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Fernande Lamonde and Sylvie Montreuil

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Article abstract

The articles in this special issue of Relations industrielles/ Industrial Relations are the first that the journal has published about ergonomics. Accordingly, the present article has two objectives: to define the object of study, the objectives and the methodology that are characteristic of ergonomics; and to highlight the common points and possibilities of collaboration between industrial relations and ergonomics. The interest inherent in a collaboration between these two disciplines is explained, among other things, by a "historical coincidence". On the ergonomics side, a period that concentrated on developing concrete ways of collaborating with technical disciplines like engineering, Computing and architecture has given way to a focus on "work organization" and the "social management aspect of ergonomics intervention". At the same time, industrial relations has developed a more pronounced interest in the practical management problems that are posed by micro-organizational processes within firms, namely, the informal work activities of operators. Three specific forms of future collaboration between ergonomists and industrial relations specialists are proposed.

Le travail humain, l'ergonomie et les relations industrielles

FERNANDE LAMONDE
SYLVIE MONTREUIL

Avec ce numéro thématique, la revue Relations industrielles/Industrial Relations publie pour la première fois des articles en ergonomie. De ce fait, le présent article vise deux objectifs : définir l'objet d'étude, l'objectif et la méthodologie d'intervention propres à l'ergonomie et mettre en lumière les points de rencontre et les perspectives de collaboration entre relations industrielles et ergonomie. L'intérêt porté à la question de la collaboration entre ces deux disciplines est expliqué, entre autres, par une « coïncidence historique ». Du côté de l'ergonomie, la popularité des volets « organisation du travail » et « gestion sociale de l'intervention ergonomique » succéderait à une période où les énergies ont été concentrées sur le développement de modalités concrètes de travail en commun avec les disciplines techniques comme l'ingénierie, l'informatique et l'architecture. Parallèlement à cela, du côté des relations industrielles s'est développé un intérêt de plus en plus marqué pour les problèmes pratiques de gestion posés par les micromécanismes organisationnels que représente, dans l'entreprise, l'activité réelle et informelle des opérateurs. Trois formes concrètes de collaboration à faire naître entre ergonomes et spécialistes en relations industrielles sont proposées.

« Le lecteur trouvera [...] dans les pages qui suivent la description d'une discipline à la fois très modeste et très ambitieuse. Très modeste [...], car elle se veut muette sur les évolutions lourdes qui modifient en

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- LAMONDE, F. et S. MONTREUIL, Département des relations industrielles, Université Laval.
 - Les auteurs tiennent à remercier leur collègue Jacques Bélanger pour ses précieux commentaires.

profondeur le monde du travail. Mais très ambitieuse cependant, car l'ergonomie prétend forger des outils, théoriques et pratiques, qui permettent de concevoir et de modifier le travail ». Cette citation de Montmollin (1990 : 4) introduit au mieux les deux objectifs poursuivis par la parution de ce numéro thématique de *Relations industrielles/Industrial Relations*. Comme premier objectif, ce numéro se veut une introduction à l'ergonomie et à ses ambitions en termes d'objectif, d'objet d'étude et de méthodologie d'intervention. En effet, avec ce numéro thématique, la revue *Relations industrielles/Industrial Relations* publie pour la première fois des articles portant sur l'ergonomie ; pour plusieurs de ses lecteurs, ce numéro constituera donc un premier contact avec cette discipline en plein essor. Comme second objectif, ce numéro vise à mettre en lumière certains problèmes pratiques et de connaissances liés au monde du travail que l'ergonome, modestement, n'est pas seul à chercher à résoudre et à propos desquels pourrait s'établir une collaboration entre relations industrielles et ergonomie.

Le choix a été fait de publier dans ce numéro des articles faisant tous état d'études de terrain, réalisées en France ou au Canada. Ces articles participent tous, à des degrés divers, aux deux objectifs du numéro en illustrant, à la fois, la démarche ergonomique et la complémentarité entre ergonomie et relations industrielles. C'est pourquoi le présent article est conçu comme une introduction et comme un guide. Comme une introduction, parce que le lecteur y trouvera, en première section, la définition des notions de base et des étapes d'intervention en ergonomie et, en seconde section, une première formulation des perspectives de collaboration entre relations industrielles et ergonomie. Comme un guide, parce que pour chacun des thèmes abordés dans ces deux sections, le lecteur qui veut en savoir plus se verra aiguillé vers les articles de ce numéro apparaissant les plus illustratifs.

AMBITIONS ET MOYENS DE L'ERGONOME

Lorsqu'il intervient dans les projets industriels, l'ergonome cherche à « comprendre ce que font les opérateurs en situation de travail, afin de répondre le plus efficacement et le plus complètement possible aux questions de la conception : c'est-à-dire déterminer ce qui doit être transformé de la situation et définir des propositions ou des principes de conception » (Pinsky 1991 : 119).

L'objectif de toute intervention ergonomique est donc de mener à la conception concrète de situations de travail. Pour ce faire, son objet d'étude est l'activité réelle des travailleurs, ce qui signifie que pour rencontrer ses objectifs de conception, l'ergonome porte son regard sur les « tours de main », les « manières de faire » et les « stratégies » mis en œuvre par les

opérateurs dans la situation de travail avant transformation. Les sections qui suivent définissent plus en détails les objectifs, objet et méthodes d'intervention de l'ergonome.

Un objectif de concevoir des situations de travail dans une diversité de contextes d'intervention

Dans l'entreprise, l'ergonome vise à influencer les décisions de conception de façon à ce que les situations de travail dans lesquelles les travailleurs sont placés soient fonctionnelles au quotidien, c'est-à-dire qu'elles leur permettent de travailler de façon sécuritaire et efficace. Cet objectif l'amène à intervenir dans des problématiques et des projets industriels très diversifiés.

En effet, la notion de « situation de travail » couvre tous les moyens de travail mis à la disposition des travailleurs pour rencontrer leurs objectifs de production. Du point de vue de l'objet de conception, l'ergonome intervient donc dans cinq domaines : la conception des équipements matériels (système de production, machinerie, etc.), des équipements immatériels (logiciels, systèmes d'aide et d'information, procédures de travail, etc.), de l'organisation du travail humain (répartition des responsabilités, effectifs, horaires, etc.), des espaces et locaux de travail et, enfin, de la formation.

Par ailleurs, la notion de « conception » est entendue dans un sens large puisque l'ergonome intervient tant dans des projets de création de situations de travail nouvelles que dans des projets de transformation de situations existantes, que ces projets soient menés dans un contexte d'améliorations continues ou d'investissements.

Enfin, l'ergonome intervient à la fois sur des projets initiés à la suite d'une idée de transformation (ex. : informatiser, réduire les effectifs, automatiser, etc.) et à la suite d'un diagnostic de dysfonctionnement se manifestant au niveau de la production (qualité, productivité, etc.) ou des individus (erreurs humaines, accidents, problèmes de santé, absentéisme, etc.).

Cette diversité des contextes d'intervention est bien illustrée par les articles consignés dans ce numéro. Ceux-ci font en effet état d'interventions ergonomiques qui ont mené à des solutions concrètes de conception de situations de travail et dont la demande initiale visait la gestion prévisionnelle des effectifs vieillissants dans le secteur automobile (Gaudart et coll.), la formation des représentants syndicaux au diagnostic ergonomique à partir de dysfonctionnements divers constatés dans des établissements de santé (Gadbois et coll.), la conception de logiciels et de systèmes d'information d'aide à la conduite automobile, au dépannage informatique téléphonique et au contrôle du trafic ferroviaire urbain (Filippi et coll.), la conception d'un

nouvel hôpital et d’une nouvelle usine dans le secteur de l’imprimerie (Bellemare et coll.), la prévention des lésions musculo-squelettiques dans le secteur agro-alimentaire de l’abattage de volailles et de porcs (Vézina et coll. ; Bellemare et coll.).

L’activité en situation réelle de travail comme objet d’étude des solutions de conception

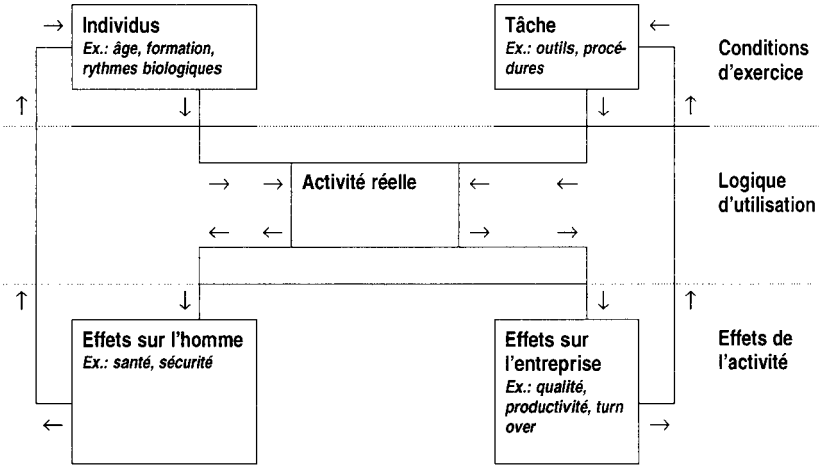
La figure 1 illustre la notion d’activité. Cette notion se trouve au cœur de la lecture que l’ergonome fait des phénomènes qui se produisent dans les entreprises et constitue l’objet central des analyses qu’il y conduit.

L’activité réelle de travail en tant que phénomène dans l’entreprise

L’activité réelle des opérateurs réfère aux stratégies cognitives, physiologiques, perceptives, sociales et psychiques mises en œuvre par eux pour réaliser, au mieux, le travail attendu, avec les moyens qui sont mis à leur disposition et avec lesquels ce travail doit être exécuté.

Les deux caractéristiques suivantes de l’activité permettent d’expliciter davantage la figure 1 et en particulier les liens qui s’établissent entre les moyens de travail, l’activité réelle des opérateurs et les résultats obtenus de leur travail.

FIGURE 1
L’activité en situation réelle, objet d’étude en ergonomie
(schéma inspiré de celui de Leplat et Cuny 1984)



L'activité est constituée de stratégies de compromis et de régulation.
Les conditions d'exécution du travail sont constituées :

- des caractéristiques du travailleur, en tant qu'humain (ayant un mode de fonctionnement cognitif, physiologique, social et psychique donné) et en tant qu'individu ayant des acquis (expérience, formation, vieillissement) et un état spontané (fatigue, rythme biologique) ;
- des caractéristiques de l'organisation où il travaille, incluant les contraintes temporelles (horaire, rythme de production, butées temporelles, etc.), les moyens organisationnels (consignes, répartition des tâches, etc.), les équipements matériels (outils, etc.), les équipements immatériels (système de communication, etc.), les locaux et espaces (ambiances physiques, aires de circulation et de stockage, etc.).

Ces conditions d'exécution ont deux caractéristiques déterminantes pour l'activité de travail :

- elles peuvent être incompatibles entre elles et de ce fait obliger les opérateurs à opter pour des stratégies de compromis ;
- elles sont variables et de ce fait obligent à développer des stratégies de régulation. Les individus varient aux niveaux intra-individuel (fatigue, apprentissage, vieillissement, etc.) et interindividuel (âge, formation, expérience, caractéristiques anthropométriques, etc.). L'organisation varie également de façon normale (la matière première à traiter, les modèles à produire, l'usure de l'équipement, l'absence temporaire d'un collègue ou du superviseur, etc.) ou incidentelle (bris d'équipement, etc.).

Un exemple, emprunté à l'article de Gaudart et coll. publié dans ce numéro, permet d'illustrer ces deux caractéristiques des conditions d'exécution du travail de même que les stratégies de compromis et de régulation. L'intervention ergonomique porte sur l'activité d'opérateurs travaillant sur une chaîne de montage de moteurs dans l'industrie automobile. L'analyse de l'activité de ces opérateurs montre que les plus âgés régularisent leur rythme de travail et économisent du temps et des déplacements par rapport aux plus jeunes en s'approvisionnant moins souvent en pièces grâce à une stratégie gestuelle développée consistant à prendre dans une main la plupart des pièces et à les faire glisser vers les doigts dans l'ordre et au moment où il faut les positionner. Il s'agit là d'une stratégie de compromis entre le rythme de travail et les capacités physiologiques, mise en œuvre par les travailleurs plus âgés pour réguler la variabilité de leurs capacités causée par le vieillissement, stratégie grâce à laquelle ces travailleurs réussissent à rencontrer les normes de production.

Ainsi, du fait de ces deux caractéristiques des conditions d'exécution, la simple prescription, par exemple, d'une procédure de travail n'est pas suffisante pour qu'elle soit suivie : encore faut-il qu'elle soit compatible avec

les autres conditions d'exécution du travail et qu'elle soit adaptée à toutes les conditions d'exécution du travail possibles. Les conditions dans lesquelles les travailleurs sont placés pour exécuter leur travail laissent donc toujours un « espace de compétences », une « marge de manœuvre », pour développer des manières de faire qui seules permettront d'atteindre au mieux les objectifs de production attendus. Ce sont ces manières de faire, ces stratégies de compromis et de régulation, déterminées par les conditions d'exécution du travail, qui constituent l'activité réelle étudiée par les ergonomes.

L'activité est un élément médiateur entre le système de production et les résultats de l'entreprise. On l'oublie trop souvent : il ne suffit pas d'informatiser une situation de travail pour que la productivité augmente, ni de prescrire une méthode de travail dite sécuritaire pour que les accidents diminuent. En d'autres termes, il n'y a pas toujours de liens directs entre les conditions d'exécution fournies aux travailleurs et les résultats obtenus par l'entreprise se manifestant aux niveaux de l'individu (accidents, lésions professionnelles, absentéisme, roulement, manifestations dans la vie hors-professionnelle, etc.) ou de la production (qualité, quantité de production, faible taux d'engagement des machines, retards de livraison, rebuts, etc.).

Les résultats obtenus à ces deux niveaux dépendent de l'activité des opérateurs, c'est-à-dire des stratégies de compromis et de régulation développées par eux pour composer avec les conditions d'exécution du travail. Ces résultats seront tantôt négatifs (ex. : accidents), tantôt positifs (ex. : efficacité), tantôt positifs à certains points de vue et négatifs à d'autres (ex. : opération plus risquée mais prenant moins de temps).

L'exemple tiré de l'article de Gaudart et coll. mentionné précédemment illustre au mieux ce rôle central de l'activité réelle des opérateurs dans le bilan de l'entreprise : les normes de production sont atteintes grâce aux stratégies de compromis et de régulation mises en œuvre par les travailleurs pour réguler les effets du vieillissement. Également dans ce numéro, l'article de Brun montre que les monteuses de ligne contournent certaines règles de sécurité qui, lorsqu'elles sont suivies, augmentent les risques d'accidents.

Tous les articles composant ce numéro fournissent des exemples de stratégies élucidées par l'ergonome au cours de son intervention. Toutefois, le lecteur intéressé à en savoir plus sur l'étude de certaines composantes de l'activité lira avec intérêt certains articles spécifiques : celui de Filippi et coll. pour la composante cognitive, celui de Brun pour la composante psychique et enfin, celui de Vézina et coll. pour la composante psychophysiologique de l'activité.

La section suivante montre en quoi ces connaissances sur l'activité réelle servent de matériau à l'élaboration de solutions concrètes de conception.

L'activité réelle en tant que matériau pour identifier des solutions concrètes de conception

Dès les débuts de son intervention en entreprise, l'ergonome approfondit, étape par étape, sa compréhension de l'activité réelle des travailleurs concernés, des conditions d'exécution du travail qui déterminent cette activité et des résultats qui en sont obtenus aux niveaux des individus et de l'organisation. L'élucidation des liens entre conditions d'exécution, activité et résultats de l'activité est fondée sur une analyse rigoureuse des stratégies cognitives, physiologiques, perceptives, sociales et psychiques des opérateurs en situation réelle de travail. C'est cette compréhension approfondie de l'activité qui lui permet d'identifier précisément les liens réels entre conditions d'exécution du travail et résultats positifs et négatifs obtenus. Ainsi, l'ergonome pointe les aspects de la situation de travail à conserver ou à transformer (diagnostic ergonomique). Puis, en agissant sur la conception de ces déterminants, l'ergonome vise à modifier et à anticiper l'activité des opérateurs de façon à s'assurer que celle qui sera déployée dans la situation de travail transformée leur permettra de mieux atteindre les objectifs de production tout en prévenant les atteintes à leur santé et à leur sécurité (pronostic ergonomique).

