of why the older workers are less inclined to adopt new working techniques should only be conceived as being factors within a more extensive causal process. In situations as complex as professional ones, where economic, social, technical and psychological factors are closely intertwined, it would be insufficient and not very fruitful to limit the explanation for this phenomenon to individuals as isolated factors, and even more so to a single motivational aspect, as it is always the result of a multiple process. This is why, while also taking this aspect into account, some other hypothetical reasons likely to account for this fact were also investigated. Seven hypothetical factors were explored in the present study:

(1) *work conditions*, i.e. the opinions that employees have of the consequences of computerization on working conditions. Each worker has formed a certain idea of this subject from observing his/her own environment, the media and his/her own practice. Such representations may reflect both objective problems posed by computer tools and the relative importance attached to them by workers.

(2) *socioprofessional consequences*, i.e. the opinions that they have of the consequences of computerization on employment, salary, qualification and peer recognition. On this point as well, representations of old workers may differ from those of young workers, as they are not at the same point of promotion in their careers and do not therefore have the same motivations; they are more likely to be in a dead-end situation in which further promotion is improbable. Moreover, new technologies are often associated with job restructuring; it may be that the older workers feel more threatened than young workers in this respect, and that they perceive any event likely to affect them in this way with more anxiety (McAuley, 1977).

(3) *age effects* on some professional skills and on the ability to adapt to changes in their jobs. Whether the stereotypes about older workers are valid or not, it is probable that they nevertheless have an effect on the behaviour of the managers and employees themselves. Of particular interest for the present work is the question of how people perceive the effect of age on certain general professional qualities, and also how it affects their capacity to adapt to changes occurring in their professional activity.

(4) *usefulness and interest*, i.e. the operators' perception of the usefulness of computer tools for their own work and the interest that they express in these tools. This strongly depends on the place assigned to operators in the work-transformation process, and on the benefits and costs that they may expect from these changes.

(5) *the effective use in a non-professional area of other new technologies*. When asking subjects to evaluate their use of fairly recent technologies that were readily available in their environment, the work tried to determine whether the relative non-involvement of the older workers with computer tools, as observed in the professional area, corresponds to a more general attitude with respect to new technologies.

(6) *consultation*, i.e. the extent to which operators were consulted and allowed to participate in the computerization process. Any technical or organizational change that is likely to have a significant effect on an operator's daily activity will cause the latter understandable anxiety. But if employees are kept fully informed and are widely consulted about decisions concerning them, then they are more likely to be reassured and to put up less resistance to these changes. This in turn will create the most favourable conditions for all the changes envisaged. This is particularly true for the older workers, who generally identify more closely with their department or company.

(7) *retraining*, i.e. the training that they underwent for computer tools and whether the training met their needs. The important question here is whether

retraining is as available for older employees as it is for younger individuals. Rosen and Jerdee's results (1976) suggest that there is discrimination with respect to older employees when choosing people for retraining to prepare for technological changes. Moreover, it is possible that other factors discourage older people from accepting retraining, such as the fear of finding themselves, in retraining situations, in competition with younger people whom they consider to be more competent than themselves, or of experiencing pedagogical methods ill-suited for adults (Belbin and Belbin, 1980).

Such hypothetical factors are not separate from each other, but are likely to play a complementary role in attitudes that develop with respect to computer work, especially in the older workers.

Methodology

Subjects

The field of investigation was limited to office personnel. The study sample consisted of 620 workers of various ages (from 18 to 70 years old), of both sexes, who either used or did not use computerized devices in their work. The subjects questioned all worked for companies in the Midi-Pyrenées region and in particular the urban area of Toulouse. The sample was drawn from 84 companies divided into two categories: those with less than 50 workers ($n = 61$) and those with more than 50 ($n = 23$). Ten of the latter were companies with greater than 500 employees. A more detailed description of the sample is provided below.

Method

A list of questions was submitted to each subject. A preliminary investigation of 60 office workers made it possible to check for the relevance and clarity of the questions.

The questions were of two types, corresponding respectively to information related to the subject or his/her professional context, and to his/her attitudes with respect to professional computer use. The questionnaires were completed individually, wth the aid of a research assistant, and anonymity was guaranteed. The time necessary to complete a questionnaire was between an half an hour and one hour.

Characterization of subjects and their working context. Subjects were asked for their age, number of years of schooling, number of years of service in the department, qualification, the type of work they most frequently do with computer devices in their job, and their rate of use of these devices in the professional context. People who only used the minitel in its most basic way, i.e. as an electronic directory, were not counted as users. Working context was characterized by the number of employees in the company.

Characterization of subjects' attitudes with respect to computer use. Most of the questions were of the multiple-choice kind, but the subjects were also invited to make more elaborate verbal remarks, which were

recorded and used in order to shed light on the interpretation of quantitative analysis. Likewise, 50 department heads were interviewed in order to get information on the point of view of those initiating changes involving office computer devices. Most of them were drawn from the same companies as those that were sampled.

This part of the questionnaire consisted of two kinds of question, the first one concerning all the subjects, the second concerning only computer users.

The questions put to all the subjects, either users or non-users of computer tools for work purposes, were related to five categories of question: the *usefulness* of these tools and the degree of interest in them (UI), the *consequences* of computerization on working conditions (WC), the socioprofessional consequences (SPC), the effects of *age* on certain professional qualities (AE), and the use of other *new technologies*, not specifically for professional purposes (LPT) (see Appendix 1).

For this first set of questions synthetic processing (global analysis of replies to each of the question categories) was used, as well as, where necessary, analysis of replies given to individual questions. For each of the five categories of question, a synthetic score was built on the form of a quantitative scale from 0 to 100 on the basis of answers to several selected questions or subquestions belonging to this category.

