Inventory of Tools for Ergonomic Evaluation

Patrick Neumann

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Bakgrund

Föreliggande rapport är en sammanställning av utvärderingsmetoder inom arbetsmiljöområdet och ingår som ett delarbete i tema Strategier, metoder och arbetssätt för fungerande arbetsmiljöarbete (SMARTA).

SMARTA ingår i Arbetslivsinstitutets temaverksamhet. Under perioden 2004–2009 samlas forskare från Arbetslivsinstitutet och andra organisationer för att genomföra aktiviteter för ett bättre fungerande arbetsmiljöarbete.

SMARTA ska bidra till ett hållbart arbetsliv där arbetsmiljöarbetet är en resurs för både arbetsplatsen och individen. För arbetsplatsen kan det handla om konkurrenskraft, lönsamhet samt attraktivitet och för individen om hälsa, välbefinnande, kreativitet och förnyelseförmåga.

SMARTA tar ett helhetsgrepp på arbetsmiljöarbete inom olika regioner och branscher. I rapporter från SMARTA sammanställs kunskapsläget och exempel ges på arbetssätt som visat sig fungera för olika verksamheter med deras specifika förutsättningar och villkor.

SMARTA ska besvara frågor som:
- Hur kan arbetsmiljöarbete bedrivas?
- Hur kan arbetsmiljöarbete integreras i organisationers kärnverksamhet?
- Hur kan interna och externa aktörer agera för att få till stånd ett hållbart och fungerande arbetsmiljöarbete?

SMARTA kännetecknas av en nära samverkan med företag, organisationer och arbetsmiljöarbetets aktörer på det lokala, regionala och nationella planet. Lärande och förändringsprocesser är centrala begrepp.

Rapporten vänder sig till praktiker, konsulter och forskare som söker en metod för att mäta, utvärdera eller utforma arbetsmiljön med stöd av, till exempel, systematiskt arbetsmiljöarbete. Metoderna i denna sammanställning har hittats genom websökningar, litteratursökningar och genom kontakter bland forskare och praktikernätverk. Metoderna är grupperade enligt vad de mäter eller var i utvecklingsprocesserna de passar. I största möjliga utsträckning finns litteraturreferenser och web-länkar till verktygen. Vidare finns länkar till sidor med ytterligare information om strategier och metoder kring utvärdering av arbetsmiljöarbete. Konceptet bakom rapporten är att presentera flera möjliga verktyg, och informationskällor, för att hjälpa läsaren att hitta en utvärderingsmetod som är anpassad till de egna behoven.

Patrick Neumann, Ph.D., Eur.Erg.
och SMARTA B2 Effektgruppen

Background

The following report is a summary, or 'Inventory', of tools for evaluating working environment and is a part-project in the SMARTA research programme (*'Strategies and Methods for Management of the Working Environment'*).

SMARTA aims at contributing to a sustainable working life where work environment improvement efforts are a resource for both the workplace and the individual. Improvements can lead to increased competitiveness and profitability for organizations and enhance creativity, health and well being for individuals. During 2004-2009 researchers from NIWL and other organizations have come together to conduct activities for improving the functioning of work-environment improvement processes. SMARTA is funded by the Swedish National Institute for Working Life (NIWL).

SMARTA takes a holistic view on work-environment work within different regions and branches. Reports from SMARTA summarise available knowledge and provide examples of workplace practices that function well in different organisations with their specific conditions and needs.

SMARTA addresses questions such as:

- How shall work-environment improvement efforts be conducted?
- How can work-environment improvement efforts be integrated into organizations core functions?
- How can internal and external actors best support the management of work environments?

SMARTA is characterised by a close cooperation with companies, organisations and work-environment actors at local, regional, and national levels. Learning and change processes are central concepts to SMARTA.

This report is directed to practitioners and researchers who are looking for a method to measure work-environment in support of, for example, ergonomics improvement processes. Methods listed here have been identified by web and literature searches as well as through contacts in research and practitioner networks. The methods are grouped according to what they measure and where in the development process they can be applied. Where possible there are literature references and web-links to the tool itself. Furthermore information and web- links are provided to additional useful information on strategies and methods for evaluating ergonomics situations. The concept behind the report is to present many possible tools, and information sources, to help you find an evaluation method that is well suited to your needs.

Patrick Neumann, Ph.D., Eur.Erg.
and the SMARTA B2 Evaluation Group

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Introduction

This is an inventory of tools for description, evaluation, and design of working environment / ergonomics. This 'Tool Inventory' is intended to assist practitioners in identifying potentially useful methods for evaluating working environment in their professional work (or perhaps evaluating their own working environment!). The emphasis here is on tools that can be used to **evaluate** a workplace or a potential design for a workplace, often in some kind of quantitative way. Evaluation methods and change tools such as focus groups, photo-safari, or dialogue conferences are not included here. A number of such improvement tools are described in a related SMARTA project (Åteg et al., 2005). There are many evaluation tools 'out there' and this list includes only some of these.

The aim of this report is to provide those seeking evaluation approaches with a broad overview of available tools and connections to information that can help choose the tool best suited to their needs.

Methods

The tools listed here were identified in a number of ways:

- Tools and methods known to the author either directly or through reports & literature
- Tools were identified in connection with the associated SMARTA evaluation review project tools that had been used in the scientific studies of ergonomics interventions were included
- Tools identified by web searches and from measurement text-books
- Tools & tips provided by colleagues who viewed early versions of this list

A classification scheme was developed as tool were collected based on characteristics of the tool and how the tool might be used. Whenever possible internet links and references are provided giving the reader access to more information and sometimes even copies or software of the method itself. This scheme is sequenced roughly in order of stages of development. Thus simulation tools, that can be used before a workplace is built, are listed before checklists that usually require existing workplaces.