Tel que mentionné dans l'article de Vézina et coll. « seule la connaissance spécifique du milieu de travail, sans cesse renouvelée à chaque étude, peut fournir des éléments de compréhension et de démonstration nécessaires au cheminement vers des transformations ». En d'autres termes, en plaçant l'analyse de l'activité au cœur de sa démarche, l'intervention ergonomique constitue donc un processus de recherche de solutions de conception rigoureux et objectif. Les connaissances de l'ergonome relatives à l'individu (ex. : mécanismes de l'erreur humaine, fonctionnement physiologique) et à l'individu au travail (ex. : normes d'aménagement des postes) ne servent donc pas à faire du *problem solving*, c'est-à-dire à identifier des solutions générales quelle que soit la situation de travail : elles servent à faire du *problem setting*, c'est-à-dire à orienter l'investigation en fonction de la demande de l'entreprise et des caractéristiques des activités de travail impliquées.

Par ailleurs, nous avons dit plus tôt que l'ergonome intervient dans des contextes de conception très diversifiés. Or, quelle que soit la nature de l'intervention, la connaissance approfondie de l'activité demeure le matériau de base utilisé pour répondre à la question de conception posée à l'ergonome. Ainsi, s'il intervient sur une problématique de dysfonctionnement ou d'incidents non contrôlés, l'ergonome pourra, par son analyse, établir un diagnostic et remonter aux conditions d'exécution du travail qui, par la médiation de l'activité réelle des travailleurs, déterminent ce dysfonctionnement ou ces incidents. De même, si la porte d'entrée de l'intervention

est une idée de transformation, l'ergonome pourra établir un diagnostic identifiant en quoi la conception existante produit des résultats positifs et négatifs et pointant les éléments de cette conception à conserver ou à transformer. Dans ces deux situations, l'analyse de l'activité est également utilisée pour établir un pronostic de l'activité qui sera déployée et des résultats qui seront obtenus une fois la situation de travail transformée.

Les détails des démarches d'analyse de l'activité, de diagnostic et de pronostic sont d'ailleurs l'objet de la section suivante.

Les méthodes de l'intervention en ergonomie

L'ouvrage de Guérin et coll. (1991) décrit dans les détails la démarche d'intervention en ergonomie, étape par étape. En marge d'une telle description chronologique de la démarche, nous opterons ici pour une description « par domaine de compétence ». Les compétences des ergonomes couvrent essentiellement quatre domaines : l'analyse de l'activité réelle, la traduction des connaissances sur l'activité réelle en repères de conception (le diagnostic ergonomique), l'accompagnement-validation des choix de conception visant à prévoir l'activité qui sera déployée dans une situation de travail future (le pronostic ergonomique) et la gestion d'une intervention ergonomique.

L'analyse (ou modélisation) de l'activité réelle

Nous avons dit plus tôt que l'élucidation des liens entre conditions d'exécution, activité et résultats de l'activité est fondée sur une analyse rigoureuse des stratégies cognitives, physiologiques, perceptives, sociales et psychiques des opérateurs en situation réelle de travail. Pour ce faire, l'analyse de l'activité articule une phase d'analyse préalable (entretiens, observations préliminaires, études d'accidents, etc.) suivie d'une phase d'analyse systématique. En phase d'analyse systématique, l'ergonome note finement ou enregistre sur vidéo des observations des gestes, déplacements, communications, opérations, etc. des opérateurs. Ces observations font par la suite l'objet de verbalisations grâce auxquelles l'opérateur peut expliciter la signification de ses manières de faire. La verbalisation, seul moyen d'accéder aux stratégies des opérateurs doit, pour être valide, être réalisée dans des conditions précises et adaptées à l'activité étudiée. Par exemple, les verbalisations en autoconfrontation (c'est-à-dire à partir d'un enregistrement vidéo) et simultanées ne permettent pas d'accéder aux manières de faire intégrées, que les opérateurs expérimentés mettent en œuvre sans en avoir conscience¹.

1. Sur les différentes formes de verbalisations, lire par exemple, Caverni (1988) ; pour une illustration des difficultés d'accès aux verbalisations des opérateurs, lire Lamonde (1995).

Dans ce numéro, deux articles traitent, en filigrane, de la verbalisation comme moyen d'accéder aux stratégies en ergonomie. Vézina et coll. montrent que l'analyse de la signification sous-jacente aux actions est incontournable même dans les cas d'activités en apparence exclusivement gestuelles et rapportent les verbalisations de travailleuses affectées à un poste répétitif de dépeçage de dinde. Bellemare et coll. explicitent les particularités de la verbalisation, laquelle ne doit pas être confondue avec des démarches du type « recueil d'opinions » ou « entretiens » dans lesquelles les travailleurs sont souvent impliqués.

Le diagnostic de conception

L'analyse de l'activité ou sa modélisation sert à l'ergonome, dans un premier temps, pour établir un diagnostic de conception. Deux types de connaissances sur l'existant sont alors dégagées et servent à élaborer des repères de conception (Jeffroy, 1993) :

- des connaissances sur les difficultés que les travailleurs éprouvent dans la situation existante et sur les causes de ces difficultés. Ces connaissances permettent d'élaborer des pistes de solutions visant à éliminer ces difficultés dans la future organisation et à favoriser de nouvelles manières de faire ;
- des connaissances sur les manières de travailler avec efficacité et sécurité développées dans la situation existante et sur les facteurs qui déterminent ces réussites. Ces connaissances permettent d'élaborer des pistes de solutions visant à transposer, dans la future organisation, les caractéristiques de la situation actuelle qui permettent à l'activité de se dérouler dans de bonnes conditions.

Par exemple, l'article de Bellemare et coll. fait état de stratégies de coopération développées par le personnel infirmier de deux unités de soins se situant à deux étages différents d'un hôpital. Ces stratégies, qui avaient des effets favorables sur la qualité des soins dispensés, étaient rendues possibles grâce à un escalier permettant la circulation d'informations. Cet élément de la situation existante a été transposé dans la conception architecturale du futur hôpital afin que ces stratégies efficaces puissent continuer à être mises en œuvre. De même, l'article de Filippi et coll. fait état de stratégies de coordination entre des contrôleurs régulant le trafic ferroviaire sur différentes sections du réseau de la banlieue parisienne. Ces stratégies reposaient fortement sur la consultation d'un tableau synoptique des circulations auquel tous les contrôleurs avaient accès. Alors que le projet initial prévoyait d'éliminer ce tableau synoptique, le diagnostic ergonomique a démontré de façon objective que le conserver était une condition d'efficacité et de sûreté du système.

Le diagnostic ergonomique conduit l'ergonome à rédiger ou à participer à la rédaction d'un cahier des charges réunissant les spécifications concrètes à rencontrer dans la conception (du dispositif technique ou informatique, de la future organisation, de la formation, etc.). L'exemple des contrôleurs du trafic ferroviaire développé dans Filippi et coll. illustre cette phase de la démarche d'intervention en ergonomie.

Le pronostic de conception

À partir des spécifications établies à la phase du diagnostic, des prototypes de conception d'équipements matériels ou immatériels, d'organisation du travail, d'espaces de travail ou de formation sont développés. Toute transformation d'une de ces composantes de la situation de travail, même mineure, peut conduire l'opérateur à développer de nouvelles manières de faire pour atteindre les objectifs attendus de lui. En ergonomie, l'intervention inclut l'accompagnement-validation de ces choix de conception. L'objectif est d'établir un pronostic de la nouvelle activité qui sera déployée et des résultats qui seront obtenus dans la situation de travail transformée. À partir de ce pronostic, l'ergonome valide les plans du futur hôpital, le prototype du logiciel nouvellement développé, etc. Le cas échéant, il identifie les difficultés probables d'utilisation que rencontreront les opérateurs et demande, avant implantation, des modifications au projet pour éviter ces difficultés.

Lorsque de nouveaux moyens de travail sont en phase d'élaboration et de développement, l'ergonome fait théoriquement face au « paradoxe de la conception » énoncé par Theureau et Pinsky (1984) : l'activité ne peut être analysée tant que la situation de travail n'est pas conçue, mais alors, il est trop tard pour influencer la conception. Des outils spécifiques ont donc dû être développés pour réaliser un tel pronostic malgré ce paradoxe. Les articles de Bellemare et coll. et de Filippi et coll., dans ce numéro, apportent une description détaillée de ce champ d'expertise de l'ergonome, à partir d'études empiriques réalisées, respectivement, dans le cadre d'un projet de conception d'une imprimerie et de conception d'une aide informatisée à la conduite automobile.

La gestion de l'intervention

L'intervention ergonomique s'accompagne d'une dynamique particulière à défaut de laquelle l'ergonome n'aura pas les moyens de réaliser ses analyses d'activité adéquatement ou encore les transformations suggérées à la suite de ces analyses ne seront ni acceptées, ni implantées. Les « compétences stratégiques » de l'ergonome s'exercent à plusieurs niveaux. Il s'agira pour lui de contribuer à la mise en place d'une structure de projet incluant les délais et moyens favorables à la réalisation des diagnostics et

pronostics de l'activité. Entre autres moyens, la structure de projet autorisera la participation des travailleurs (observés et impliqués dans le pronostic des futures manières de faire) et des concepteurs (architectes, ingénieurs, informaticiens, responsables ressources humaines, etc.) responsables des conceptions techniques, organisationnelles ou de formation. Une structure de gestion politique des choix de conception devra permettre que soient effectivement discutées les propositions qui ne font pas consensus entre ergonomes, concepteurs et travailleurs. La gestion politique de l'intervention même pose des défis considérables à l'ergonome qui intervient dans certaines entreprises où ceux qui, jusqu'ici, prenaient seuls les décisions de conception et d'organisation du travail (sans ergonome et sans prise en compte des besoins fonctionnels des travailleurs !) font preuve de résistance au changement.

Trois articles de ce numéro apportent une description détaillée de ce dernier champ de compétence de l'ergonome. Les articles de Bellemare et coll. et de Filippi et coll. traitent de l'interface entre la démarche d'intervention en ergonomie et les démarches traditionnelles de conduite de projet technique (respectivement, la conduite de projet en ingénierie et en informatique). L'article de Gadbois et coll. quant à lui aborde les implications sociales de l'intervention ergonomique par rapport aux institutions habituelles de négociation et de décision présentes dans les entreprises.

Une fois ces bases de l'ergonomie exposées, des perspectives de collaboration entre relations industrielles et ergonomie peuvent maintenant être proposées.

LE TRAVAIL HUMAIN, L'ERGONOMIE ET LES RELATIONS INDUSTRIELLES

La question de la collaboration entre ergonomie et relations industrielles apparaît justifiée dès lors que l'on admet que les deux disciplines cherchent à résoudre les problèmes pratiques et de connaissances relatifs au travail humain. Au-delà de cette observation générale, nous proposons, dans un premier temps, de préciser les points de rencontre entre les deux disciplines en étudiant l'objet d'étude, l'objectif pratique et l'évolution de chacune. Dans un deuxième temps, des formes concrètes de collaboration à faire naître entre ergonomes et spécialistes en relations industrielles sont proposées.

Les points de rencontre entre les deux disciplines

L'objet d'étude des relations industrielles peut être défini comme étant l'« ensemble des rapports économiques et sociaux, individuels et collectifs,

formels et informels, structurés et non structurés, qui naissent et s'établissent à l'occasion du travail (en vue de la production de biens et de services) dans un établissement, une entreprise... » (Dion 1986 : 405). *A priori*, il diffère considérablement de celui de l'ergonomie, défini préalablement comme étant l'activité des opérateurs en situation réelle de travail. Toutefois, cette différence d'objet n'empêche pas les deux disciplines de se pencher, dans certains cas, sur l'étude des mêmes phénomènes liés au travail humain. Par exemple, les chercheurs en relations industrielles ont depuis longtemps analysé sur le terrain et commenter les écarts entre travail prescrit et travail réel. Toutefois, ce même phénomène, étudié avec des « lunettes » différentes, a donné lieu à des explications différentes et complémentaires. En relations industrielles, l'écart entre travail prescrit et travail réel a trouvé des explications relatives à l'expression de l'autonomie ouvrière, de luttes de pouvoir et du contrôle ouvrier (ex. : Bélanger 1991), complémentaires à celles, amenées par les ergonomes, relatives à l'expression d'un besoin fonctionnel de produire.

Les deux disciplines se rejoignent par ailleurs au niveau de leurs objectifs pratiques. En effet, par ses interventions, l'ergonome peut jouer un rôle dans l'atteinte de l'objectif des professionnels en relations industrielles, qui est de « contribuer à l'émergence d'un climat de travail sain et bénéfique pour l'économie² ». Inversement, l'objectif de l'ergonomie, qui est de concevoir des situations de travail, recoupe le champ d'action des relations industrielles, notamment lorsque la composante de la situation de travail à concevoir touche l'organisation du travail et la formation. En fait, en matière d'organisation du travail et de formation, les deux disciplines se complètent en prenant en considération des critères de décision différents, les relations industrielles cherchant à agir sur les relations entre employés et employeurs, l'ergonomie cherchant à optimiser l'activité quotidienne de travail. Une collaboration comme celle de Teiger et Bernier (1990) permet d'ailleurs d'illustrer des points de rencontres possibles entre deux disciplines œuvrant dans un même domaine d'action. Cette étude aborde en effet la question de la qualification du travail et de son évolution en empruntant, en parallèle, une approche sociologique et une approche ergonomique. Pour ces auteures, l'analyse d'activité permet « d'inférer les compétences sous-jacentes [aux conduites des opérateurs], nécessaires et mises en œuvre, compétences souvent méconnues ou sous-estimées, y compris par les opérateurs eux-mêmes ». D'une façon générale, du seul fait des recoupements au niveau des champs d'action de l'ergonomie et des relations industrielles dans les entreprises, l'identification des formes d'interaction possibles entre les deux disciplines revêt un intérêt pratique

2. Documentation 1995 de l'Ordre professionnel des conseillers en relations industrielles du Québec (CRI).

indéniable : dans l'entreprise, le travail humain est un tout indivisible, son organisation ne doit donc pas souffrir d'une multiplication des rationalités et des méthodes artificiellement créées par la formation « des spécialistes du travail ».

Enfin, il semble bien qu'une « coïncidence historique » permette également d'expliquer l'intérêt actuellement porté à la question de la collaboration entre ergonomie et relations industrielles.

Du point de vue de l'ergonomie, l'intérêt de développer des liens avec les relations industrielles et les sciences de la gestion en général peut être vu comme le résultat d'un mûrissement de la discipline, mûrissement ayant connu deux phases préalables : une phase « identitaire » où l'ergonomie a positionné ses frontières par rapport aux divers domaines d'intervention traditionnellement associés aux relations industrielles, notamment par rapport à l'économie du travail, la gestion des ressources humaines, la psychologie industrielle, la sociologie du travail et l'organisation du travail (Montmollin 1990, 1994) et la santé et sécurité du travail (Lamonde et coll. 1993) ; une phase « technique » où l'ergonomie a concentré ses énergies sur le développement de modalités concrètes de collaboration avec les concepteurs travaillant en ingénierie (Daniellou et Garrigou 1990), en informatique (Theureau et Jeffroy 1994) et en architecture (Ledoux 1995)³. Tout se passe comme si l'ergonomie arrivait maintenant à une phase où elle se penche davantage sur l'opérationnalisation plus poussée des volets « organisation » et « gestion sociale » de sa pratique.

Parallèlement à cela, du côté des relations industrielles s'est développé un intérêt de plus en plus marqué pour les problèmes pratiques de gestion posés par les micromécanismes organisationnels que représente, dans l'entreprise, l'activité réelle et informelle des opérateurs⁴.

3. La phase « technique » a connu son équivalent dans les institutions d'enseignement, du moins au Québec l'ergonomie a d'abord pris place dans des départements de génie (École polytechnique, UQTR) et de sciences biologiques (UQAM). Puis, tout récemment, l'ergonomie s'est développée au sein des relations industrielles et du management (depuis 1991 à l'Université Laval).