Synthetic scores were computed in such a way that a favourable situation with respect to each of these aspects would result in higher synthetic scores, and an unfavourable situation in lower synthetic scores. For instance, subjects who thought that computers improved the working conditions or increased their chances of a better work situation, or that age resulted in an increase in the professional qualities described above, should have higher scores than those whose opinions were more reserved or who had a frankly negative opinion of these different aspects. The means of all these synthetic scores (MSS) also provided, for a particular group of subjects, an overall image of their objective and subjective situations with respect to these various aspects. These variables were divided into three or four categories (or modalities) in such a way that the number of subjects was roughly identical in each category for a given variable (see Table 1 for details).

The other type of question dealt with the *training* received and with *consultation*. These questions were only posed to the user subset ($n = 493$). Replies to the individual questions were analysed. Four questions were asked to determine whether ('yes' or 'no') workers (only word-processing and computer users) had the feeling of having been consulted to a greater or lesser extent when these tools were introduced into their present or previous working environment. Three questions referred to 'the decision to computerize', 'the choice of equipment' (type of machines and software), and the 'choice of site for installation'. A fourth question asked was whether subjects who had been consulted to any extent thought that their opinion had been taken into account.

With respect to training, the workers were asked to give the total number of training days received in basic training and in ongoing training, particularly concern-

Table 1 Explanation of synthetic variables

Symbols	Modalities (synthetic score classs)	Meaning
UI	1 ≤ 50 2 = 51–75 3 > 75	Usefulness and interest
WC	1 ≤ 25 2 = 26–50 3 = 51–75 4 > 75	Working conditions
SPC	1 ≤ 25 2 = 26–50 3 = 51–75 4 > 75	Socioprofessional consequences
AE	1 ≤ 25 2 = 26–50 3 = 51–75 4 > 75	Age effects
LPT	1 ≤ 25 2 = 26–50 3 = 51–75 4 > 75	Less professional-specific technologies
MSS	1 ≤ 40 2 = 41–50 3 = 51–60 4 > 60	Mean synthetic scores

ing the learning of word processing, introduction to computers, the apprenticeship of different software packages, of computer-based services and of programming. In spite of the unquestionable memory effort required of some of them, this estimation appeared to be fairly easy for most of the people questioned and seems to be reliable.

The people surveyed were then asked to say whether the training they had received appeared to them to be quantitatively sufficient in relation to their needs, and if they thought it to be well suited (quality). On the basis of the preliminary questionnaire, which had revealed this criticism as being widely held, those who were dissatisfied with the quality of the training received were also asked to say whether, according to them, this was due to the fact that the training was 'too theoretical'.

A final question put to subjects, whether or not they had already received computer training, was whether they wished to increase their skills through further training if this were to be possible.

Results

Description of the sample

As shown in Table 2, and as expected in office work situations, females were more represented in the sample than males. For 80% of the users of computer tools, the computer was the tool most often used, and 88% of the people in the sample using word processing did so on a computer.

As age is a crucial variable in this study, and as it is useful when interpreting the results to know how the three age groups are distributed within the different classes of main variables, this distribution is also shown in Table 2. In spite of an effort to balance the number of people in the age classes as equitably as possible for the different variables, it was not possible to achieve a

perfect balance; this would have required a large increase in the total sample or a decrease in the number of people for each variable class, or again a reduction of the number of variables taken into account. Concerning seniority in the department, the unequal distribution of number of people in the three age groups is normal as this variable is partly dependent on age.

With respect to the other variables, one may assume that some of these distributions reflect, to a certain extent, the characteristics of workers according to their age class. Thus, for instance, the fact that the older workers are less numerous than the younger workers in using computers for more than 1 h a day is compatible with Bué and Gollac's results (1988). Likewise, the greater representation of older executives and their lower number of years of study than for the younger ones also seems to be consistent with social reality.

Factorial correspondence analysis and detailed analyses (for the whole sample)

A correspondence analysis, based on the synthetic scores and the subject's characteristics, was processed in order to provide a pluri-dimensional representation of the data (see Appendix 2 for detailed description of the statistical method).

The first two factors account for 30% of the total inertia (21% for f1 and 9% for f2), which is quite a significant amount when working with disjunctive tables. Figure 1 shows that the MSS variable (mean synthetic scores) is arranged in a quasi-linear fashion along the f1 axis, from MSS1 at the right of the figure (the lowest MSS) up to MSS4 on the left (the highest MSS). On the extreme right of the f1 axis one can distinguish groups of subjects with the lowest synthetic scores (particularly UI1, WC1 and LPT1) and with which the non-users (RU1) are strongly associated. Also associated, though less strongly, are workers with a lot of seniority in the department (LS3) and the older workers (AGE3).

At the other end one can find the highest scores for synthetic variables (in particular UI3) with a high contribution and correlation for heavy users (RU3) and for people who especially use word processing (MFU2). This factor therefore especially opposes non-users of computer tools but also workers of more than 44 years old and with seniority in the department (characterized by low synthetic scores) to heavy users who on the contrary have the highest synthetic scores.

The f2 factor opposes the heavy users (RU3), most often female (SEX2), employees (QUAL1) and especially doing word processing (MFU2), to light users (RU2), most often male (SEX1) and with a higher level of qualification (QUAL2), mostly involved in searching for information and handling electronic mail (MFU1). The synthetic variables are not very dependent on this factor. Only the SPC1, WC1 and MSS1 modalities contribute a little to f2, but with a weak correlation to it.