4. Bien que le contexte actuel semble effectivement favorable au rapprochement, on ne peut laisser sous silence le fait que les deux disciplines auraient pu se rencontrer beaucoup plus tôt. En effet, pendant les années 50 à 70, l'ergonomie s'est beaucoup attachée à défendre le respect de l'intégrité physique des travailleurs comme critère de conception des situations de travail (les critères de productivité, d'efficacité et de fiabilité humaine étaient beaucoup moins prégnants) (lire, par exemple, Laville et coll. 1973). Parallèlement à cela, dans les années 50, les relations industrielles naissaient et s'organisaient comme discipline universitaire afin de s'intéresser au salarié « noyé dans de grands ensembles, mal assuré de sa sécurité [...] » et qui, de ce fait, « au risque d'être écrasé, s'il demeure seul [...] tend à rejoindre les diverses formations syndicales, pour mieux défendre et promouvoir ses intérêts professionnels » (Gosselin 1967 : 157). Plus encore, les deux

Ainsi, historiquement, la recherche en relations industrielles s'est surtout intéressée à l'étude des institutions, des lois et des rapports organisés qui s'établissent et évoluent à l'occasion du travail. Or, actuellement, il semble que l'on assiste à un déplacement de cet intérêt pour les institutions et les rapports organisés vers un intérêt pour l'étude des micro-rapports sociaux et de leurs relations avec le niveau macro-organisationnel. La conception même du champ de recherche évoluerait vers la notion de « régulation de la relation d'emploi », délaissant celle centrée sur le fonctionnement de la négociation collective (Edwards 1995). En conséquence, les études de cas deviendraient une méthode de recueil de données privilégiée parce que permettant de faire le lien entre le détail du site à l'étude et des questions plus larges sur la gestion des entreprises. Des généralisations pourraient alors en être tirées vis-à-vis la gestion des ressources humaines et le management.

Dans le même ordre d'idées, les spécialistes en gestion remettent maintenant en cause la pensée gestionnaire selon laquelle les actes de production peuvent être prédéterminés, pilotés et prévisibles ; dans ce contexte, ils doutent de la possibilité de relier directement certains modes de gestion organisationnelle à des indicateurs de performance (Moisson 1994). En d'autres termes, l'écart entre travail prescrit et travail réel serait l'expression d'une incapacité de l'appareil gestionnaire à mettre en place des procédures et des règles régulant entièrement l'activité de production et les performances. De Terssac (1992) a étudié ces phénomènes, qu'il a appelé « de régulation conjointe », à partir d'études empiriques du travail, dans des situations marquées par l'automatisation. Il montre que les règles formelles, bien que nombreuses, ne peuvent suffire. Les pannes et les imprévus obligent les opérateurs à transgresser ces règles pour assurer la continuité de la production de sorte « qu'un système de règles efficace n'est pas celui qui est décrété tel par l'encadrement ou par les exécutants, mais celui qu'ils produisent ensemble » (p. 221). Pour Moisson (1994), le versant pratique de ces phénomènes est que l'« on sent poindre un nouveau modèle gestionnaire, consistant à reconnaître *a priori* des zones d'autonomie importantes aux différents opérateurs de l'organisation. Un tel mouvement [...] suppose une transformation [...] profonde des relations internes

disciplines peuvent être vues comme étant nées, au même moment (au milieu du XX^e siècle), « en réaction » au taylorisme. En effet, dès ses débuts, l'ergonome a démontré qu'il fallait faire une distinction fondamentale entre travail prescrit et travail réel (Ombredane et Favre 1955 ; Montmollin 1967). Du côté des relations industrielles, le mouvement des relations humaines dans les années 50 (suivi du courant de psychologisation des organisations dans les années 60 et 70) est indirectement né du taylorisme qui, en menant à des formes abusives d'organisation du travail, a attiré l'attention des chercheurs intéressés par l'amélioration des conditions de travail (Friedberg 1993). Pour une brève description de l'histoire de l'ergonomie, lire Laville (1986).

aux entreprises : il s'agirait d'obtenir des modes d'implication des membres de l'entreprise relevant davantage du terme vague mais évocateur de citoyenneté que de l'assujettissement » (p. 15).

Dans l'entreprise : une synergie à faire naître

Les évolutions respectives de l'ergonomie et des relations industrielles auraient donc amené chacune de ces deux disciplines à se préoccuper, au même moment, des problèmes pratiques liés à la prise en compte du travail réel dans la gestion organisationnelle. Les sections qui suivent permettent d'avancer dans l'opérationnalisation d'une collaboration entre les deux disciplines visant à résoudre ces problèmes pratiques. En particulier, trois niveaux concrets de collaboration sont exposés et illustrés par les articles rassemblés dans ce numéro : l'élaboration de politiques de gestion du personnel, le processus de l'organisation du travail et le recours à la participation des travailleurs dans un contexte de réorganisation du travail.

Ergonomie et gestion du personnel

La figure 1 a permis d'expliquer la grille au travers de laquelle l'ergonome analyse et interprète les phénomènes relatifs au travail humain se produisant dans l'entreprise. Cette grille de lecture amène l'ergonome à documenter certains phénomènes provoqués ou traditionnellement gérés par le service du personnel.

En effet, du point de vue de l'ergonome, les décisions d'organisation du travail émanant du service du personnel constituent « des conditions d'exécution du travail » qui, au même titre que n'importe quelle autre condition de travail, déterminent l'activité quotidienne des opérateurs. L'analyse de l'activité peut donc l'amener à élucider précisément les liens entre de telles décisions d'organisation et les résultats qui en découlent pour l'entreprise. Deux articles de ce numéro illustrent comment l'analyse de l'activité documente les liens entre les décisions de gestion du personnel, l'activité quotidienne et les résultats de l'activité. Gaudart et coll. montrent que les politiques d'embauche, sous-traitance, réaffectation et mobilité selon l'ancienneté de même que les politiques d'organisation de la production affectent les marges de manœuvre dont les travailleurs âgés disposent pour élaborer des stratégies efficaces. L'activité quotidienne des travailleurs cachent donc les effets souvent insoupçonnés que les décisions de gestion du personnel ont sur la productivité effective mais également sur le roulement du personnel (phénomène de la sélection naturelle). L'article de Brun montre que les décisions émanant du service du personnel font, elles aussi, l'objet de stratégies de compromis et de régulation et que du fait de l'activité quotidienne déployée par les travailleurs, ces décisions peuvent

n'avoir qu'un impact relatif. À partir d'une étude des monteuses de ligne, l'auteur traite d'une forme particulière d'écart au travail prescrit : ceux que les travailleurs développent pour éviter la maladie mentale au travail et qui peuvent consister à braver le danger. Cet article montre donc les limites des politiques de sanctions et de réprimandes comme moyen d'éliminer des pratiques apparemment téméraires et périlleuses, mais répondant dans les faits à une logique à la fois opérationnelle et subjective.

Par ailleurs, du point de vue de l'ergonomie, les indices de dysfonctionnement se manifestant au niveau des individus, habituellement gérés par les responsables du personnel, peuvent être « des résultats de l'activité quotidienne » des opérateurs. Les articles de Brun, Gaudart et coll. et Vézina et coll. illustrent comment l'analyse de l'activité donne des explications opérationnelles et trouvent des causes techniques à des dysfonctionnements apparemment « humains » comme l'absence d'entraide et de coopération, l'exclusion de certains individus des collectifs du travail, la non-mobilité du personnel et le refus de changer de poste (notamment dans les cas où les postes de travail présentent des contraintes physiques fortes), le roulement du personnel (notamment, la sélection naturelle qui s'opère sur les postes de travail pénalisant les travailleurs âgés), la résistance au changement, le non respect des procédures prescrites de sécurité (ou le retour temporaire à leur respect au lendemain des accidents).

Nous avons vu que l'ergonome exploite ses analyses d'activité pour établir un diagnostic et un pronostic de conception des situations de travail. De ce fait, la lecture des phénomènes relatifs à la gestion du personnel que lui autorisent l'analyse de l'activité laisse entrevoir deux scénarios de collaboration entre ergonome et responsable ressources humaines pour résoudre des problèmes concrets de gestion du personnel.

Un premier scénario où le responsable ressources humaines est demandeur d'ouvrage. C'est-à-dire qu'il fait appel à l'ergonome pour intervenir sur un projet de transformation de l'organisation humaine du travail ou sur un dysfonctionnement se manifestant au niveau humain. Le lecteur intéressé par une illustration de ce scénario lira l'article de Vézina et coll. qui présente une intervention réalisée dans le secteur de l'abattage de volailles à partir d'une demande d'implantation de la polyvalence entre les employés de production et de réduction des lésions musculo-squelettiques. L'article de Bellemare et coll. présente également une intervention dont la demande initiale était formulée en termes de réduction des lésions musculo-squelettiques. Enfin, Gaudart et coll. sont intervenus sur un projet de gestion prévisionnelle des effectifs afin d'aider l'entreprise de fabrication de moteurs d'automobile à faire face au vieillissement de sa population de travailleurs. Tel que démontré dans ces trois articles, à l'issue de l'intervention ergonomique, la demande initiée par le service du personnel pourra

donner lieu à la conception d'équipements (matériels et immatériels) ou d'espaces et de locaux, à une réorganisation du travail ou au développement d'une formation opérationnelle.

Un second scénario où le responsable ressources humaines agit comme concepteur ayant à prendre en compte les résultats du diagnostic ergonomique. L'article de Bellemare et coll. montre que si l'ergonome est un acteur à part entière dans les processus menant à concevoir les situations de travail, celui-ci ne se substitue pas aux concepteurs techniques lorsque vient le temps de développer un logiciel, des plans architecturaux ou des équipements matériels. De la même façon, et quelle que soit la demande initiale, l'intervention ergonomique peut conduire à un diagnostic de transformation nécessitant de faire appel à l'expertise des spécialistes en ressources humaines. Par exemple, si aménager la coopération entre des opérateurs peut relever d'une conception technique (voir par exemple l'étude sur les contrôleurs de trafic ferroviaire dans Filippi et coll.), elle peut également relever de considérations humaines et sociales et nécessiter que soient atténuées les luttes de pouvoir divisant deux groupes professionnels (Lamonde, à paraître). Barthet et Pinsky (1987) clarifient le rôle de l'ergonome par rapport à l'informaticien en établissant un parallèle avec les liens entre architectes et ingénieurs. Dans ce dernier cas, l'architecte traduit les besoins des utilisateurs en spécifications d'espace puis, il collabore avec l'ingénieur à l'intégration de ces besoins dans la construction d'un édifice. De la même façon, l'ergonome traduit les besoins opérationnels des opérateurs afin qu'ils aient les moyens de réaliser un travail efficace (en quantité et qualité) et sécuritaire. Si ces besoins requièrent une transformation relevant de l'expertise du responsable ressources humaines, l'ergonome travaillera en collaboration avec lui pour concevoir la nouvelle situation de travail.

« Conduite simultanée » des projets de réorganisation du travail

Selon que l'on est ingénieur, informaticien, architecte, responsable ressources humaines ou ergonome, ce que l'on comprendra du travail que l'on organise et ce que l'on considérera comme un critère légitime d'organisation dépendra de notre culture professionnelle. Afin de faire échec au phénomène bien connu de la rationalité limitée⁵, la coopération entre ergonomes, spécialistes des ressources humaines et concepteurs techniques est nécessaire et ce, le plus tôt possible, dans le cadre des projets de transformation et de réorganisation menés dans les entreprises.

5. Les sociologues du travail Friedberg, Reynaud et Eraly ont beaucoup traité de ce concept de rationalité limitée. Bucciarelli (1988) a démontré ces différences de perspectives entre des ingénieurs de spécialisation différente (mécanique, électrique, etc.) travaillant en commun à un projet de conception technique.

L'objectif est d'enrichir les phases amonts des projets conduits dans les entreprises en évitant de dissocier l'information, la formation et l'organisation du travail de la réalisation technique. En s'assurant d'explorer ainsi les avenues possibles en début de projet, la pertinence des décisions sera moins sujette à une remise en cause tardive.

L'expression « conduite simultanée » fait référence à l'approche dite d'« ingénierie simultanée », basée sur le principe d'une coopération entre des concepteurs techniques qui, traditionnellement, intervenaient de manière séquentielle au cours d'un projet donné (par exemple, ingénierie de produit, de méthodes, puis de production). Ce dont il est question ici, c'est de faire évoluer une pratique encore répandue où les concepteurs techniques font appel aux ergonomes et aux spécialistes en relations industrielles pour gérer les impacts d'un projet industriel, une fois les décisions prises, vers une pratique où les différents acteurs de l'organisation du travail sont impliqués tôt dans les projets.

Cette perspective de synergie à faire naître entre les responsables ressources humaines, les ergonomes et les concepteurs techniques n'est pas nouvelle. Des développements parallèles menés par des ergonomes d'une part et des socio-techniciens d'autre part, ont déjà été réalisés en vue de faire infléchir les méthodes traditionnelles de conduite de projets informatiques, industriels et architecturaux. Ainsi, tel que discuté en première partie, les ergonomes ont développé des moyens concrets d'intégration de la prise en compte des besoins des utilisateurs dans les projets industriels ; ceux des socio-techniciens visent à intégrer la prise en compte des besoins humains et sociaux dans ces mêmes projets (Riboud 1987 ; Navarre 1993 ; Maire et Brument 1988). Par ailleurs, un mouvement similaire est perceptible du côté des ingénieurs qui voient de plus en plus les limites de l'approche technocentrée des problèmes de conception et l'intérêt de s'ouvrir aux sciences humaines et sociales lorsqu'il s'agit de concevoir des situations de travail (Lhote et coll. 1994).

Toutefois, les efforts réalisés jusqu'ici pour développer une pratique de conduite simultanée des projets de réorganisation du travail possèdent deux particularités desquelles émergent une limite importante à dépasser. Premièrement, les réflexions d'enrichissement des conduites de projet traditionnelles sont essentiellement menées discipline par discipline. Deuxièmement, elles abordent la simultanéité essentiellement « par couple de disciplines » (sciences humaines et disciplines techniques, ergonomie et disciplines techniques). Ainsi, à notre connaissance, seuls les écrits de Maire et Brument (1988) et de Riboud (1987) ont tenté une réelle intégration à la fois de l'ergonomie (pour la prise en compte de l'activité réelle et des besoins d'utilisation), des disciplines liées à la gestion des ressources humaines (pour la prise en compte de critères humains et sociaux) et des

disciplines techniques (pour la prise en compte de critères techniques). De même, ce numéro spécial est tout à fait représentatif de ces deux particularités : tel que mentionné plus tôt, les réflexions de l'ergonomie relative à l'établissement d'une coopération concrète avec les relations industrielles lors de réorganisations du travail en sont à leur début et les articles qui, dans ce numéro, traitent de conduite de projet (Filippi et coll. ; Bellemare et coll.) abordent exclusivement la coopération ergonomo-concepteur technique (informaticien ou ingénieur).

L'ergonomie a donc beaucoup à faire pour établir des modalités concrètes de collaboration avec les responsables ressources humaines (quel cahier des charges et quel accompagnement de projet mettre en place pour travailler avec une concepteur « ressources humaines » ?). De plus, pour que des modalités concrètes et applicables de synergie entre ergonomie, relations industrielles et disciplines techniques soient développées, les réflexions sur la conduite de projets industriels devront davantage être menées par le biais de collaborations interdisciplinaires.

Participation des travailleurs et relations de travail

La compréhension nécessaire de l'activité de travail, par l'ergonome, aux phases du diagnostic et de l'élaboration du pronostic en repères de conception appropriés, prévoit une participation des travailleurs. En relations industrielles, et particulièrement dans les processus de réorganisation du travail que vivent les entreprises ces dernières années, l'engagement des syndicats et les répercussions de cet engagement sont également des thèmes fortement présents (par ex. Bourque et Rioux 1994). Toutefois, l'expérience de participation à laquelle chacune des deux disciplines convie l'entreprise diffère à plusieurs niveaux.

Premièrement, en relations industrielles, les formes prédominantes de la participation des salariés aux réorganisations du travail sont tributaires de l'action syndicale alors qu'en ergonomie, c'est l'engagement direct des travailleurs à titre d'experts de leur travail qui est privilégié. Deuxièmement, dans un contexte de réorganisation, en relations industrielles, l'action des syndicats ou des travailleurs est principalement orientée vers les enjeux propres à la négociation alors qu'en ergonomie, l'action vise l'élaboration de critères de conception fonctionnels qui optimiseront le travail efficace et sécuritaire. Troisièmement, en relations industrielles, lorsque les travailleurs ou leurs représentants sont impliqués pour un apport fonctionnel, on sollicite leurs opinions en considérant qu'ils sont d'emblée « porteurs de solutions » alors qu'en ergonomie, cette forme de participation est considérée non suffisante. Il a en effet été montré que les travailleurs ne sont généralement pas en mesure de traduire leurs pratiques quotidiennes en repères de conception concrets, ni de faire valoir leurs besoins fonctionnels

comme critère d'organisation tout au long d'un projet (Lamonde 1995). En remplacement des modes spontanés d'exploration, l'ergonomie a développé des méthodes permettant d'aller plus loin qu'une simple sollicitation des opinions des principaux intéressés, notamment l'analyse de situations réelles de même que le pronostic centrés sur l'activité et basés sur des méthodes rigoureuses d'observation et de verbalisation, le recours à la validation et aux échanges avec les travailleurs en tant qu'experts et enfin, la démarche d'accompagnement des projets de conception. Ces aspects sont particulièrement explicites dans les articles de Filippi et coll. et de Bellemare et coll. décrivant les rôles que sont appelés à jouer les concepteurs, les travailleurs, l'ergonome et une instance négociatrice (comité de suivi composé des parties patronales et syndicales) à différentes étapes d'un projet de réorganisation. Une autre méthode, développée en ergonomie pour contrer les difficultés liées aux modes spontanés de sollicitation des travailleurs, consiste à former les travailleurs, leurs représentants syndicaux ou leurs supérieurs aux rudiments de l'analyse ergonomique de l'activité. Cette démarche est illustrée dans l'article de Gadbois et coll. relatant une expérience dite d'ergonomie participative menée auprès de représentants syndicaux.

À partir de ce constat de la diversité des pratiques des deux disciplines en matière de participation, deux perspectives de collaboration entre ergonomie et relations industrielles peuvent être identifiées. Une première apparaît d'emblée lorsque l'on envisage la coexistence concrète de l'ergonomie et des relations industrielles « sur le terrain » : il ne peut subsister plusieurs formes de participation dans l'entreprise sans que celles-ci ne soient intégrées, sans quoi les rôles de chacun et les objectifs poursuivis risquent d'être confus et l'exercice de participation inutile.

La seconde perspective de collaboration entre les deux disciplines est liée à la forte interaction qui existe entre la participation des travailleurs et les relations de travail. En particulier, des démarches comme celles mises en place en ergonomie ont deux types de répercussions sur les relations de travail dans l'entreprise. D'une part, elles changent la distribution du pouvoir entre hiérarchie et employés. En mettant en évidence l'existence d'une pluralité de rationalités dans l'entreprise et en légalisant la rationalité des opérateurs, elles favorisent en effet une reconnaissance des compétences informelles. De plus, elles redéfinissent le partage des rôles lors des projets puisqu'avec une démarche ergonomique, les concepteurs ne sont plus les seuls à faire valoir leur point de vue aux stades de la prise de décision (De Terssac 1990). D'autre part, la démarche ergonomique pose des questions relatives à la distribution du pouvoir entre le syndicat et ses membres. Dans une telle démarche, les travailleurs participent, à titre d'expert de leur travail, à l'élaboration de critères d'organisation du travail basés sur la prise

en compte de leurs besoins fonctionnels. De ce fait, ils peuvent être amenés à défendre des choix organisationnels qui sont en opposition avec les besoins collectifs défendus par les instances syndicales de négociation (Lamonde 1995). Une seconde perspective de collaboration entre ergonomie et relations industrielles peut donc être envisagée, qui tournerait autour de la question des interactions entre relations de travail et démarche participative.

À ce niveau, deux problèmes de connaissances et d'action concrète se posent. Un premier problème est lié à la phase qui précède l'intervention participative. Par exemple, la question a été rarement posée de savoir quel type de relations de travail préalables sont nécessaires pour pouvoir mettre en place avec succès une intervention ergonomique (Lamonde 1995). Un second problème concerne la phase d'intervention comme telle. Jusqu'ici, l'ergonomie a établi quelques règles d'intervention relatives à la division du fonctionnel et du négocié. Toutefois, il est probable qu'une série de relations de travail complexes s'opèrent dans l'entreprise et déterminent l'intervention ergonomique plus ou moins à l'insu de l'ergonome. L'expertise du spécialiste en relations industrielles pourrait à coup sûr aider l'ergonome à mieux comprendre les jeux relationnels et de pouvoir qui influencent l'efficacité de sa pratique.

CONCLUSION

L'ergonomie est une discipline relativement jeune et encore souvent méconnue. Dans ce contexte, le premier article de ce numéro spécial se devait de présenter les ambitions et moyens de l'ergonomie : son objet d'étude, l'activité de travail, défini comme étant les stratégies cognitives, physiologiques, perceptives, sociales et psychiques mis en œuvre par les travailleurs en situation réelle de travail ; son objectif, qui est de contribuer à la conception de ces situations ; les méthodes utilisées pour élaborer un diagnostic de l'activité en situation existante, un pronostic de l'activité après transformation et pour gérer une intervention jusqu'aux transformations effectives.

Une fois ces spécificités établies, la suite de cet article a été consacrée à la discussion des points de rencontre entre l'ergonomie et les relations industrielles. L'identification et le développement des interactions entre les deux disciplines revêt en effet un intérêt pratique indéniable. Si les deux s'intéressent à l'organisation du travail humain, dans l'entreprise, celle-ci ne doit pas souffrir des différences de rationalité artificiellement créées par la formation des « spécialistes du travail ». Selon que l'on est ingénieur, informaticien, architecte, responsable ressources humaines ou ergonome, ce que l'on comprendra du travail que l'on organise et ce que l'on considérera

comme un critère légitime d'organisation dépendra de notre culture professionnelle. Toutefois, la réalité quotidienne du travail et la solution optimale d'organisation transcendent les différences de langages, de perspectives et d'intérêts professionnels. Plus encore, dans le cas particulier des deux disciplines en cause, une telle position d'indifférence serait pratiquement impardonnable. En effet, l'ergonomie ne peut à la fois prôner « la prise en compte du travail réel » et autoriser une analyse en fonction d'un découpage artificiel basé sur sa seule expertise. De leur côté, les relations industrielles ne peuvent nier l'importance de reconnaître l'efficacité du travail réel et de mettre à la disposition des travailleurs les outils et moyens correspondant aux responsabilités et aux tâches qui leurs sont assignés.

Trois pôles de travail en commun ont été identifiés : la gestion des ressources humaines, la conduite des projets de réorganisation et la gestion des répercussions des démarches participatives sur les relations de travail. Le fait que ces trois pôles couvrent une part importante des activités de recherche et d'intervention qui ont déjà cours à la fois en ergonomie et en relations industrielles ajoute à l'importance de développer une réelle synergie entre les deux disciplines.

Ce numéro spécial, incluant cet article introductif, doit être vu comme une première tentative pour identifier des perspectives de collaboration entre ergonomie et relations industrielles. Il faut espérer qu'il suscitera la réflexion à propos d'autres modalités de collaboration possibles. Plus encore, il faut souhaiter que, concrètement, des ergonomes et des spécialistes en relations industrielles s'attacheront à résoudre ensemble certains problèmes pratiques et de connaissances posés par l'organisation du travail humain.

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Work, Ergonomics and Industrial Relations

FERNANDE LAMONDE
SYLVIE MONTREUIL

The articles in this special issue of Relations industrielles/Industrial Relations are the first that the journal has published about ergonomics. Accordingly, the present article has two objectives: to define the object of study, the objectives and the methodology that are characteristic of ergonomics; and to highlight the common points and possibilities of collaboration between industrial relations and ergonomics. The interest inherent in a collaboration between these two disciplines is explained, among other things, by a "historical coincidence". On the ergonomics side, a period that concentrated on developing concrete ways of collaborating with technical disciplines like engineering, computing and architecture has given way to a focus on "work organization" and the "social management aspect of ergonomics intervention". At the same time, industrial relations has developed a more pronounced interest in the practical management problems that are posed by micro-organizational processes within firms, namely, the informal work activities of operators. Three specific forms of future collaboration between ergonomists and industrial relations specialists are proposed.

"In the following pages, the reader will find [...] the description of a discipline that is both very modest and very ambitious. Modest in that it remains silent about the important changes that are completely changing the work environment. Very ambitious, however, in that ergonomics claims to create tools, theories and practices that allow it to design and modify work" (our translation). This quote from Montmollin (1990: 4) serves as an

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- LAMONDE, F. and S. MONTREUIL, Département des relations industrielles, Université Laval.
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excellent introduction to the two objectives of this thematic issue of *Relations industrielles/Industrial Relations*. The first objective is to provide an introduction to ergonomics and its ambitions in terms of objectives, objects of study and methodology. Indeed, this thematic issue represents the first time that *Relations industrielles/Industrial Relations* has published articles on ergonomics. For many of its readers, this article will therefore be their first contact with this rapidly growing discipline. The second objective is to identify certain practical and theoretical problems related to the work environment, problems that are not the exclusive preserve of ergonomists and which may therefore serve to promote a collaboration between industrial relations and ergonomics.

The articles selected for publication in this issue all describe field studies conducted in France or Canada. By illustrating both the ergonomic approach and the complementary nature of ergonomics and industrial relations, all of the articles contribute, to various degrees, to the two objectives of the issue. The present article is designed as an introduction and a guide. As an "introduction" because the first section provides a definition of the basic concepts of ergonomics and the steps of an ergonomic project, and the second section proposes a first sketch of the collaboration possibilities between industrial relations and ergonomics. As a "guide" because, for each of the themes discussed in these two sections, readers who wish to know more are directed to those articles in the issue which best illustrate the various points.

AMBITIONS AND TOOLS OF ERGONOMISTS

When ergonomists participate in industrial projects, they try to "understand what operators do in work situations, in order to find as complete and efficient an answer as possible to design questions: that is, determine what needs to be transformed in a situation and define design propositions or principles" (Pinsky 1991: 119, our translation).

The objective of all ergonomics studies is thus to arrive at a concrete design of work situations. This is accomplished by studying work activities, which means that in order to achieve design objectives, ergonomists must look at the "tricks of the trade", "ways of doing things" and "strategies" used by operators in work situations before these situations are transformed. The following sections define in more detail the objectives, object of study and methods of ergonomics.

The Objective: Designing Work Situations in a Variety of Contexts

The goal of ergonomists is to influence design decisions in companies so that the work situations of workers are functional or, in other words, so

that workers can work safely and efficiently in these situations. This objective leads ergonomists to examine a wide range of problems and industrial projects.

Indeed, the concept of a "work situation" covers all the conditions in which workers are placed to meet their production objective. From the viewpoint of the design object, ergonomists work in five fields: the design of material equipment (production systems, machinery, etc.), immaterial equipment (software, information and support systems, work procedures, etc.), work organization (division of responsibilities, number of employees, schedules, etc.), work space and premises, and, finally, training.

Moreover, the concept of "design" is to be understood in its largest sense, since ergonomists are involved in both creating new work situations and transforming existing situations, whether these projects are conducted in a continuous improvement or investment context. Finally, ergonomists are involved in projects that arise either from a proposed transformation (e.g., computerization, workforce reduction, automation, etc.) or from the diagnosis of a dysfunctional situation involving production (quality, productivity, etc.) or individuals (human errors, accidents, health problems, absenteeism, etc.).

The diversity of intervention contexts is well illustrated by the articles appearing in this issue. They describe ergonomics projects that led to concrete design solutions for work situations with diverse initial requirements: the anticipatory management of older workers in the automobile sector (Gaudart et al.); the training of union representatives to conduct ergonomics diagnoses of various dysfunctional situations in health establishments (Gadbois et al.); the design of autonomous intelligent cruise control for automobiles, control of urban rail traffic, and telephone assisted computer support (Filippi et al.); the design of a new residential and extended care centre and a new newspaper printing plant (Bellemare et al.); and the prevention of musculoskeletal injuries in poultry and pig processing plants (Vézina et al.; Bellemare et al.).

Finding Design Solutions by Studying Activities in Real Work Situations

Figure 1 illustrates the concept of an "activity". This concept is at the very heart of the analysis that ergonomists conduct and it constitutes their central object of study.

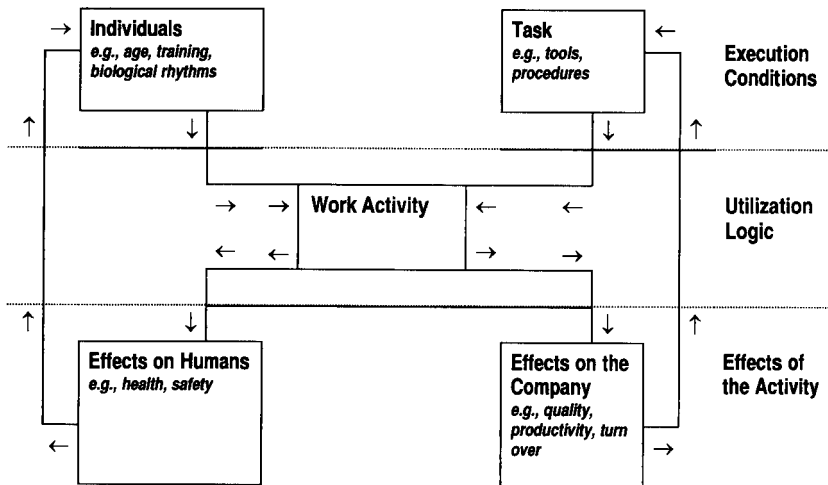
Work Activity as a Phenomena in Companies

The work activity of operators refers to the cognitive, physiological, perceptual, social and psychic strategies used by operators to execute their work as well as the means at their disposal for accomplishing the work.

The following two characteristics of work activities provide a fuller explanation of Figure 1, in particular the relationship that develops between available means, the work activity of operators and the results of their work.

FIGURE 1

Activities in Real Work Situation, the Object of Study of Ergonomics
(Diagram inspired by Leplat and Cuny 1984)



An activity is composed of compromise and adjustment strategies.
Work execution conditions comprise:

- worker characteristics, as human beings (with a given cognitive, physiological, social and psychic mode of functioning) and as individuals with acquired characteristics (experience, training, age) and spontaneous states (fatigue, biological rhythm);
- organizational characteristics, including temporal restrictions (schedules, production rhythm, deadlines, etc.), organizational means (instructions, task division, etc.) material equipment (tools, etc.), immaterial equipment (communication systems, etc.), and a physical environment (work environment, areas for movement and storage, etc.).

Work activity is determined by two characteristics of these execution conditions:

- they can be incompatible and thus oblige operators to develop compromise strategies;

- they can be variable and thus oblige operators to develop adjustment strategies. Individuals vary at an intra-individual level (fatigue, learning, aging, etc.) and an inter-individual level (age, training, experience, anthropometric characteristics, etc.). Organizational characteristics also vary regularly (raw materials to be used, different models to be produced, aging of equipment, temporary absence of a colleague or supervisor, etc.) and occasionally (equipment breakdown, etc.).

An example taken from the article by Gaudart et al. illustrates these two characteristics of work execution conditions and the resulting compromise and adjustment strategies. The project in question examined the activity of workers on an automobile engine production line. Analysis of their activity showed that older workers adapted their work rhythm and saved time and movement, as compared to younger workers, by going for parts less often. They accomplished this through a movement strategy which consisted of taking most of the parts in one hand and sliding them towards the fingers in the correct order and when needed. This compromise strategy between work rhythm and physiological capacities was developed by the older workers in order to adjust to a difference in their capacities brought about by aging, a strategy which permitted them to meet production standards.

It follows from these two characteristics of execution conditions that simply prescribing a work procedure is not sufficient for it to be followed. It must be compatible with other work execution conditions and adaptable to all of them. The conditions in which workers are placed must leave them "room to manoeuvre" and "space for their expertise" so that they may develop ways of doing things that will allow them to attain the expected production objectives. Determined by work execution conditions, it is these ways of doing things, these compromise and adjustment strategies, which represent the work activity studied by ergonomists.

An activity is a mediating element between a production system and company results. It is too often forgotten that computerizing a system does not necessarily result in an increase in productivity, just like prescribing a supposedly safe work method does not mean that accidents will decrease. In other words, there is not always a direct relationship between the execution conditions provided to workers and the results obtained by the company with respect to both individuals (accidents, work injuries, absenteeism, turnover, impact on personal life, etc.) and production (quality, quantity, low rate of machine use, delivery rates, rejects, etc.).

The results obtained concerning these two aspects depend on operator activities, namely, the compromise and adjustment strategies that they develop to cope with work execution conditions. These results will sometimes be negative (e.g., accidents), sometimes positive (e.g., efficiency), and

sometimes positive in some respects and negative in others (e.g., a riskier operation that takes less time).

The example cited above from Gaudart et al. gives a good illustration of the central role that an operator's work activity plays in a company's performance: production standards are achieved through the compromise and adjustment strategies adopted by workers to adjust to the effects of aging. Similarly, the article by Brun describes how linemen bypass certain safety rules which, when followed, actually increase the risk of accidents.