These two first factors f1 × f2, taken together, therefore provide a description of data that highlights three groups of operators with distinct profiles, with the non-users and heavy users having extreme positions on the MSS axis, and with the light users having an intermediate position on this axis.
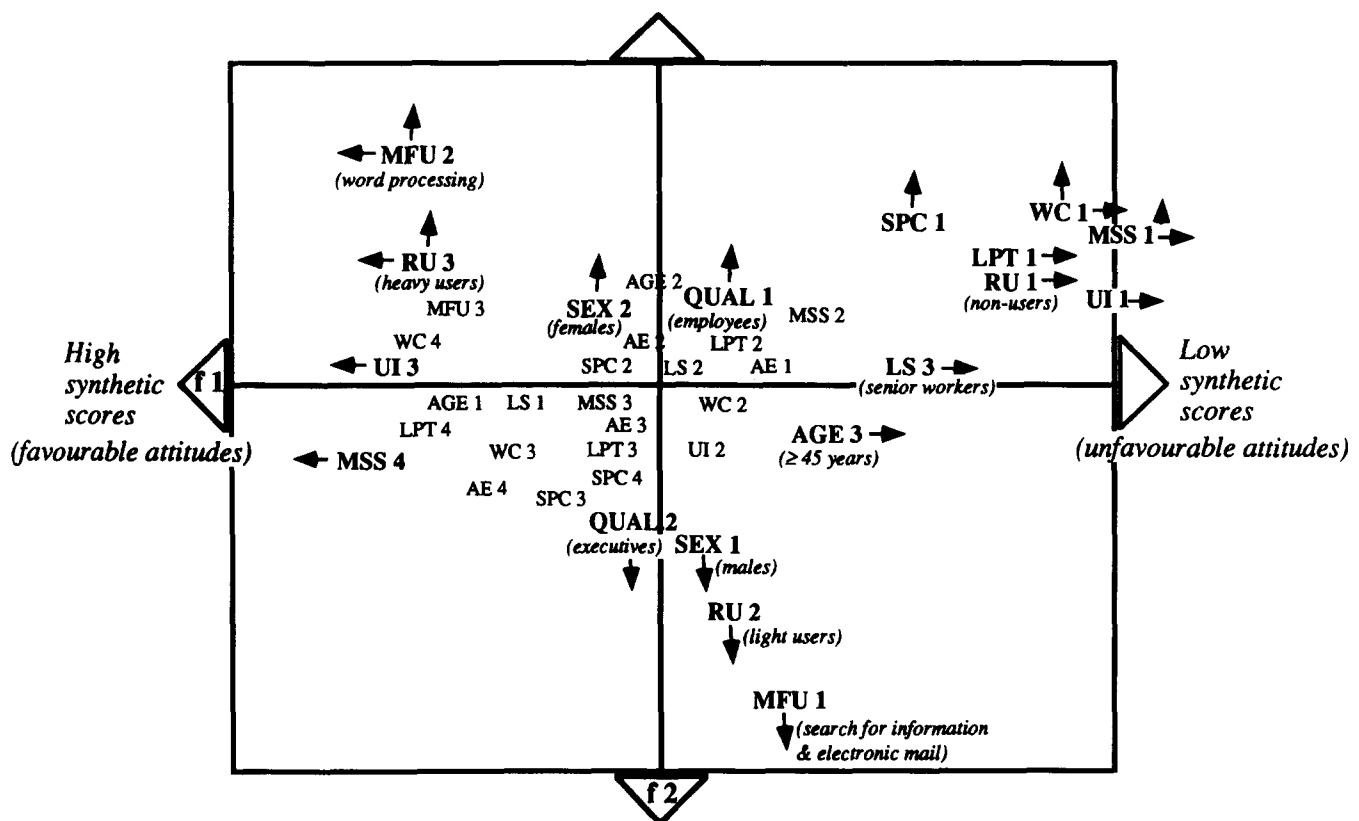
Figure 1 Results of the correspondence analysis (factors f1 × f2). All the synthetic variables are shown in the figure. For better visibility, only the subjects' characterizing variables that are strongly associated with the factors are shown in the figure. For each variable, the modalities mostly contributing to and correlating with the factors are highlighted in bold in the figure. The arrows indicate the axis to which they are most related. For the meaning of symbols see Table 1

In further detailing the results, more importance will be attributed to the variables RU, AGE and LS (in particular by relying when necessary on the analysis of basic questions used to construct the synthetic scores) as they contribute most to explaining the first factor, the one that accounts for most of the total inertia.

Rate of use. The RU variable is the one that, in the correspondence analysis, best distinguished the subjects on the basis of their synthetic scores. This fact is mainly due to the variables UI, WC, LPT and MSS (all are significant at $p \leqslant 0.01$). Non-users (RU1) have the lowest score for the perceived usefulness of computer tools and the interest expressed in them (UI). Likewise their representations of the effects of computerization on working conditions (WC) are generally more negative than the representations of the users.

The detailed analysis of questions used to build the synthetic scores reveals that RU1 subjects are more numerous than the users in representing computer work as more monotonous than non-computerized work (respectively for the RU1, RU2 and RU3 categories: 31.6%, 25.4% and 18.3%; $p \leqslant 0.02$), as not improving quality of work (respectively 23.5%, 4.5% and 2.5%; $p \leqslant 0.0001$), nor quantity (respectively 20%, 2% and 1.5%; $p \leqslant 0.0001$). They also have in common with the light users the opinion that computer work does not improve communication with fellow workers (respectively 27.3%, 25.1% and 16.7%; $p \leqslant 0.05$).

There appears to be no difference between the three groups of users concerning the effect of computerization

on work pace, autonomy/independence and on symptoms of fatigue in general: 32% of the sample consider that computer work leads to a faster pace of work than with traditional methods, 30% that it leads to more dependence on fellow workers, and 18% that it makes work more tiring in general. For all these questions relative to working conditions, the other replies are most often of the 'it doesn't change anything' type.

Finally, the non-users are significantly less numerous in criticizing computer tools for being too slow (respectively 3.5%, 22.1% and 24%; $p \leqslant 0.0001$).

For the SPC variable (socioprofessional consequences), no significant difference was found between the non-users, the light and heavy users in synthetic scores as well as in the detailed analysis. The same was true for representations constructed by workers on the effects of age on the professional qualities mentioned to them (AE).

The use of not specifically professional technologies (LPT) is more frequent among the users ($p \leqslant 0.01$). But the detailed analysis shows that this result is due mainly to use of the minitel: those who most use computer tools in their professional environment are also more inclined to use the minitel at home for more sophisticated functions than the simple electronic directory (respectively for RU1, RU2 and RU3: 11.4%, 58% and 57.4%; $p \leqslant 0.0001$).