All of the articles in this issue provide examples of strategies discovered by ergonomists. Nonetheless, readers who wish to know more about the study of specific components of work activity will find the following articles of interest: Filippi et al. for the cognitive component, Brun for the psychic component and Vézina et al. for the psycho-physiological component.

The following section demonstrates how this knowledge of work activity serves as the basis for the development of concrete design solutions.

Work Activity as the Material Needed in the Design of Concrete Solutions

Right from the beginning of a project, ergonomists take a step-by-step approach to deepening their understanding of the work activities performed by workers, the work execution conditions that determine these activities and their results with respect to both individuals and the organization. The clarification of the relationship between work conditions, activities and their results is based on a rigorous analysis of the cognitive, physiological, perceptual, social and psychic strategies of operators in real work situations. It is through this detailed understanding of activities that an ergonomist can precisely identify the relationship between work execution conditions and positive and negative results. Ergonomists thus indicate which aspects of a work situation are to be retained and which are to be changed (ergonomics diagnosis). It is the goal of ergonomists, by working on the design of these determinants, to modify and anticipate the activity of operators so as to ensure that the activity used in this transformed work situation will make it easier for operators to meet production standards while still protecting their health and safety (ergonomics prognosis).

As mentioned in the article by Vézina et al., "only specific knowledge of a work environment, continuously renewed with each study, can provide the necessary elements of understanding and demonstration that lead to transformation" (our translation). In other words, by putting activity analysis at the heart of its approach, ergonomics provides a rigorous and objective process for the development of design solutions. The knowledge of ergonomists concerning human beings (e.g., mechanics of human error,

psychological functioning) and human beings at work (e.g., work station guidelines) help not only to identify possible solutions but also to orient the investigation to the company's requirements and to the characteristics of the work activities under study.

As was previously mentioned, ergonomists are called upon to study a diverse range of contexts. However, no matter the nature of the intervention, thorough knowledge of an activity remains the basic material that ergonomists use to answer design questions. For example, when confronted with a dysfunctional situation, an ergonomic analysis allows the researcher to make a diagnosis and to piece together the work execution conditions that, via the work activity of an operator, have caused the problem. Likewise, if the project arises out of a proposal for change, the ergonomist's diagnosis can identify the positive and negative results in the current design, and decide which elements should be kept or transformed. In both of these situations, activity analysis is also used to make a prognosis of the future activity and the results that will be obtained once the situation is transformed. The following section examines the details of activity analysis, diagnosis and prognosis.

Ergonomics Intervention Methods

A recent book by Guérin et al. (1991) gives a detailed, step-by-step description of the ergonomics approach. Our description differs in that it focuses on "fields of expertise". Ergonomics expertise can basically be divided into four categories: work activity analysis, transformation of knowledge about work activity into design criteria (ergonomics diagnosis), surveillance/validation of design choices in order to foresee activities to be used in future work situations (ergonomics prognosis) and management of an ergonomics project.

Analysis (or Modelling) of Work Activity

It was noted earlier that the clarification of the relationship between execution conditions, activities and activity results is founded on a rigorous analysis of the cognitive, physiological, perceptual, social and psychic strategies of operators in real work situations. This is accomplished by a preliminary analysis phase (interviews, preliminary observations, accident studies, etc.) followed by a phase of systematic analysis. In the systematic analysis phase, ergonomists use detailed notes or videotapes to make observations of the gestures, movements, communications, operations, etc. of operators. Operators then verbalize these observations so as to explain the meaning behind their ways of doing things. Verbalization is the only way of understanding the strategies of operators; to be valid, it must be

conducted under particular conditions and adapted to the activity being studied. For example, neither simultaneous nor self-confrontation (that is, using a video recording) verbalizations make it possible to understand the integrated ways of doing things that experienced operators unconsciously put into action.¹

Two of the articles in this issue indirectly discuss ergonomics' use of verbalization as a way of uncovering strategies. Vézina et al. show that analyzing the significance of an action is unavoidable even when activities seem only to be gestures, and give as an example the verbalizations of women making repetitive movements on a turkey cutting production line. Bellemare et al. explain the particularities of verbalization, a method that needs to be distinguished from such approaches as "collecting opinions" or "interviews" in which workers often take part.

Design Diagnosis

Ergonomists analyse or model an activity so as to determine, in the first instance, a design diagnosis. Two types of knowledge about the situation in question are thus gained and then used to develop design criteria (Jeffroy 1993):

- knowledge about the difficulties workers have with existing situations and the cause of these difficulties. This knowledge makes it possible to develop solutions whose goal is to eliminate these difficulties in the future and to encourage new ways of doing things;
- knowledge about the ways of doing things efficiently and safely that have been developed in the existing situation and about the factors that have contributed to these successes. This knowledge makes it possible to develop solutions which aim to carry over, into the new organization of work, those characteristics of the existing situation that create the appropriate conditions for the successful execution of an activity.

For example, the article by Bellemare et al. describes cooperation strategies developed by the nursing personnel of two units located on two different hospital floors. These strategies, which had a favourable impact on the quality of care, were made possible by a stairwell allowing direct communication and information exchange. This element of the existing situation was transposed in the architectural design of the future hospital so that efficient strategies could continue to be put into effect. In the same vein, the article by Filippi et al. describes coordination strategies between rail traffic controllers responsible for different network sections in Parisian

1. For more information on different forms of verbalizations, see Caverni (1988); for a description of difficulties in understanding operators's verbalizations, see Lamonde (1995).

suburbs. These strategies were directly based on a synoptic traffic table to which all the controllers had access. Although it had been proposed to eliminate this synoptic table, the ergonomics diagnosis showed objectively how retaining it would contribute to system efficiency and safety.

An ergonomics diagnosis leads ergonomists to write, or to help to write, a technical requirement report containing concrete design specifications (including technical, organizational, and training aspects). The example of the rail traffic controllers discussed by Filippi et al. illustrates this phase of an ergonomics project.

Design Prognosis

Using specifications established during the diagnostic phase, design prototypes for material or immaterial equipment, training, and work and space organization are developed. Transforming any one of the components of a work situation, however minor, can cause an operator to develop new ways of doing things to reach the required objectives. The ergonomics approach includes the surveillance/validation of these design choices. The objective is to make a prognosis of both the future activity and the results arising from the transformed work situation. Based on this prognosis, ergonomists validate the plans of a future hospital, a recently developed software prototype, etc. If need be, they identify probable utilization problems that operators will run into and propose modifications, before implementation, to avoid these difficulties.

When new work components are in the developmental phase, ergonomists are theoretically faced with the "design paradox" put forth by Theureau and Pinsky (1984): an activity cannot be analyzed as long as a situation has not been designed, and when it has, it is too late to influence the design. Specific tools have therefore been developed to make such prognoses possible despite this paradox. The articles by Bellemare et al. and Filippi et al. give a detailed description, based on empirical studies, of this field of expertise. The articles discuss respectively a design project for a newspaper printing plant and design of a software tool for automobile driving.

Managing Ergonomics Projects

An ergonomics project is necessarily dynamic; otherwise, ergonomists would not have the means to adequately conduct activity analysis, nor would the changes suggested by the analysis likely be accepted or implemented. There are several aspects to an ergonomist's "strategic expertise". The ergonomist must contribute to the implementation of a project structure that includes the deadlines and means required to make a

diagnosis and prognosis of an activity. One of the elements of the project structure is to ensure the participation of workers (who are observed and are involved in the prognosis of future ways of doing things) and designers (architects, engineers, computer analysts, human resource managers, etc.) in charge of technical and organizational design and training. A structure for the political management of design choices allows ergonomists, designers and workers to discuss propositions upon which they do not fully agree. The political management of a project can present considerable challenges for ergonomists, since in some of the companies they study, work design and organization decisions are made by managers (without ergonomists or any consideration of the operational needs of workers!) who prove to be rather resistant to change.

Three articles in this issue provide a detailed description of this field of ergonomics expertise. The articles by Bellemare et al. and Filippi et al. deal with the interface between the ergonomics intervention approach and the traditional approaches of technical project management in, respectively, engineering and computing. The article by Gadbois et al. discusses the social implications of ergonomics intervention with respect to the traditional structures of negotiation and decision making in companies.

This first section has described the basic concepts of ergonomics; the following section discusses possible areas of collaboration between industrial relations and ergonomics.

WORK, ERGONOMICS AND INDUSTRIAL RELATIONS

The possibility of collaboration between ergonomics and industrial relations arises from the fact that the two disciplines are trying to find solutions to practical and theoretical problems related to work. Beyond this general observation, this section first seeks to specify the points in common of these two disciplines by examining their objects of study, practical objectives and evolution. This is followed by some concrete proposals for future collaboration between ergonomists and industrial relations specialists.

Points in Common Between the Two Disciplines

The object of study of industrial relations can be defined as the "economic and social, individual and collective, formal and informal, and structured and unstructured relationships that arise and develop in a company or establishment's work (with a view to the production of goods and services)" (Dion 1986: 405, our translation). At first glance, this differs considerably from the object of study of ergonomics, defined earlier as the activity of operators in real work situations. Nonetheless, these different

objects of study do not keep the two disciplines from studying, in certain cases, the same work phenomena. For a long time now, industrial relations researchers have conducted field analyses and noted the gap between prescribed work and real work. However, this same phenomena, studied through different lenses, has given rise to different and complementary explanations. In industrial relations, the gap between prescribed work and real work has been explained as an expression of worker independence, power struggles and worker control (e.g., Bélanger 1991). This is complementary to the ergonomics explanation of a functional need to produce.

Furthermore, the two disciplines intersect with respect to their practical objectives. The research of ergonomists can play a role in successfully achieving the objective of industrial relations specialists, which is to "contribute to the emergence of a healthy climate which is beneficial for the economy" (our translation).² Conversely, the objective of ergonomics, which is to design work situations, overlaps with industrial relations' field of action, especially when the design of a particular aspect of a work situation affects work organization and training. In fact, as concerns work organization and training, the two disciplines complement each other by taking different decision criteria into consideration. Industrial relations is concerned with the relations between employees and employers, ergonomics with the optimization of daily work activities. The collaboration between Teiger and Bernier (1990) illustrates the possible common points existing between two disciplines working in the same field of action. Indeed, this study examines the question of work qualifications and their evolution by taking both a sociological and ergonomics approach. These authors believe that through activity analysis it is possible "to infer the underlying expertise [of operator conduct] that is both necessary and used, and which is often misunderstood and underestimated, including by the operators themselves" (our translation). The very fact that the fields of action of ergonomics and industrial relations intersect means that the identification of possible forms of interaction between the two disciplines has an undeniably practical side to it, since in companies, work is an indivisible whole. Its organization must therefore not be subject to multiple rationales and to methods that are artificially created by the training of "work specialists".

Finally, there seems to be an "historical coincidence" that can likewise explain the current interest in promoting collaboration between ergonomics and industrial relations.

From an ergonomics point of view, the interest in developing links with industrial relations and management sciences in general can be seen as the

2. Documentation from the Ordre professionnel des conseillers en relations industrielles du Québec (CRI).

result of the maturing of the discipline after two preliminary phases: an "identifying" phase during which ergonomics established its borders with respect to the various fields associated with industrial relations, especially with respect to labour economics, human resource management, industrial psychology, sociology of work, work organization (Montmollin 1990, 1994) and health and safety (Lamonde et al. 1993); and a "technical" phase during which ergonomics concentrated its energy on the development of concrete ways of collaborating with designers working in engineering (Daniellou and Garrigou 1990), computing (Theureau and Jeffroy 1994) and architecture (Ledoux 1995).³ Ergonomics now seems to have begun to take a more in-depth look at the operationalization of its "organizational" and "social management" aspects.

At the same time, industrial relations has developed a more pronounced interest in the practical management problems that are posed by micro-organizational processus within firms, namely the informal work activities of operators.⁴

Historically, industrial relations research has been interested in the study of the institutions, laws and organized relationships that are established and occur in the workplace. Presently however, there seems to be a shift towards an interest in the study of micro social relationships and their link with the macro-organizational level. The very conception of the field of study seems to be evolving from an examination of the functioning of collective negotiations to that of the "regulation of the employment

3. The "technical" phase has seen an equivalent development in teaching institutions, at least as far as Quebec is concerned. For example, ergonomics studies were originally part of engineering departments (École polytechnique, Université du Québec à Trois-Rivières) and biological sciences (Université du Québec à Montréal). In recent years, ergonomics has been associated with industrial relations and management (since 1991 at Université Laval).
4. Although the current context seems to favour closer ties, the fact that the two disciplines could have developed links long ago should not be ignored. Indeed, from the 1950s to the 1970s, ergonomics vigorously defended the respect of workers' physical integrity as a design criteria of work situations (productivity, efficiency and human reliability criteria were much less important) (see, for example, Laville et al. 1973). At the same time, 1950s saw the birth of industrial relations as a university discipline interested in the employee, who, "drowned in huge organizations, with little security [...]" and consequently "in danger of being squashed if he remained alone, [...] tended to join various union organizations in order to better defend and promote his occupational interests (our translation)" (Gosselin 1967: 157). Furthermore, the two disciplines can be seen as being born at the same time (in the middle of the 20th century) in "reaction" to Taylorism. In its early days, ergonomics showed that it was necessary to make a fundamental distinction between prescribed work and real work (Ombredane and Faverge 1955; Montmollin 1967). As concerns industrial relations, the human relations movement of the 1950s (followed by the psychologization of organizations in the 1960s and 1970s) arose indirectly out of Taylorism which, by leading to abusive forms of work organization, attracted the attention of researchers interested in improving work conditions (Friedberg 1993).

relationship" (Edwards 1995). Consequently, case studies will likely become a more popular data collection method, since they permit the establishment of a relationship between the particularity of the study site and wider questions about company management. Certain generalizations could then be made concerning human resources management and management itself.

In the same vein, management specialists have begun to question the idea that all of the various dimensions of production can be predetermined, guided and predicted. They doubt that it is possible to directly link certain types of organizational management with performance indicators (Moisdon 1994). In other words, the gap between prescribed work and real work is an expression of the management structure's inability to implement procedures and rules that entirely determine production and performance activities. De Terssac (1992) studied these phenomena, which he called "joint regulation", using empirical studies of work in the context of automation. He showed that formal rules, though numerous, were not sufficient. Breakdowns and unforeseen events force operators to bend rules in order to ensure that production continues. De Terssac concludes that an "efficient system of rules is not one that is ordained by either management or operators, but rather is one that they produce together" (p. 221, our translation). For Moisdon (1994), the practical side of these phenomena is that "a new management model seems to be taking form which accords, from the start, significant zones of autonomy to the various operators of an organization. Such an evolution [...] presupposes a profound transformation [...] of a company's internal relations: it is a question of having participation forms for company members that are inspired more by the vague but evocative term of citizenship than by that of subjection" (p. 15, our translation).

Creating Synergy Within Companies

The historical trajectories of ergonomics and industrial relations have therefore brought the two disciplines, at the same time, to examine practical problems related to taking real work into account in organizational management. The following sections examine how closer collaboration between these two disciplines, focused on these practical problems could be encouraged. In particular, three areas of collaboration are presented and illustrated by the other articles published in this issue: the development of personnel management policies, the process of work organization and the participation of workers in the reorganization of work.

Ergonomics and Personnel Management

Figure 1 set out the analytical framework used by ergonomists to analyze and interpret work phenomena occurring in organizations. This

framework aids ergonomists in documenting phenomena that are caused or traditionally managed by the personnel department.

In fact, ergonomists see personnel department decisions concerning work organization as being "work execution conditions" which, like any other work condition, determine the daily activity of operators. Activity analysis is thus used by ergonomists to specify the links between a given organizational decision and the results for the company. Two of the articles in this issue illustrate how activity analysis documents the links between personnel management decisions, daily activities and the results of those activities. Gaudart et al. show how hiring policies, subcontracting, job assignment and mobility based on seniority, and the organization of production can affect the manoeuvring room that older workers have in the development of efficient strategies. The unsuspected effects that personnel management decisions have not only on real productivity but also on employee turnover (selection mechanism) are often hidden in the daily activities of workers. The article by Brun shows how management decisions are subject to compromise and adjustment strategies, and how, due to the workers' daily activity, these decisions may only have a relative impact. Based on his study of linemen, Brun discusses a specific form of divergence from prescribed work, one which workers develop to avoid mental health problems and which can even go so far as acts of bravado. This article thus shows the limitations of penalties and reprimands as a way of eliminating apparently foolhardy and reckless practices that nonetheless correspond to an operational and subjective logic.