Age. No significant relation was found between age and MSS. This means that age as such does not result in generally negative representations. However, the use-

fulness of computer tools and interest shown in them are more positively expressed among young people than in the two other age groups. The different questions used to construct the UI score lead in the same way to this result. Likewise, the use of new technologies that are non-specifically professional (LPT) is generally less frequent in the oldest group (AGE3; $p \leqslant 0.0001$). A detailed analysis of this variable shows that it is less the use of the minitel in the home or of automatic petrol pumps that determines this result than the use of bank distributors: 80% of young people use bank distributors as often as they can, whereas only 66.7% of the 36–44 year olds and 52% of the over 44 year olds give this reply ($p \leqslant 0.0001$).

The other synthetic variables are not significantly related to age. However, the detailed question-by-question analysis for the WC category (working conditions) reveals a difference related to age in two questions relating to criticisms made by subjects of computer tools (Figure 2): the older subjects are more numerous in finding these tools too abstract in their procedures ($p \leqslant 0.02$), whereas the younger ones especially criticize their slowness ($p \leqslant 0.05$).

The detailed analysis of SPC (socioprofessional consequences) only reveals a difference related to age in one of the initial questions, the question relating to employment: the workers between 36–44 and older than 44 are relatively more numerous (respectively 51% and 50.7%) than the younger ones (32.6%) in considering that computerization represents a threat to employment ($p \leqslant 0.001$). Young people are therefore more numerous in thinking either that computerization does not change anything or that it is a favourable opportunity for employment.

Concerning the AE variable (age effects), the detailed analysis only revealed differences between the age groups for two questions: the young are more numerous (17%) than the others (9.5% for the AGE2 group and 4.5% for the AGE3) in thinking that care taken in one's work lessens with age ($p \leqslant 0.001$). They are also more numerous (35.8%) than their older colleagues (respectively 23.3% and 20%) in thinking that with age one is less committed to one's work ($p \leqslant 0.001$).

Length of service in the department. This variable, which is only partly dependent on age, shows a significant relationship with three synthetic variables (UI, SPC, LPT; $p \leqslant 0.02$). Operators who have worked for a long time in the same department, and particularly those who have been working there for more than 20 years, find computer tools to be less useful and less motivating (UI) than do workers who have only recently arrived in the department (who represent, it should be remembered, about 80% of the young people).

As was the case for the AGE variable, a significant relationship was also found between LS and LPT (less professional-specific technologies), with newcomers in the department (LS1) being more frequently users of these devices. This is certainly due to a great extent to the weight of young people in LS1. It was mainly the question on the use of bank distributors that contributed to this result ($p \leqslant 0.0001$). However, the LS variable differs from the AGE variable in that it shows a

Table 2 Proportion (%) of workers of each age class in the modalities of the subjects' characterizing variables

Symbols Modalities	n	SEX 1 (M)	SEX 2 (F)	YS 1 (≤11)	YS 2 (12 and 13)	YS 3 (≥14)	QUAL 1 (Employ)	QUAL 2 (Execut)	LS 1 (≤5)	LS 2 (6–19)	LS 3 (≥20)	RU 1 (0)	RU 2 (1–60)	RU 3 (<60)	SF 1 (≤50)	SF 2 (>50)	MFU 1	MFU 2	MFU 3 (See footnote)
n		226	394	141	271	208	383	237	264	247	109	127	206	287	308	312	168	165	160
Age 1 (≤34 years)	195	30.8ª	69.2	11.8	41.5	46.7	70.8	29.2	78.8	21.2	0	20	29.8	50.2	44.1	55.9	31.5	35.6	32.9
Age 2 (35–44 years)	200	33.3	66.6	18.2	42.2	35.6	62.2	37.8	35	56.7	8.3	17.8	28.4	53.8	40.6	59.4	29.6	37.1	33.3
Age 3 (≥45 years)	225	44	56	34.8	44.2	21	54.3	45.7	21.4	43.6	35	22.7	40.9	36.4	44	56	41.5	27.4	31.1

YS, years of schooling; QUAL, qualification; LS, length of service in the department (years); RU, rate of use (min day⁻¹); SF, size of the firm (number of workers); MFU, most frequent use (MFU1, search for information and electronic mail; MFU2, word processing; MFU3, other software uses and programming)
aFigures in italic: chi-square significant ($p \leqslant 0.05$)

significant relation with SPC: more senior workers in the department than recently arrived ones see computerization as a threat to employment or, in the best of cases, consider that it changes nothing in respect to the different aspects of one's professional career.

The detailed analysis (Table 3) shows that, except for the question relating to salaries, the senior workers differ from the more recent ones for all of the other aspects: employment ($p \leq 0.05$), qualification ($p \leq 0.01$), and peer status ($p \leq 0.01$). As there were very few replies in terms of 'threats', except for the question on employment, the chi-square tests could only be used by taking into account replies of the type 'doesn't change anything' and 'favourable opportunity' as far as salaries, qualification and peer status are concerned. Note that replies of the 'threat' type were relatively numerous for the question on employment: this clearly shows that computerization is perceived by a lot of people as associated with a certain risk of losing one's job.

A question that was not taken into account in constructing the synthetic index, partly because it was redundant and partly owing to its more qualitative nature, makes it possible to specify the position of senior and recent workers: among the several reasons likely to explain why senior workers might have, if this were the case, more trouble or reluctance than the others in coming to grips with computers and following their evolution, Figure 3 shows some replies to this question. The replies A and C were dominant but only reply A significantly distinguished workers according to their seniority: the senior workers were more numerous in considering that it is 'because it makes no contribution to one's personal career' ($p \leq 0.01$).

With respect to questions on working conditions (WC), the difference between senior and more recent workers was not on the whole significant even though it was close to the significance level ($p = 0.067$). However, the detailed analysis showed a few differences between these workers on certain questions: more senior workers criticized computer tools for being too abstract (respectively for LS1, LS2 and LS3: 4.4%, 7.1% and 21.3%; $p \leq 0.0001$), and too rigid (respectively 18.1%, 22.3% and 34.6%; $p \leq 0.01$). They were more numerous in finding that computer work makes them more dependent on other workers (respectively 30%, 26.7% and 40.2%; $p \leq 0.001$).

The representation made by the senior workers of the changes in professional qualities due to age (AE) were not different from those of other workers for all of the qualities chosen.

Finally, and particularly because of the strong contribution of UI, SPC and LPT, senior workers were more

numerous than recent workers in the department in having a relatively negative attitude to computer work, and in having relatively negative representations of the advantages it provides and of the capacities of individuals to master it, as shown by the significant relation found between LS and MSS ($p \leq 0.0001$).

Other variables. The QUAL variable showed no effect on any particular synthetic variable, but it did have a slight effect, in a certain way, on all of them, as more qualified workers have mean scores that are higher than the employees ($p \leq 0.02$).

The MFU variable affects only the synthetic variable UI ($p \leq 0.0001$): workers who do mainly word processing and who use various software packages on the computer, or who program, see more clearly the usefulness of computer tools and are more interested in them than those who mainly search for information and use electronic mail (mostly users of the minitel and fax facilities).

Finally, YS3 (≥ 14 years of schooling) and to a lesser extent YS2 (12 and 13 years) differ from YS1 (≤ 11 years) in that they are less pessimistic concerning the effects of computers on an individual's career (SPC) and in that they are more heavy users of new technologies outside of the work context (LPT).

Consultation and training (users)

Main results are given in Table 4.

Consultation. It may be seen that the workers with more qualifications and a higher level of schooling are more numerous in saying that they were consulted during the computerization process and in considering that their opinions were taken into account. This is probably due in part, at least for the most qualified
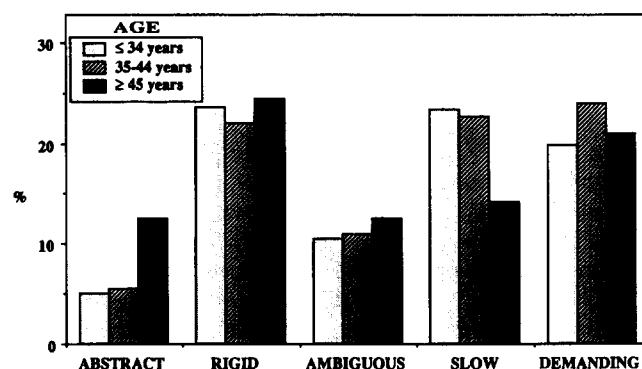

Figure 2 Proportion (%) of subjects in each age group having described computer tools with the adjectives mentioned

Table 3 Proportion (%) of individuals in each seniority group in the department who consider that computer work (a) 'doesn't change anything', (b) 'represents a favourable opportunity', or (c) 'is a threat' to employment, salary, qualification and peer status

	Employment			Salaries			Qualification			Peer status		
	a	b	c	a	b	c	a	b	c	a	b	c
LS1	46.7	15.5	37.8	82.5	16.1	1.4	44	54.2	1.8	62.3	35.9	1.8
LS2	38.7	13.3	48	82.7	12.8	4.5	54.9	43.9	1.2	72.4	25.5	2.1
LS3	32.3	14	53.8	82.8	12.9	4.3	61.3	34.4	4.3	75.3	21.5	3.2

Table 4 Proportion (%) of subjects having made the replies mentioned to different questions relating to consultation (first 4 rows) and training (next rows).

Questions	Replies	Age 1	Age 2	Age 3	LS 1	LS 2	LS 3	QUAL 1	QUAL 2	YS 1	YS 2	YS 3	RU 1	RU 2	MFU 1	MFU 2	MFU 3	SF 1	SF 2
Decision to computerize	Yes	28.6ª	45.2	44.4	35.5	45.3	36.8	30.6	53.9	29.3	37.4	51.3	42.2	39.3	40.5	32	47.8	56	30.6
Choice of equipment	Yes	20.6	29.9	28.2	28.3	27.7	19.3	15.6	43	13.2	21.4	42.7	26.9	26.7	17.9	24.8	34.1	41.6	17.6
Choice of site for installation	Yes	39.2	59.8	62.6	51.4	57.8	56.1	43.1	72.5	17.1	51	65.8	50	57.3	51.2	52.7	59.7	61.4	51.2
If yes, opinion taken into account	Not at all	30.2	25.7	24	28.6	23.5	27.9	33.6	17.7	38.5	28.9	14.9	28.4	25.1	26.2	30.5	22.3	17.3	31.7
	Partly	44.4	44	36.5	43.8	34.8	48.8	45.4	36.3	32.7	44.6	42.6	30.9	46	41	38.9	43.8	33.7	46.3
	Altogether	25.4	30.3	39.5	27.6	41.7	23.3	21	46	28.8	26.5	42.5	40.7	28.9	32.8	36.6	33.9	49	22
Total number of training days	0	33.8	35.8	34.1	35.2	32.8	36.8	37.6	30.1	37.7	37	29.4	46.8	25.9	49.4	27.7	26.8	41.5	29.8
	1-7	40.9	39.5	40.5	37.7	43.9	38.2	43.8	34.7	38.7	41.1	40.5	33.5	45.1	28.4	44.7	47.7	38.5	41.5
	8-29	14.3	21	22	17.4	19.8	22.4	14.2	26.9	17.9	18.7	20.3	15.8	21.7	16.7	20	21	13.5	23.2
	≥30	11	3.7	3.4	9.7	3.5	2.6	4.4	8.3	5.7	3.2	9.8	3.9	7.3	5.5	7.6	4.5	6.5	5.5
Sufficient in quantity	Yes	64.4	61.9	55.2	66.4	59.4	49	59.7	61.6	63.1	57.4	62.5	59.4	61	64.5	60.3	58	63.8	58.9
Quality of training	Good	59.4	75.7	65.7	65.9	72	60.8	64.7	71.7	63.6	67.6	68.8	67.3	67.3	69.2	72.5	59.8	66.7	67.6
Otherwise too theoretical	Yes	75.8	71.9	97.6	72.7	89.2	95.8	82.2	85.3	100	77.4	81.3	92.2	79.4	81.5	78.9	88.1	76.7	85.7
Desire for further training	Yes	72.6	73.2	60.1	72.1	70.5	53.6	70.6	64.8	58.7	67.5	73.7	60.5	72.7	62.7	76.5	63.6	61.8	72.9