Moreover, from an ergonomics point of view, dysfunctional situations which are expressed at the individual level, and which are traditionally the responsibility of managers, can be "the result of the daily activities" of operators. The articles by Brun, Gaudart et al. and Vézina et al. describe how activity analysis provides operational explanations and finds the technical causes of dysfunctional situations hidden behind apparently "human" causes, such as: absence of cooperation and mutual support, exclusion of certain individuals from work groups, lack of mobility among personnel and refusal to change work stations (especially in cases where work stations have serious physical constraints), personnel turnover (especially at work stations that impose a natural selection by penalizing older workers), resistance to change, lack of adherence to prescribed safety procedures or the temporary period of adherence that occurs after an accident.

We have seen that ergonomists use activity analysis to make diagnoses and prognoses of work situation designs. Therefore, the interpretation they make, based on activity analysis, of aspects of personnel management provides two possible scenarios for collaboration between ergonomists and human resources specialists.

The first scenario is one where human resources specialists have requested the study. That is, ergonomists are asked to contribute to a work redesign project or to examine a dysfunctional work situation. Interested readers should refer to Vézina et al.'s article which presents a project conducted in the poultry processing sector. This project was initiated by a request to implement job rotation among the production employees and reduce musculoskeletal injuries. The article by Bellemare et al. likewise discusses a project that was initiated by a request to reduce musculoskeletal injuries. Finally, Gaudart et al. worked on a project of anticipatory personnel management in order to help an automobile engine manufacturing company deal adequately with its aging population of workers. As shown in these three articles, an ergonomics project that begins with a request by management might result in the design of equipment (material or immaterial), work space or premises, work reorganization or the development of a training programme.

The second scenario is one where human resources specialists are designers who must take an ergonomics diagnosis into account. The article by Bellemare et al. shows that though ergonomists are important actors in the process leading to the design of work situations, they cannot replace technical designers when it is time to develop software, architectural plans or physical equipment. Likewise, and whatever the initial request, an ergonomics project can lead to a transformation diagnosis that then requires the expertise of human resources specialists. For example, if the development of cooperation between operators can be a matter of technical design (see for example the study of rail traffic controllers in Filippi et al.), it can also involve human and social considerations and require the mitigation of power struggles between groups of workers (Lamonde forthcoming). Barthet and Pinsky (1987) clarify the role of ergonomists with respect to computer analysts by drawing a parallel between architects and engineers. In the latter case, architects translate user needs into spatial specifications and then collaborate with engineers to integrate these needs into the construction of a building. In the same way, ergonomists translate the operational needs of operators so that they may work efficiently and safely (in quantity and quality). If the transformation of these needs requires the expertise of human resources specialists, ergonomists will work with them to design new work situations.

"Concurrent Management" of Work Reorganization Projects

Depending on whether we are engineers, computer analysts, architects, human resources specialists or ergonomists, our understanding of work organization and what we consider to be legitimate organization criteria depends on our professional culture. If the well-known phenomenon of

bounded rationality⁵ is to be avoided, ergonomists, human resources specialists and technical designers must cooperate, as early as possible, when conducting transformation and reorganization projects in companies. The objective is to enrich the earlier phases of such projects by not separating information, training and work organization from technical execution. By ensuring that the various possible options are explored from the start, the relevance of certain decisions will be less likely to be questioned later on.

The expression "concurrent management" refers to an approach called "concurrent engineering", which is based on the principle of cooperation between technical designers, who, in the past, worked sequentially on a given project (e.g., product engineering, methods and then production). The objective here is to change from the still very common practice of technical designers calling upon ergonomists and industrial relations specialists to manage the impact of an industrial project only after the decisions have been made, to a practice where the different actors involved in work organization participate at an earlier stage in the project.

This prospect of an eventual synergy between human resources specialists, ergonomists and technical designers is not new. Ergonomists and socio-technical specialists have both carried out work intended to reorient the traditional methods of computing, industrial and architectural project management. As discussed in the first section, ergonomists have developed concrete methods of taking user needs into account and integrating them into industrial projects; the socio-technical approach has done the same for human and social needs in these same projects (Riboud 1987; Navarre 1993; Maire and Brument 1987). Moreover, a similar shift can be seen on the side of technical designers, who are becoming more and more aware of the limitations of a technology-centred approach to design problems and of the interest of benefitting from social and human sciences in work situation design (Lhote et al. 1994).

Nonetheless, efforts to date to develop a practice of concurrent management of work reorganization projects have been limited in two ways. Firstly, efforts to enrich traditional project management are essentially carried out discipline-by-discipline. Secondly, disciplinary linkages essentially occur in "twos", that is, human sciences and technical disciplines, or ergonomics and technical disciplines. To our knowledge, only Maire and Brument (1987) and Riboud (1987) have made serious attempts to integrate

5. The work sociologists Friedberg, Reynaud and Eraly have contributed greatly to the concept of limited rationale. Bucciarelli (1988) showed how engineers with different specializations (mechanical, electrical, etc.) could have different viewpoints when working together on a technical design project.

ergonomics (work activity and user needs) with disciplines concerned with human resources management (human and social criteria) and technical disciplines (technical criteria). Indeed, the articles published in this issue illustrate these two limits. As previously mentioned, ergonomics is only beginning to consider cooperation with industrial relations on work reorganization projects, and the articles on project management (Filippi et al. and Bellemare et al.) only discuss cooperation between ergonomists and technical designers (engineers and computer analysts).

Much therefore remains to be done before ergonomics can collaborate concretely with human resources specialists (e.g., which technical requirement report and project accompaniment should be used to work with a "human resources" designer?). Moreover, in order to develop a concrete and practical synergy between ergonomics, industrial relations and technical disciplines, there should be more emphasis on conducting industrial projects within an interdisciplinary framework.

Worker Participation and Work Relations

If ergonomists are to gain a sufficient understanding of work activity in the diagnosis and prognosis phases, in terms of appropriate design criteria, workers must participate in the study. In industrial relations, and in particular in the work reorganization process that companies have recently been going through, the involvement of unions and the effects of this involvement are likewise highly visible themes (e.g., Bourque and Rioux 1994). However, though both of these disciplines are encouraging companies to be more open to participatory practices, they differ in several respects.

Firstly, in industrial relations, the predominant form of employee participation in work reorganization arises from union action, whereas in ergonomics it is the direct participation of workers as experts in their work that is encouraged. Secondly, in a reorganization context, union and/or worker action is primarily directed towards negotiation issues in industrial relations, whereas in ergonomics their action aims at developing functional design criteria for the optimization of safe and efficient work. Thirdly, in industrial relations, when workers or their representatives are asked to make a functional contribution by expressing their opinions, it is assumed that they already have the solution, whereas in ergonomics this form of participation is considered to be insufficient. Indeed, it has been shown that workers are not generally capable of translating their daily habits into concrete design criteria, nor of describing their functional needs as organizational criteria throughout a project (Lamonde 1995). By replacing non-rigorous methods of exploration, ergonomics has developed methods which go farther than simply asking those concerned for their opinion,

namely: analysis of real situations, prognosis of an activity based on rigorous observation and verbalization methods, use of validation and exchanges with workers as experts, and, finally, a continuing surveillance approach to design projects. These aspects are particularly highlighted in the articles by Filippi et al. and Bellemare et al. which describe the role that designers, workers, ergonomists and a negotiating body (a committee composed of management and union representatives) must play at different stages of a reorganization project. Another method, developed in ergonomics to counteract difficulties associated with non-rigorous questioning of workers, consists of training workers, their union representatives and/or their supervisors to use elementary ergonomics activity analysis. This approach is illustrated in Gadbois et al.'s article, which discusses a case of union representatives' involvement in "participatory ergonomics".

Based on this description of the different participatory approaches of the two disciplines, two possible forms of collaboration between ergonomics and industrial relations can be identified. The first becomes apparent when we consider the concrete co-existence of ergonomics and industrial relations in the field: in a company, different forms of participation can only coexist if they are integrated. If such is not the case, there could be confusion about objectives and participants' roles, rendering the whole exercise futile.

The second possible form of collaboration between the two disciplines is related to the close interaction existing between worker participation and work relations. In particular, the approaches used in ergonomics have two types of repercussions on a company's work relations. On the one hand, they change the distribution of power between management and employees. By emphasizing the existence of several types of rationality in the company, and by legitimizing the rationality of operators, these approaches encourage a recognition of informal expertise. Moreover, they redefine the distribution of roles during projects, since in an ergonomics approach, designers are not the only ones to express their viewpoint during decision-making stages (De Terssac 1990). On the other hand, the ergonomics approach asks questions about the distribution of power between unions and their members. In such an approach, workers are considered to be experts at their jobs and participate in the development of work organization criteria, which is based on a consideration of their functional needs. Consequently, they might end up defending organizational choices that are opposed to the collective needs defended by union negotiators (Lamonde 1995). A second collaboration possibility between ergonomics and industrial relations can thus be proposed, revolving around the interaction between work relations and a participatory approach. There are two types of practical and theoretical problems that arise. The first is linked to the phase that precedes

a participatory project. For example, it is rarely asked what type of work relations are necessary to ensure the successful implementation of an ergonomics project (Lamonde 1995). A second problem concerns the intervention phase itself. Up until now, ergonomics has established a number of methodological rules concerning the separation of functional and negotiated aspects. However, it is difficult for ergonomists to be fully aware of all of the complex work relations that are present in a company. The expertise of industrial relations specialists could surely provide ergonomists with a better understanding of the relational interactions and power struggles that influence the effectiveness of their work.

CONCLUSION

Ergonomics is still a relatively young and misunderstood discipline. In this context, this article has sought to introduce the contents of the special issue by describing the ambitions and tools of ergonomics: its focus on work activity, which is defined as being the cognitive, physiological, perceptual, social and psychic strategies used by workers in real work situations; its objective, which is to contribute to the design of these situations; and its methods, which are used to make a diagnosis of the activity in an existing situation, a prognosis of the eventual activity after transformation and to manage the project until the transformation is completed.

The article has also discussed the points that ergonomics and industrial relations have in common. Identifying and developing the interaction between these two disciplines is a matter of no little practical interest. Though both are interested in work organization in companies, reorganization efforts should not be penalized by artificial differences in rationale arising from the training of "work specialists". Depending on whether we are engineers, computer analysts, architects, human resources specialists or ergonomists, our understanding of work organization and what we consider to be legitimate organization criteria depend on our specialization. Nonetheless, the daily reality of work and optimal organizational solutions transcend the differences in language, viewpoints and interests of our occupations. What is more, in the particular case of the two disciplines in question, such an attitude of indifference is inexcusable from a very practical point of view. Indeed, ergonomics cannot promote "the taking into account of work activity" and at the same time continue to pursue an analysis based on an artificial separation arising solely from ergonomics expertise. As for industrial relations specialists, they cannot deny the importance of recognizing the effectiveness of real work and of making tools available to workers that correspond to the responsibilities and tasks assigned to them.

Three kinds of common concerns have been identified, namely: management of human resources, management of reorganization projects and management of the repercussions of a participatory approach on work relations. The fact that these three issues cover a significant part of the current research and intervention activities of both ergonomics and industrial relations gives added importance to the development of a real synergy between these two disciplines.

This special issue of *Relations industrielles/Industrial Relations*, including this introductory article, should be seen as a first attempt at identifying possible areas of collaboration between ergonomics and industrial relations. We hope that it will stimulate other ideas concerning collaboration. Even more importantly, we hope that ergonomists and industrial relations specialists will work together to solve the practical and theoretical problems that arise from the way work is organized.

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Work, Ergonomics and Industrial Relations

FERNANDE LAMONDE
SYLVIE MONTREUIL

The articles in this special issue of Relations industrielles/Industrial Relations are the first that the journal has published about ergonomics. Accordingly, the present article has two objectives: to define the object of study, the objectives and the methodology that are characteristic of ergonomics; and to highlight the common points and possibilities of collaboration between industrial relations and ergonomics. The interest inherent in a collaboration between these two disciplines is explained, among other things, by a "historical coincidence". On the ergonomics side, a period that concentrated on developing concrete ways of collaborating with technical disciplines like engineering, computing and architecture has given way to a focus on "work organization" and the "social management aspect of ergonomics intervention". At the same time, industrial relations has developed a more pronounced interest in the practical management problems that are posed by micro-organizational processes within firms, namely, the informal work activities of operators. Three specific forms of future collaboration between ergonomists and industrial relations specialists are proposed.

"In the following pages, the reader will find [...] the description of a discipline that is both very modest and very ambitious. Modest in that it remains silent about the important changes that are completely changing the work environment. Very ambitious, however, in that ergonomics claims to create tools, theories and practices that allow it to design and modify work" (our translation). This quote from Montmollin (1990: 4) serves as an

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- LAMONDE, F. and S. MONTREUIL, Département des relations industrielles, Université Laval.
 - The authors would like to thank their colleague, Jacques Bélanger for his invaluable comments.

excellent introduction to the two objectives of this thematic issue of *Relations industrielles/Industrial Relations*. The first objective is to provide an introduction to ergonomics and its ambitions in terms of objectives, objects of study and methodology. Indeed, this thematic issue represents the first time that *Relations industrielles/Industrial Relations* has published articles on ergonomics. For many of its readers, this article will therefore be their first contact with this rapidly growing discipline. The second objective is to identify certain practical and theoretical problems related to the work environment, problems that are not the exclusive preserve of ergonomists and which may therefore serve to promote a collaboration between industrial relations and ergonomics.

The articles selected for publication in this issue all describe field studies conducted in France or Canada. By illustrating both the ergonomic approach and the complementary nature of ergonomics and industrial relations, all of the articles contribute, to various degrees, to the two objectives of the issue. The present article is designed as an introduction and a guide. As an "introduction" because the first section provides a definition of the basic concepts of ergonomics and the steps of an ergonomic project, and the second section proposes a first sketch of the collaboration possibilities between industrial relations and ergonomics. As a "guide" because, for each of the themes discussed in these two sections, readers who wish to know more are directed to those articles in the issue which best illustrate the various points.

AMBITIONS AND TOOLS OF ERGONOMISTS

When ergonomists participate in industrial projects, they try to "understand what operators do in work situations, in order to find as complete and efficient an answer as possible to design questions: that is, determine what needs to be transformed in a situation and define design propositions or principles" (Pinsky 1991: 119, our translation).

The objective of all ergonomics studies is thus to arrive at a concrete design of work situations. This is accomplished by studying work activities, which means that in order to achieve design objectives, ergonomists must look at the "tricks of the trade", "ways of doing things" and "strategies" used by operators in work situations before these situations are transformed. The following sections define in more detail the objectives, object of study and methods of ergonomics.

The Objective: Designing Work Situations in a Variety of Contexts

The goal of ergonomists is to influence design decisions in companies so that the work situations of workers are functional or, in other words, so

that workers can work safely and efficiently in these situations. This objective leads ergonomists to examine a wide range of problems and industrial projects.

Indeed, the concept of a "work situation" covers all the conditions in which workers are placed to meet their production objective. From the viewpoint of the design object, ergonomists work in five fields: the design of material equipment (production systems, machinery, etc.), immaterial equipment (software, information and support systems, work procedures, etc.), work organization (division of responsibilities, number of employees, schedules, etc.), work space and premises, and, finally, training.

Moreover, the concept of "design" is to be understood in its largest sense, since ergonomists are involved in both creating new work situations and transforming existing situations, whether these projects are conducted in a continuous improvement or investment context. Finally, ergonomists are involved in projects that arise either from a proposed transformation (e.g., computerization, workforce reduction, automation, etc.) or from the diagnosis of a dysfunctional situation involving production (quality, productivity, etc.) or individuals (human errors, accidents, health problems, absenteeism, etc.).

The diversity of intervention contexts is well illustrated by the articles appearing in this issue. They describe ergonomics projects that led to concrete design solutions for work situations with diverse initial requirements: the anticipatory management of older workers in the automobile sector (Gaudart et al.); the training of union representatives to conduct ergonomics diagnoses of various dysfunctional situations in health establishments (Gadbois et al.); the design of autonomous intelligent cruise control for automobiles, control of urban rail traffic, and telephone assisted computer support (Filippi et al.); the design of a new residential and extended care centre and a new newspaper printing plant (Bellemare et al.); and the prevention of musculoskeletal injuries in poultry and pig processing plants (Vézina et al.; Bellemare et al.).