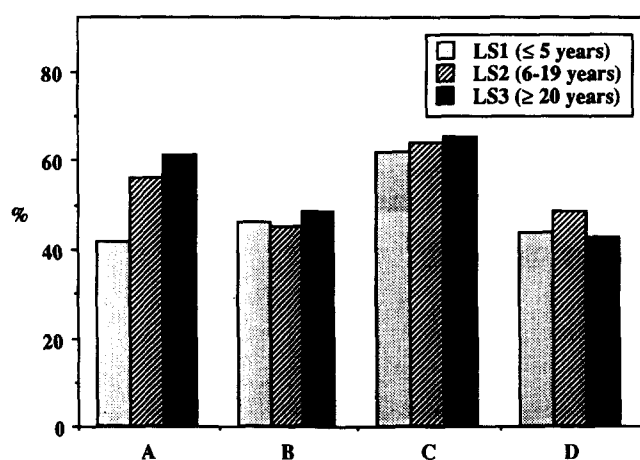ªFigures in italic: chi-square significant (p ≤ 0.05)

Figure 3 Proportion (%) of subjects having qualified the statements A, B, C and D as 'rather true', according to length of service in the department (LS). The question was: 'If you consider that with age it becomes more difficult to adapt to computer work and keep up with its evolution, or that age causes more reservations concerning this change, do you find the reasons A, B, C and D "rather true" or "rather false"?'
A: 'It won't help a personal career in any way'
B: 'It's too difficult to learn how to manipulate this equipment'
C: 'It's too difficult to follow as it changes all the time'
D: 'I don't really have time to start using it as I have too much else to do.'

people, to the fact that these operators received more training in computer work, as shown by the same table, and also to the fact that they are generally more involved than employees in decision making.

Likewise, it is probable that the replies, more positive, of the middle and older age groups to questions on consultation may be explained in part by the fact that young workers, precisely because of their age, are less likely than their older counterparts to have witnessed the computerization process. The slightly greater proportion of executives in the group of workers more than 44 years old as compared with groups of younger operators (see Table 2) probably also accounts for the fact that older workers appear to have been consulted more. Likewise, the absence of a significant seniority effect on this point may be understood by the fact that a significant proportion of old and fairly old subjects in the sample did not have much seniority in the department (see Table 2).

Consultation was experienced more positively in small companies than in large ones, probably as communication is easier in this case. It was also more positively experienced by the workers of the MFU3 group and even, though to a lesser extent, by those of the MFU1 group as compared with the MFU2 group. This result may certainly be explained by the fact that in this user subset employees are more represented in MFU2 (39.6%) than in MFU1 and MFU3 (respectively 30.5% and 29.9%), whereas executives are on the contrary better represented in MFU1 and MFU3 (respectively 37.3% and 35.2%) than in MFU2 (27.5%; $p \leq 0.05$). Finally, one might note that workers are consulted more about the decision to computerize and

the place of installation than on the choice of equipment, which seems to be entrusted to people with more competence in computer work.

Training. The operators who received the most training in computer work were the most qualified ones, the heavy users, those who do mainly word processing, programming or who use the computer for other functions than word processing, and those in companies with more than 50 employees. Young and older workers also differ but only in the last two classes of length of training: subjects 35 years old and over are slightly more numerous in having received between 7 and 30 days of training than young people, whereas these latter are more numerous in having received lengthy training of more than 30 days. Among the latter, certain of them received this training during their normal schooling. The level of schooling and seniority in the deparment are not related to the amount of training received.

It may also be noted, on the one hand, that about a third of the workers received no training at all in the use of word processing machines and computers (one may suppose that this third corresponds to those who mainly use the minitel and fax facilities) and, on the other hand, for those who did receive training, that most of them received training lasting less than 7 days (more than half of these had no more than 3 days of training). More than 50% of the workers considered that the amount of training they received was sufficient for their needs. No variable was able to distinguish the subjects on this point.

Concerning the quality of the training, two thirds of the operators thought that it was well done. Only age distinguished the individuals on this question: young people appeared to be more demanding than their elders. By contrast, workers 45 years old and over, who were not satisfied with the quality of the training, were quasi-unanimous in criticizing this training for being too theoretical. Almost all of the workers with most seniority in the department and those with a low level of schooling who were also dissatisfied with the quality of the training agreed with this criticism.

Concerning the last question, it may be seen that young or middle-aged workers, people who have worked for less than 20 years in the department, those with a high level of schooling, heavy users, people who mainly do word processing, and those working in companies with more than 50 employees, were significantly more numerous in stating that they wished to undergo further training in order to increase their skills.

Discussion

Age is not the most determining factor

A major finding of the study was that age alone is not the most important factor affecting the measured variables. Results show that the most negative representations of computer work, the least favourable opinions, were above all expressed by those who do not use computer tools at all. Attitudes with respect to computer work were more favourable for light users and even more so for heavy users.

Non-users appear to be mainly characterized by the fact that they have less insight into the usefulness of computer tools and less interest in using them as well as a more negative representation of the consequences of these tools on working conditions. They also appear to be less inclined to use the new technologies (especially the minitel) outside the professional area. Older operators, as well as those with more seniority in the same department, also tend to have a negative opinion on the usefulness of computer work, to be not very interested, and to use services based on new technologies outside the work context less often, especially bank distributors. But more than age, the longer an operator has been in a department the less likely he is to have a generally favourable opinion, and especially with respect to socioprofessional consequences.