Finding Design Solutions by Studying Activities in Real Work Situations

Figure 1 illustrates the concept of an "activity". This concept is at the very heart of the analysis that ergonomists conduct and it constitutes their central object of study.

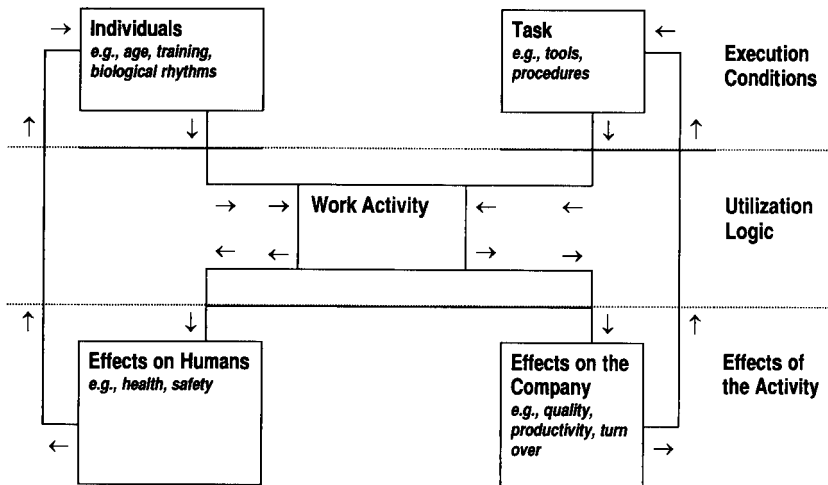
Work Activity as a Phenomena in Companies

The work activity of operators refers to the cognitive, physiological, perceptual, social and psychic strategies used by operators to execute their work as well as the means at their disposal for accomplishing the work.

The following two characteristics of work activities provide a fuller explanation of Figure 1, in particular the relationship that develops between available means, the work activity of operators and the results of their work.

FIGURE 1

Activities in Real Work Situation, the Object of Study of Ergonomics
(Diagram inspired by Leplat and Cuny 1984)



An activity is composed of compromise and adjustment strategies.
Work execution conditions comprise:

- worker characteristics, as human beings (with a given cognitive, physiological, social and psychic mode of functioning) and as individuals with acquired characteristics (experience, training, age) and spontaneous states (fatigue, biological rhythm);
- organizational characteristics, including temporal restrictions (schedules, production rhythm, deadlines, etc.), organizational means (instructions, task division, etc.) material equipment (tools, etc.), immaterial equipment (communication systems, etc.), and a physical environment (work environment, areas for movement and storage, etc.).

Work activity is determined by two characteristics of these execution conditions:

- they can be incompatible and thus oblige operators to develop compromise strategies;

- they can be variable and thus oblige operators to develop adjustment strategies. Individuals vary at an intra-individual level (fatigue, learning, aging, etc.) and an inter-individual level (age, training, experience, anthropometric characteristics, etc.). Organizational characteristics also vary regularly (raw materials to be used, different models to be produced, aging of equipment, temporary absence of a colleague or supervisor, etc.) and occasionally (equipment breakdown, etc.).

An example taken from the article by Gaudart et al. illustrates these two characteristics of work execution conditions and the resulting compromise and adjustment strategies. The project in question examined the activity of workers on an automobile engine production line. Analysis of their activity showed that older workers adapted their work rhythm and saved time and movement, as compared to younger workers, by going for parts less often. They accomplished this through a movement strategy which consisted of taking most of the parts in one hand and sliding them towards the fingers in the correct order and when needed. This compromise strategy between work rhythm and physiological capacities was developed by the older workers in order to adjust to a difference in their capacities brought about by aging, a strategy which permitted them to meet production standards.

It follows from these two characteristics of execution conditions that simply prescribing a work procedure is not sufficient for it to be followed. It must be compatible with other work execution conditions and adaptable to all of them. The conditions in which workers are placed must leave them "room to manoeuvre" and "space for their expertise" so that they may develop ways of doing things that will allow them to attain the expected production objectives. Determined by work execution conditions, it is these ways of doing things, these compromise and adjustment strategies, which represent the work activity studied by ergonomists.

An activity is a mediating element between a production system and company results. It is too often forgotten that computerizing a system does not necessarily result in an increase in productivity, just like prescribing a supposedly safe work method does not mean that accidents will decrease. In other words, there is not always a direct relationship between the execution conditions provided to workers and the results obtained by the company with respect to both individuals (accidents, work injuries, absenteeism, turnover, impact on personal life, etc.) and production (quality, quantity, low rate of machine use, delivery rates, rejects, etc.).

The results obtained concerning these two aspects depend on operator activities, namely, the compromise and adjustment strategies that they develop to cope with work execution conditions. These results will sometimes be negative (e.g., accidents), sometimes positive (e.g., efficiency), and

sometimes positive in some respects and negative in others (e.g., a riskier operation that takes less time).

The example cited above from Gaudart et al. gives a good illustration of the central role that an operator's work activity plays in a company's performance: production standards are achieved through the compromise and adjustment strategies adopted by workers to adjust to the effects of aging. Similarly, the article by Brun describes how linemen bypass certain safety rules which, when followed, actually increase the risk of accidents.

All of the articles in this issue provide examples of strategies discovered by ergonomists. Nonetheless, readers who wish to know more about the study of specific components of work activity will find the following articles of interest: Filippi et al. for the cognitive component, Brun for the psychic component and Vézina et al. for the psycho-physiological component.

The following section demonstrates how this knowledge of work activity serves as the basis for the development of concrete design solutions.

Work Activity as the Material Needed in the Design of Concrete Solutions

Right from the beginning of a project, ergonomists take a step-by-step approach to deepening their understanding of the work activities performed by workers, the work execution conditions that determine these activities and their results with respect to both individuals and the organization. The clarification of the relationship between work conditions, activities and their results is based on a rigorous analysis of the cognitive, physiological, perceptual, social and psychic strategies of operators in real work situations. It is through this detailed understanding of activities that an ergonomist can precisely identify the relationship between work execution conditions and positive and negative results. Ergonomists thus indicate which aspects of a work situation are to be retained and which are to be changed (ergonomics diagnosis). It is the goal of ergonomists, by working on the design of these determinants, to modify and anticipate the activity of operators so as to ensure that the activity used in this transformed work situation will make it easier for operators to meet production standards while still protecting their health and safety (ergonomics prognosis).

As mentioned in the article by Vézina et al., "only specific knowledge of a work environment, continuously renewed with each study, can provide the necessary elements of understanding and demonstration that lead to transformation" (our translation). In other words, by putting activity analysis at the heart of its approach, ergonomics provides a rigorous and objective process for the development of design solutions. The knowledge of ergonomists concerning human beings (e.g., mechanics of human error,

psychological functioning) and human beings at work (e.g., work station guidelines) help not only to identify possible solutions but also to orient the investigation to the company's requirements and to the characteristics of the work activities under study.

As was previously mentioned, ergonomists are called upon to study a diverse range of contexts. However, no matter the nature of the intervention, thorough knowledge of an activity remains the basic material that ergonomists use to answer design questions. For example, when confronted with a dysfunctional situation, an ergonomic analysis allows the researcher to make a diagnosis and to piece together the work execution conditions that, via the work activity of an operator, have caused the problem. Likewise, if the project arises out of a proposal for change, the ergonomist's diagnosis can identify the positive and negative results in the current design, and decide which elements should be kept or transformed. In both of these situations, activity analysis is also used to make a prognosis of the future activity and the results that will be obtained once the situation is transformed. The following section examines the details of activity analysis, diagnosis and prognosis.

Ergonomics Intervention Methods

A recent book by Guérin et al. (1991) gives a detailed, step-by-step description of the ergonomics approach. Our description differs in that it focuses on "fields of expertise". Ergonomics expertise can basically be divided into four categories: work activity analysis, transformation of knowledge about work activity into design criteria (ergonomics diagnosis), surveillance/validation of design choices in order to foresee activities to be used in future work situations (ergonomics prognosis) and management of an ergonomics project.

Analysis (or Modelling) of Work Activity

It was noted earlier that the clarification of the relationship between execution conditions, activities and activity results is founded on a rigorous analysis of the cognitive, physiological, perceptual, social and psychic strategies of operators in real work situations. This is accomplished by a preliminary analysis phase (interviews, preliminary observations, accident studies, etc.) followed by a phase of systematic analysis. In the systematic analysis phase, ergonomists use detailed notes or videotapes to make observations of the gestures, movements, communications, operations, etc. of operators. Operators then verbalize these observations so as to explain the meaning behind their ways of doing things. Verbalization is the only way of understanding the strategies of operators; to be valid, it must be

conducted under particular conditions and adapted to the activity being studied. For example, neither simultaneous nor self-confrontation (that is, using a video recording) verbalizations make it possible to understand the integrated ways of doing things that experienced operators unconsciously put into action.¹

Two of the articles in this issue indirectly discuss ergonomics' use of verbalization as a way of uncovering strategies. Vézina et al. show that analyzing the significance of an action is unavoidable even when activities seem only to be gestures, and give as an example the verbalizations of women making repetitive movements on a turkey cutting production line. Bellemare et al. explain the particularities of verbalization, a method that needs to be distinguished from such approaches as "collecting opinions" or "interviews" in which workers often take part.

Design Diagnosis

Ergonomists analyse or model an activity so as to determine, in the first instance, a design diagnosis. Two types of knowledge about the situation in question are thus gained and then used to develop design criteria (Jeffroy 1993):

- knowledge about the difficulties workers have with existing situations and the cause of these difficulties. This knowledge makes it possible to develop solutions whose goal is to eliminate these difficulties in the future and to encourage new ways of doing things;
- knowledge about the ways of doing things efficiently and safely that have been developed in the existing situation and about the factors that have contributed to these successes. This knowledge makes it possible to develop solutions which aim to carry over, into the new organization of work, those characteristics of the existing situation that create the appropriate conditions for the successful execution of an activity.

For example, the article by Bellemare et al. describes cooperation strategies developed by the nursing personnel of two units located on two different hospital floors. These strategies, which had a favourable impact on the quality of care, were made possible by a stairwell allowing direct communication and information exchange. This element of the existing situation was transposed in the architectural design of the future hospital so that efficient strategies could continue to be put into effect. In the same vein, the article by Filippi et al. describes coordination strategies between rail traffic controllers responsible for different network sections in Parisian

1. For more information on different forms of verbalizations, see Caverni (1988); for a description of difficulties in understanding operators's verbalizations, see Lamonde (1995).

suburbs. These strategies were directly based on a synoptic traffic table to which all the controllers had access. Although it had been proposed to eliminate this synoptic table, the ergonomics diagnosis showed objectively how retaining it would contribute to system efficiency and safety.

An ergonomics diagnosis leads ergonomists to write, or to help to write, a technical requirement report containing concrete design specifications (including technical, organizational, and training aspects). The example of the rail traffic controllers discussed by Filippi et al. illustrates this phase of an ergonomics project.

Design Prognosis

Using specifications established during the diagnostic phase, design prototypes for material or immaterial equipment, training, and work and space organization are developed. Transforming any one of the components of a work situation, however minor, can cause an operator to develop new ways of doing things to reach the required objectives. The ergonomics approach includes the surveillance/validation of these design choices. The objective is to make a prognosis of both the future activity and the results arising from the transformed work situation. Based on this prognosis, ergonomists validate the plans of a future hospital, a recently developed software prototype, etc. If need be, they identify probable utilization problems that operators will run into and propose modifications, before implementation, to avoid these difficulties.

When new work components are in the developmental phase, ergonomists are theoretically faced with the "design paradox" put forth by Theureau and Pinsky (1984): an activity cannot be analyzed as long as a situation has not been designed, and when it has, it is too late to influence the design. Specific tools have therefore been developed to make such prognoses possible despite this paradox. The articles by Bellemare et al. and Filippi et al. give a detailed description, based on empirical studies, of this field of expertise. The articles discuss respectively a design project for a newspaper printing plant and design of a software tool for automobile driving.

Managing Ergonomics Projects

An ergonomics project is necessarily dynamic; otherwise, ergonomists would not have the means to adequately conduct activity analysis, nor would the changes suggested by the analysis likely be accepted or implemented. There are several aspects to an ergonomist's "strategic expertise". The ergonomist must contribute to the implementation of a project structure that includes the deadlines and means required to make a

diagnosis and prognosis of an activity. One of the elements of the project structure is to ensure the participation of workers (who are observed and are involved in the prognosis of future ways of doing things) and designers (architects, engineers, computer analysts, human resource managers, etc.) in charge of technical and organizational design and training. A structure for the political management of design choices allows ergonomists, designers and workers to discuss propositions upon which they do not fully agree. The political management of a project can present considerable challenges for ergonomists, since in some of the companies they study, work design and organization decisions are made by managers (without ergonomists or any consideration of the operational needs of workers!) who prove to be rather resistant to change.

Three articles in this issue provide a detailed description of this field of ergonomics expertise. The articles by Bellemare et al. and Filippi et al. deal with the interface between the ergonomics intervention approach and the traditional approaches of technical project management in, respectively, engineering and computing. The article by Gadbois et al. discusses the social implications of ergonomics intervention with respect to the traditional structures of negotiation and decision making in companies.

This first section has described the basic concepts of ergonomics; the following section discusses possible areas of collaboration between industrial relations and ergonomics.

WORK, ERGONOMICS AND INDUSTRIAL RELATIONS

The possibility of collaboration between ergonomics and industrial relations arises from the fact that the two disciplines are trying to find solutions to practical and theoretical problems related to work. Beyond this general observation, this section first seeks to specify the points in common of these two disciplines by examining their objects of study, practical objectives and evolution. This is followed by some concrete proposals for future collaboration between ergonomists and industrial relations specialists.

Points in Common Between the Two Disciplines

The object of study of industrial relations can be defined as the "economic and social, individual and collective, formal and informal, and structured and unstructured relationships that arise and develop in a company or establishment's work (with a view to the production of goods and services)" (Dion 1986: 405, our translation). At first glance, this differs considerably from the object of study of ergonomics, defined earlier as the activity of operators in real work situations. Nonetheless, these different

objects of study do not keep the two disciplines from studying, in certain cases, the same work phenomena. For a long time now, industrial relations researchers have conducted field analyses and noted the gap between prescribed work and real work. However, this same phenomena, studied through different lenses, has given rise to different and complementary explanations. In industrial relations, the gap between prescribed work and real work has been explained as an expression of worker independence, power struggles and worker control (e.g., Bélanger 1991). This is complementary to the ergonomics explanation of a functional need to produce.

Furthermore, the two disciplines intersect with respect to their practical objectives. The research of ergonomists can play a role in successfully achieving the objective of industrial relations specialists, which is to "contribute to the emergence of a healthy climate which is beneficial for the economy" (our translation).² Conversely, the objective of ergonomics, which is to design work situations, overlaps with industrial relations' field of action, especially when the design of a particular aspect of a work situation affects work organization and training. In fact, as concerns work organization and training, the two disciplines complement each other by taking different decision criteria into consideration. Industrial relations is concerned with the relations between employees and employers, ergonomics with the optimization of daily work activities. The collaboration between Teiger and Bernier (1990) illustrates the possible common points existing between two disciplines working in the same field of action. Indeed, this study examines the question of work qualifications and their evolution by taking both a sociological and ergonomics approach. These authors believe that through activity analysis it is possible "to infer the underlying expertise [of operator conduct] that is both necessary and used, and which is often misunderstood and underestimated, including by the operators themselves" (our translation). The very fact that the fields of action of ergonomics and industrial relations intersect means that the identification of possible forms of interaction between the two disciplines has an undeniably practical side to it, since in companies, work is an indivisible whole. Its organization must therefore not be subject to multiple rationales and to methods that are artificially created by the training of "work specialists".

Finally, there seems to be an "historical coincidence" that can likewise explain the current interest in promoting collaboration between ergonomics and industrial relations.

From an ergonomics point of view, the interest in developing links with industrial relations and management sciences in general can be seen as the

2. Documentation from the Ordre professionnel des conseillers en relations industrielles du Québec (CRI).

result of the maturing of the discipline after two preliminary phases: an "identifying" phase during which ergonomics established its borders with respect to the various fields associated with industrial relations, especially with respect to labour economics, human resource management, industrial psychology, sociology of work, work organization (Montmollin 1990, 1994) and health and safety (Lamonde et al. 1993); and a "technical" phase during which ergonomics concentrated its energy on the development of concrete ways of collaborating with designers working in engineering (Daniellou and Garrigou 1990), computing (Theureau and Jeffroy 1994) and architecture (Ledoux 1995).³ Ergonomics now seems to have begun to take a more in-depth look at the operationalization of its "organizational" and "social management" aspects.