Thus these results show that as long as the 'step' towards using these tools, even minimally, has not been taken, then perception of computer work is on the whole less positive. They also show that the fact of having worked for more than 20 years in the same department (which implies a certain age and long-hardened work habits) means that this perception will be even more negative and that operators will be more reluctant concerning these new technologies. When this 'step' has been taken, then the advantages of computerization are more apparent to workers, and numerous fears held by non-users are greatly decreased. This fact was also mentioned by Gillet (1990).

Other factors are found to play a role in the variables measured: workers with a higher level of qualification and schooling, and those who mainly do word processing or who use the computer for different functions (but who are also heavy users) hold more favourable opinions and attitudes for some or all measured aspects with respect to computer technology. These results thus yield a set of characteristics defining the profile of workers with the most reticence or with the least favourable representations of computerization in office work.

For a clearer understanding of the cause of these reservations, in particular those of operators who are both older and have more seniority in the department – a category of particular interest for this work – it is necessary to discuss more closely certain of the results obtained in the light of comments recorded during completion of the questionnaires, and in the light of interviews with department heads.

Fears and expected benefits

A first point worth discussing relates to the socioprofessional consequences of computerization in terms of expected benefits for career purposes, or on the contrary in terms of threats to employment. The fact that, as seen above, senior workers do not expect any positive consequences for their career appears to be responsible in part for the lesser motivation of some of them in making the necessary efforts to learn the new working techniques and methods. Willingness to undergo further training, less often expressed by them, appears to confirm this hypothesis.

It should be emphasized as well that a relatively significant proportion of workers consider that

computerization may be accompanied by threats to employment, and this is true for all subjects, but more particularly so for the more senior workers. For the latter, this fact causes extreme anxiety, as they most often suffer restructuring or elimination of jobs following technological changes, either in the form of transfers to other work positions that do not necessarily correspond to their qualification, or through forced early retirement, or even through being fired. This was admitted by some of the department or company heads questioned, a minority it is true, even though the majority declares that one of the major objectives of computerization is to increase productivity without increasing the personnel, or possibly by decreasing the personnel.

By contrast, young people and more generally people who are newcomers in a department have much more initiative with respect to computer work, even if they do not have high levels of training and qualification, as they see clearly all the benefits to be gained from computerization for negotiating a promotion or future employment. It is easier for them to consider computer skills as an advantage that increases their qualifications and enhances their peer status.

Training

The discrepancy in terms of training duration between young and older workers is not as great as was expected. From a first analysis these results appear to go against the observations made by Rosen and Jerdee (1976). But it should be remembered that one third of the people did not receive any training (a good part of these probably were people who mainly used the minitel and fax facilities). Furthermore, for the large majority of those who did receive training, this training was short and often did not exceed 3 days. In spite of this, most of the workers questioned, whatever their characteristics, said that they were satisfied with the length of the training received with respect to their needs. This may be partly due to the fact that they assessed their needs from what they know (mainly by the training received) about the functional possibilities of computers. However, this must not make one forget the 40% of workers who, having received some training, found the length of this training quantitatively insufficient with respect to their needs.

The satisfaction concerning the quality of the training, most often expressed by the older workers (35 years old and over), also seems surprising when one considers the observations made by certain authors, who found the greatest difficulties among older trainees in acquiring new knowledge in training situations (Hartley et al, 1984; Gomez et al, 1986; Baracat and Marquié, 1991; Czaja and Sharit, 1991). However, the oldest workers who were dissatisfied with the quality of the training were quite unanimous in criticizing it for being too theoretical. It may be that the greater satisfaction expressed by older workers reflects, as suggested above, a lesser expectation than for young people with respect to what computers can do for them, and that they are thus less demanding.

The subjects (between 30 and 40%) who appeared to be not very satisfied with the duration and quality of

the training specified, in the interviews, the reasons for their dissatisfaction. Certain said that the post-training period is very difficult, as they find themselves alone in front of their machine, without assistance. This is particularly true during the transition phase between the old system and the new one, when the computerization is not implemented gradually. The workload is therefore greater as the apprenticeship is not yet finished, and it is necessary for a certain time to work simultaneously with the old and the new methods. This is also a period during which errors and incidents are frequent.

Employees and department heads mentioned that the oldest workers often express the fear of having to learn everything from scratch again, and of their current skills, valid until now, becoming obsolete; of having to compete with their young colleagues, whom they consider to be more at ease with these new devices, and therefore of finding themselves in an unfavourable position (see also Sterns, 1986). They are afraid of not knowing how to use the computers and of making serious mistakes, such as wiping out a program or even damaging equipment through wrong manipulation.

The ergonomics of computerized work

One has first to note that the scores obtained in this respect showed that all the workers, including heavy users, were fairly realistic concerning the improvement that computers could make to working conditions. In addition, even though the questionnaire in no way dealt with all aspects of this problem, and in spite of the fact that no significant differences between non-users, light and heavy users were found in synthetic scores relating to working conditions, certain problems that are or are not specific to older workers should be emphasized.

It was in fact among the older workers with the most seniority in the department that most operators criticizing computer tools for being too abstract were found. They have more difficulties in conceiving of how the machine operates, how it manipulates information, and how and where this information is stored. In addition, the older workers appear to be more sensitive to the rigidity of the procedures. The lack of flexibility during the task (for instance, returning to a previous stage) and the unsuitable nature of certain procedures were also mentioned.

It seems normal that operators who have been working for a long time with manual procedures that are well adapted to the job in hand would suffer more than others from the rupture involved in changing to computer work. This is felt even more deeply when the software used is standardized: that is, not specifically adapted to their particular needs and working methods. It appears that ergonomic software design should especially take into account this category of workers as they are, because of their experience, the ones with the best knowledge of suitable procedures for the needs of their department.