At the same time, industrial relations has developed a more pronounced interest in the practical management problems that are posed by micro-organizational processus within firms, namely the informal work activities of operators.⁴

Historically, industrial relations research has been interested in the study of the institutions, laws and organized relationships that are established and occur in the workplace. Presently however, there seems to be a shift towards an interest in the study of micro social relationships and their link with the macro-organizational level. The very conception of the field of study seems to be evolving from an examination of the functioning of collective negotiations to that of the "regulation of the employment

3. The "technical" phase has seen an equivalent development in teaching institutions, at least as far as Quebec is concerned. For example, ergonomics studies were originally part of engineering departments (École polytechnique, Université du Québec à Trois-Rivières) and biological sciences (Université du Québec à Montréal). In recent years, ergonomics has been associated with industrial relations and management (since 1991 at Université Laval).
4. Although the current context seems to favour closer ties, the fact that the two disciplines could have developed links long ago should not be ignored. Indeed, from the 1950s to the 1970s, ergonomics vigorously defended the respect of workers' physical integrity as a design criteria of work situations (productivity, efficiency and human reliability criteria were much less important) (see, for example, Laville et al. 1973). At the same time, 1950s saw the birth of industrial relations as a university discipline interested in the employee, who, "drowned in huge organizations, with little security [...]" and consequently "in danger of being squashed if he remained alone, [...] tended to join various union organizations in order to better defend and promote his occupational interests (our translation)" (Gosselin 1967: 157). Furthermore, the two disciplines can be seen as being born at the same time (in the middle of the 20th century) in "reaction" to Taylorism. In its early days, ergonomics showed that it was necessary to make a fundamental distinction between prescribed work and real work (Ombredane and Faverge 1955; Montmollin 1967). As concerns industrial relations, the human relations movement of the 1950s (followed by the psychologization of organizations in the 1960s and 1970s) arose indirectly out of Taylorism which, by leading to abusive forms of work organization, attracted the attention of researchers interested in improving work conditions (Friedberg 1993).

relationship" (Edwards 1995). Consequently, case studies will likely become a more popular data collection method, since they permit the establishment of a relationship between the particularity of the study site and wider questions about company management. Certain generalizations could then be made concerning human resources management and management itself.

In the same vein, management specialists have begun to question the idea that all of the various dimensions of production can be predetermined, guided and predicted. They doubt that it is possible to directly link certain types of organizational management with performance indicators (Moisdon 1994). In other words, the gap between prescribed work and real work is an expression of the management structure's inability to implement procedures and rules that entirely determine production and performance activities. De Terssac (1992) studied these phenomena, which he called "joint regulation", using empirical studies of work in the context of automation. He showed that formal rules, though numerous, were not sufficient. Breakdowns and unforeseen events force operators to bend rules in order to ensure that production continues. De Terssac concludes that an "efficient system of rules is not one that is ordained by either management or operators, but rather is one that they produce together" (p. 221, our translation). For Moisdon (1994), the practical side of these phenomena is that "a new management model seems to be taking form which accords, from the start, significant zones of autonomy to the various operators of an organization. Such an evolution [...] presupposes a profound transformation [...] of a company's internal relations: it is a question of having participation forms for company members that are inspired more by the vague but evocative term of citizenship than by that of subjection" (p. 15, our translation).

Creating Synergy Within Companies

The historical trajectories of ergonomics and industrial relations have therefore brought the two disciplines, at the same time, to examine practical problems related to taking real work into account in organizational management. The following sections examine how closer collaboration between these two disciplines, focused on these practical problems could be encouraged. In particular, three areas of collaboration are presented and illustrated by the other articles published in this issue: the development of personnel management policies, the process of work organization and the participation of workers in the reorganization of work.

Ergonomics and Personnel Management

Figure 1 set out the analytical framework used by ergonomists to analyze and interpret work phenomena occurring in organizations. This

framework aids ergonomists in documenting phenomena that are caused or traditionally managed by the personnel department.

In fact, ergonomists see personnel department decisions concerning work organization as being "work execution conditions" which, like any other work condition, determine the daily activity of operators. Activity analysis is thus used by ergonomists to specify the links between a given organizational decision and the results for the company. Two of the articles in this issue illustrate how activity analysis documents the links between personnel management decisions, daily activities and the results of those activities. Gaudart et al. show how hiring policies, subcontracting, job assignment and mobility based on seniority, and the organization of production can affect the manoeuvring room that older workers have in the development of efficient strategies. The unsuspected effects that personnel management decisions have not only on real productivity but also on employee turnover (selection mechanism) are often hidden in the daily activities of workers. The article by Brun shows how management decisions are subject to compromise and adjustment strategies, and how, due to the workers' daily activity, these decisions may only have a relative impact. Based on his study of linemen, Brun discusses a specific form of divergence from prescribed work, one which workers develop to avoid mental health problems and which can even go so far as acts of bravado. This article thus shows the limitations of penalties and reprimands as a way of eliminating apparently foolhardy and reckless practices that nonetheless correspond to an operational and subjective logic.

Moreover, from an ergonomics point of view, dysfunctional situations which are expressed at the individual level, and which are traditionally the responsibility of managers, can be "the result of the daily activities" of operators. The articles by Brun, Gaudart et al. and Vézina et al. describe how activity analysis provides operational explanations and finds the technical causes of dysfunctional situations hidden behind apparently "human" causes, such as: absence of cooperation and mutual support, exclusion of certain individuals from work groups, lack of mobility among personnel and refusal to change work stations (especially in cases where work stations have serious physical constraints), personnel turnover (especially at work stations that impose a natural selection by penalizing older workers), resistance to change, lack of adherence to prescribed safety procedures or the temporary period of adherence that occurs after an accident.

We have seen that ergonomists use activity analysis to make diagnoses and prognoses of work situation designs. Therefore, the interpretation they make, based on activity analysis, of aspects of personnel management provides two possible scenarios for collaboration between ergonomists and human resources specialists.

The first scenario is one where human resources specialists have requested the study. That is, ergonomists are asked to contribute to a work redesign project or to examine a dysfunctional work situation. Interested readers should refer to Vézina et al.'s article which presents a project conducted in the poultry processing sector. This project was initiated by a request to implement job rotation among the production employees and reduce musculoskeletal injuries. The article by Bellemare et al. likewise discusses a project that was initiated by a request to reduce musculoskeletal injuries. Finally, Gaudart et al. worked on a project of anticipatory personnel management in order to help an automobile engine manufacturing company deal adequately with its aging population of workers. As shown in these three articles, an ergonomics project that begins with a request by management might result in the design of equipment (material or immaterial), work space or premises, work reorganization or the development of a training programme.

The second scenario is one where human resources specialists are designers who must take an ergonomics diagnosis into account. The article by Bellemare et al. shows that though ergonomists are important actors in the process leading to the design of work situations, they cannot replace technical designers when it is time to develop software, architectural plans or physical equipment. Likewise, and whatever the initial request, an ergonomics project can lead to a transformation diagnosis that then requires the expertise of human resources specialists. For example, if the development of cooperation between operators can be a matter of technical design (see for example the study of rail traffic controllers in Filippi et al.), it can also involve human and social considerations and require the mitigation of power struggles between groups of workers (Lamonde forthcoming). Barthet and Pinsky (1987) clarify the role of ergonomists with respect to computer analysts by drawing a parallel between architects and engineers. In the latter case, architects translate user needs into spatial specifications and then collaborate with engineers to integrate these needs into the construction of a building. In the same way, ergonomists translate the operational needs of operators so that they may work efficiently and safely (in quantity and quality). If the transformation of these needs requires the expertise of human resources specialists, ergonomists will work with them to design new work situations.

"Concurrent Management" of Work Reorganization Projects

Depending on whether we are engineers, computer analysts, architects, human resources specialists or ergonomists, our understanding of work organization and what we consider to be legitimate organization criteria depends on our professional culture. If the well-known phenomenon of

bounded rationality⁵ is to be avoided, ergonomists, human resources specialists and technical designers must cooperate, as early as possible, when conducting transformation and reorganization projects in companies. The objective is to enrich the earlier phases of such projects by not separating information, training and work organization from technical execution. By ensuring that the various possible options are explored from the start, the relevance of certain decisions will be less likely to be questioned later on.

The expression "concurrent management" refers to an approach called "concurrent engineering", which is based on the principle of cooperation between technical designers, who, in the past, worked sequentially on a given project (e.g., product engineering, methods and then production). The objective here is to change from the still very common practice of technical designers calling upon ergonomists and industrial relations specialists to manage the impact of an industrial project only after the decisions have been made, to a practice where the different actors involved in work organization participate at an earlier stage in the project.

This prospect of an eventual synergy between human resources specialists, ergonomists and technical designers is not new. Ergonomists and socio-technical specialists have both carried out work intended to reorient the traditional methods of computing, industrial and architectural project management. As discussed in the first section, ergonomists have developed concrete methods of taking user needs into account and integrating them into industrial projects; the socio-technical approach has done the same for human and social needs in these same projects (Riboud 1987; Navarre 1993; Maire and Brument 1987). Moreover, a similar shift can be seen on the side of technical designers, who are becoming more and more aware of the limitations of a technology-centred approach to design problems and of the interest of benefitting from social and human sciences in work situation design (Lhote et al. 1994).

Nonetheless, efforts to date to develop a practice of concurrent management of work reorganization projects have been limited in two ways. Firstly, efforts to enrich traditional project management are essentially carried out discipline-by-discipline. Secondly, disciplinary linkages essentially occur in "twos", that is, human sciences and technical disciplines, or ergonomics and technical disciplines. To our knowledge, only Maire and Brument (1987) and Riboud (1987) have made serious attempts to integrate

5. The work sociologists Friedberg, Reynaud and Eraly have contributed greatly to the concept of limited rationale. Bucciarelli (1988) showed how engineers with different specializations (mechanical, electrical, etc.) could have different viewpoints when working together on a technical design project.

ergonomics (work activity and user needs) with disciplines concerned with human resources management (human and social criteria) and technical disciplines (technical criteria). Indeed, the articles published in this issue illustrate these two limits. As previously mentioned, ergonomics is only beginning to consider cooperation with industrial relations on work reorganization projects, and the articles on project management (Filippi et al. and Bellemare et al.) only discuss cooperation between ergonomists and technical designers (engineers and computer analysts).

Much therefore remains to be done before ergonomics can collaborate concretely with human resources specialists (e.g., which technical requirement report and project accompaniment should be used to work with a "human resources" designer?). Moreover, in order to develop a concrete and practical synergy between ergonomics, industrial relations and technical disciplines, there should be more emphasis on conducting industrial projects within an interdisciplinary framework.

Worker Participation and Work Relations

If ergonomists are to gain a sufficient understanding of work activity in the diagnosis and prognosis phases, in terms of appropriate design criteria, workers must participate in the study. In industrial relations, and in particular in the work reorganization process that companies have recently been going through, the involvement of unions and the effects of this involvement are likewise highly visible themes (e.g., Bourque and Rioux 1994). However, though both of these disciplines are encouraging companies to be more open to participatory practices, they differ in several respects.

Firstly, in industrial relations, the predominant form of employee participation in work reorganization arises from union action, whereas in ergonomics it is the direct participation of workers as experts in their work that is encouraged. Secondly, in a reorganization context, union and/or worker action is primarily directed towards negotiation issues in industrial relations, whereas in ergonomics their action aims at developing functional design criteria for the optimization of safe and efficient work. Thirdly, in industrial relations, when workers or their representatives are asked to make a functional contribution by expressing their opinions, it is assumed that they already have the solution, whereas in ergonomics this form of participation is considered to be insufficient. Indeed, it has been shown that workers are not generally capable of translating their daily habits into concrete design criteria, nor of describing their functional needs as organizational criteria throughout a project (Lamonde 1995). By replacing non-rigorous methods of exploration, ergonomics has developed methods which go farther than simply asking those concerned for their opinion,

namely: analysis of real situations, prognosis of an activity based on rigorous observation and verbalization methods, use of validation and exchanges with workers as experts, and, finally, a continuing surveillance approach to design projects. These aspects are particularly highlighted in the articles by Filippi et al. and Bellemare et al. which describe the role that designers, workers, ergonomists and a negotiating body (a committee composed of management and union representatives) must play at different stages of a reorganization project. Another method, developed in ergonomics to counteract difficulties associated with non-rigorous questioning of workers, consists of training workers, their union representatives and/or their supervisors to use elementary ergonomics activity analysis. This approach is illustrated in Gadbois et al.'s article, which discusses a case of union representatives' involvement in "participatory ergonomics".

Based on this description of the different participatory approaches of the two disciplines, two possible forms of collaboration between ergonomics and industrial relations can be identified. The first becomes apparent when we consider the concrete co-existence of ergonomics and industrial relations in the field: in a company, different forms of participation can only coexist if they are integrated. If such is not the case, there could be confusion about objectives and participants' roles, rendering the whole exercise futile.

The second possible form of collaboration between the two disciplines is related to the close interaction existing between worker participation and work relations. In particular, the approaches used in ergonomics have two types of repercussions on a company's work relations. On the one hand, they change the distribution of power between management and employees. By emphasizing the existence of several types of rationality in the company, and by legitimizing the rationality of operators, these approaches encourage a recognition of informal expertise. Moreover, they redefine the distribution of roles during projects, since in an ergonomics approach, designers are not the only ones to express their viewpoint during decision-making stages (De Terssac 1990). On the other hand, the ergonomics approach asks questions about the distribution of power between unions and their members. In such an approach, workers are considered to be experts at their jobs and participate in the development of work organization criteria, which is based on a consideration of their functional needs. Consequently, they might end up defending organizational choices that are opposed to the collective needs defended by union negotiators (Lamonde 1995). A second collaboration possibility between ergonomics and industrial relations can thus be proposed, revolving around the interaction between work relations and a participatory approach. There are two types of practical and theoretical problems that arise. The first is linked to the phase that precedes

a participatory project. For example, it is rarely asked what type of work relations are necessary to ensure the successful implementation of an ergonomics project (Lamonde 1995). A second problem concerns the intervention phase itself. Up until now, ergonomics has established a number of methodological rules concerning the separation of functional and negotiated aspects. However, it is difficult for ergonomists to be fully aware of all of the complex work relations that are present in a company. The expertise of industrial relations specialists could surely provide ergonomists with a better understanding of the relational interactions and power struggles that influence the effectiveness of their work.

CONCLUSION

Ergonomics is still a relatively young and misunderstood discipline. In this context, this article has sought to introduce the contents of the special issue by describing the ambitions and tools of ergonomics: its focus on work activity, which is defined as being the cognitive, physiological, perceptual, social and psychic strategies used by workers in real work situations; its objective, which is to contribute to the design of these situations; and its methods, which are used to make a diagnosis of the activity in an existing situation, a prognosis of the eventual activity after transformation and to manage the project until the transformation is completed.

The article has also discussed the points that ergonomics and industrial relations have in common. Identifying and developing the interaction between these two disciplines is a matter of no little practical interest. Though both are interested in work organization in companies, reorganization efforts should not be penalized by artificial differences in rationale arising from the training of "work specialists". Depending on whether we are engineers, computer analysts, architects, human resources specialists or ergonomists, our understanding of work organization and what we consider to be legitimate organization criteria depend on our specialization. Nonetheless, the daily reality of work and optimal organizational solutions transcend the differences in language, viewpoints and interests of our occupations. What is more, in the particular case of the two disciplines in question, such an attitude of indifference is inexcusable from a very practical point of view. Indeed, ergonomics cannot promote "the taking into account of work activity" and at the same time continue to pursue an analysis based on an artificial separation arising solely from ergonomics expertise. As for industrial relations specialists, they cannot deny the importance of recognizing the effectiveness of real work and of making tools available to workers that correspond to the responsibilities and tasks assigned to them.

Three kinds of common concerns have been identified, namely: management of human resources, management of reorganization projects and management of the repercussions of a participatory approach on work relations. The fact that these three issues cover a significant part of the current research and intervention activities of both ergonomics and industrial relations gives added importance to the development of a real synergy between these two disciplines.

This special issue of *Relations industrielles/Industrial Relations*, including this introductory article, should be seen as a first attempt at identifying possible areas of collaboration between ergonomics and industrial relations. We hope that it will stimulate other ideas concerning collaboration. Even more importantly, we hope that ergonomists and industrial relations specialists will work together to solve the practical and theoretical problems that arise from the way work is organized.

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