Finally, the older workers perceived computer tools as making them more dependent on their colleagues. The comments recorded suggest that this is partly due to their poor mastery of computers, which means that they often require assistance.

Age and use of new technologies outside the professional setting

Analysis of the questions designed to assess this point shows that age does not systematically cause reservations with respect to new technologies. No difference between age groups was discovered in users of automatic petrol pumps activated by bank cards and of the minitel in the home. However, young people were much more numerous in declaring that they used bank distributors as often as possible. It is possible that middle-aged and old adults are more sensitive to certain problems encountered when using these machines, such as breakdowns, lack of supplies, queues, and the absence of human contact; other reasons might be problems of safety in public places and of the reliability of the machines, given that money is involved. But some of these difficulties are not actually specific to bank distributors and may also be found in the use of automatic petrol pumps. It appears to be more probable that older adults have more varied needs and uses for banking services than young people, which lead them to go into a bank branch rather than relying on bank distributors.

The need for more information and involvement of the personnel

The last point to be dealt with has to do with consultation. The replies obtained on this subject revealed that consultation is low, that it applies mainly to the best-trained and qualified people, and that it is more developed in small companies. But apart from the replies to these few questions, it is the overall results of the survey that suggest the importance, if computerization is to succeed and be accepted by all, of carefully planning for successive phases of preparation, explanation, training and integration of these new techniques by the personnel.

The major finding of the study is that resistance to change depends not so much on age or other individual factors as on the lack of knowledge of the innovation effects. Indeed, most reservations are to be found among non-users, even more so if they are older and have a lot of seniority in the department, but these reservations decrease or disappear when the workers start using computer tools.

This shows very clearly the essential role of information and the necessity of involving all of the personnel from the very beginnings of computerization in order to demystify computer work and to give the employees the means of evaluating properly the consequences to themselves of the transformations envisaged. This would make it possible to decrease anxiety (which is only natural when someone is faced with changes likely to affect one's daily life). This anxiety was quite apparent from interviews with department heads and from survey replies to the open questions. For instance, when asked 'what would you do differently if you had to start computerization of your department over again?' many department heads replied that they would allow themselves more time to prepare the personnel, to explain the nature and consequences of the changes envisaged in order to get more support for these changes.

Conclusion

Obviously some workers, employees as well as executives, do not use computers because their department is not equipped or only partially so, or even because their function does not require them to make use of computer technology quite as much as other people. But whatever the case, the aim of the study was to understand better how different workers' categories are actually prepared to use such new technologies, what is the origin of the difficulties for some of them, and, in doing so, to provide insight into the means likely to reduce them.

Although further research in this area is still required, especially in relation to job content, this work already provides precious clues for an ergonomics approach to technical changes. Knowing the role of individual factors like age, seniority and qualification may allow for more suitable adaptations of the methods of introducing technical changes to the characteristics of the personnel involved. This would mean that many workers who encounter some difficulties with these changes, particularly older ones, could be helped to make the necessary adaptations, and would not be put into a marginal situation.

Acknowledgements

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Appendix 1

Questions put to the whole sample and used for the correspondence analysis

Usefulness and interest (UI)

Subjects were asked to evaluate on a three-point scale the usefulness of computers for their own work and their interest in using them.

Working conditions (WC)

A series of questions enabled the subjects to say whether they think, from their experience, that computers change work in any way (improvement, deterioration, or no change) in terms of monotony, pace of work, possibility of communicating with fellow workers, quality and quantity of the work done, autonomy with respect to fellow workers, and fatigue in general. They were also asked to express specific criticisms that they might make of computer devices, both hardware and software: too abstract in their functioning, rigid and ambiguous in their procedures, slow in their response times and attention-demanding (yes/no responses).

Socioprofessional consequences (SPC)

Selected questions asked subjects whether, according to them, computers represent a threat, a favourable opportunity or no change with respect to employment, salary, work qualifications and peer status.

Age effects (AE)

The questions dealt with professional qualities. The subjects had to say whether they thought that ageing increases, diminishes or does not change these qualities. Half the items concerned general qualities (autonomy, care taken in work, commitment to work and efficiency); the other half were more directly related to the capacity to adapt to changes occurring in their professional life (changes of station, of working methods, of techniques, and the desire for new training).

Less professional-specific technologies (LPT)

Subjects were asked to describe their effective use (as often as possible, sometimes but seldom, never) of three new, less professional-specific technologies: bank distributors, automatic petrol pumps activated with a bank card, and the minitel used for domestic purposes.

These three technologies are widely available in the geographic area in which the enquiry was carried out. For the Minitel, the factors taken into account were when it was present in the subject's home, whether it was used or not, and whether it was used uniquely for its most basic function (the electronic directory) or for more sophisticated functions (such as consultation of specialized, on-line databases or electronic mail).

Appendix 2

Description of the statistical method

As all the variables were divided into several modalities, a contingency table was constructed with the subjects in the different rows and the modalities labelled in columns. Each cell in the table contained 1 if the subjects fell into the category, and 0 otherwise. Then all the categories were crossed two by two, giving Burtt's matrix, in which the categories are labelled in rows and columns, and the cells of which contain the number of subjects that fall into the two categories. This matrix is symmetrical, and its main diagonal contains the overall number of subjects in each category.

This matrix was subject to correspondence analysis in order to reveal the associations between categories. Correspondence analysis is based on factorial methods and uses the chi-square distance to find a multidimensional representation of the row points and the column points of the table in a factorial graph (Benzécri, 1973; Greenacre, 1984; Lebart *et al*, 1984). Correspondence analysis breaks down the chi-square value of the table into independent dimensions (or factors) and is formally identical to the canonical

correlation analysis of categorical data developed by Kendall and Stuart (1973) as underlined by van der Heijden (1987). Each factor extracted by the analysis corresponds to a certain proportion (expressed as a percentage) of the overall chi-square (the total inertia), which is broken down on that factor. In some cases, chi-squares were computed on a subset of the table to reveal the dependence between two variables with more precision.

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