Results

The main list of tools is presented in the Appendix (below).

Tool were categorised as follows:

1. Tools for Strategic Decision making
2. Tools for Work System & Product Design
    - A. Complex Human Simulation Models
    - B. Simpler Computerised Human Biomechanical Models
    - C. Design Checklists and Other Design tools
    - D. Flow Simulation Tools
    - E. Tools for Product Design

3. Instruments for Evaluating Work Environment
4. Computer Based Evaluation Tools
5. Checklists for Workplace Evaluation
6. Questionnaires on Risk Factor Perceptions
    A. Physical Risk Factors
    B. Psychosocial & Psychophysical
7. Questionnaires on Health & Wellbeing
    A. Fatigue, Motivation, Satisfaction etc.
    B. Pain, Disability & Symptom surveys
8. Economic Models

Tools for evaluating work environment were found in all categories except for the support of strategic decision-making. The most common tool identified was the 'Checklist' type tool, many of which exist in computerized formats.

Discussion

Use the right tool for the job. There is no 'best' tool. After all a hammer is not a 'better' tool than a saw. The choice of tool depends therefore on what needs to be done. Early in a design phase it may be more suitable to use simulation approaches that can be based on early design specifications. If a workplace is running, and a specific concern is to be addressed, then a simple paper and pencil tool may be more cost effective. When choosing a tool consider: What is the purpose of the evaluation? Who will gather the information? Who will use or act on the information? **Just because you have a hammer in your hand doesn't mean your problem is a nail.**

These tools aim to evaluate risk and consequences. Most of the tools listed here attempt to quantify the physical load or psychosocial conditions for the employee. Several tools are oriented to quantifying outcomes such as pain or disability. A few tools consist of economic models that try to evaluate a potential change in terms of productivity, costs, and financial benefits.

Every tool has a 'blind spot'. No tool is perfect. Carpenters have dozens of tools for different tasks. Remember that there are often 'intangible' effects from change projects. It is helpful to try and capture these with more qualitative approaches – by interviewing the people involved. This can provide insight into the effects (and process) of change that might not be clear from a particular tool. Operator and supervisor descriptions of how the system is working and where improvements might be made can support and shed light on the results of your analysis.

It's the skill of the carpenter not just the sharpness of the saw that counts. Of course a good tool makes a big difference, but how the tool is used is also critical. The way you use a tool and the process by which the information is used by you and by others can always be improved. Think of the tool as supporting your organisations continuing development efforts.

This list is incomplete. New tools are being developed continuously and old tools may become obsolete, unavailable, or simply missing from this list! (please submit tool information for inclusion in future inventory versions) Look around before choosing a tool. It may seem like extra effort but it can both save time and give better results in the long run making the early investment worthwhile. Use this list, and the links contained here, as a

jumping off point to your own search for tools that suit your needs and the needs of your workplace.

Conclusions

There are many tools available for evaluating ergonomics at different stages in the development process. Checklists (often implemented on computers) for evaluating current working situation appear to be the most common tool type. Research is needed to examine the extent to which tools are being used by practitioners, the process by which tools are used, and their experience of the benefits and drawbacks of various tools.

Acknowledgements

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APPENDIX

Inventory of Tools for Ergonomic Evaluation

1. Tools for Strategic Decision making

We are not aware of any tools available to help managers evaluate strategic alternatives in work-environment terms. Nevertheless some tools do exist in this area such as workshops, focus groups and the like that are intended to provide a forum in which alternatives can be developed and examined by a broad range of stakeholders with different perspectives on the issues involved (Jensen, 2002).

This category remains part of this inventory to emphasise the importance strategic decision making has for working environment (Neumann, 2004) and, conversely, the importance work environment can have for realising company strategy - the topic of another SMARTA project (Dul & Neumann, 2005; Neumann & Dul, 2005). Strategic choices frame all subsequent decision making that ultimately affects ergonomics.

Know a tool? submit suggestions to: pneumann@ryerson.ca

2. Tools for Work System & Product Design

Tools in this category are useful in the evaluation of workplaces in the design stage. These tools can also often be used to evaluate existing designs.

A. Complex Human Simulation Models

"Complex" computer models include higher-end products designed to allow 3D modelling of humans in a 3D environment such as CAD. For a complete discussion of the capabilities and utility of these tools check out works by Sundin for pracitioners and researchers (A. Sundin, 2001; A. Sundin et al., 2004; A Sundin & Cyrén, 1998; A. Sundin & Sjöberg, 2004).

i. **Jack** - see www.eds.com/products/plm/efactory/jack or www.ugs.com/products/tecnomatix/human_performance/jack

ii. **Ramsis -** see www.ramsis.de

iii. **SAFEWORK -** see www.safework.com

iv. **ENVISION/ERGO -** see www.delmia.com

v. **eMHuman –** see www.ugs.com/products/tecnomatix/human_performance

vi. **ERGOMan -** see www.delmia.com

vii. **ManneQuinPRO –** see www.nexgenergo.com/ergonomics/mqpro.html

viii. **IPME –** see www.maad.com/index.pl/ipme

Other? submit to: pneumann@ryerson.ca

These tools often contain various ergonomics assessment approaches such as reach and fit checking, NIOSH equation, modified Checklist approaches, and biomechanical models to determine physical loading and exposure to risk factors.

B. Simpler Computerised Human Biomechanical Models

These models are generally less expensive and simpler to use. They may be 2 or 3 dimensional and may even consider repeated or cumulative loading as part of the assessment. These are good tools both in design stages and also to quantify loading of existing systems to help identify areas for improvement and quantify the extent of load reduction in a particular situation.

i. **4D WATBAK** – A simple model from the University of Waterloo that allows modelling of single work activites as well as calculating cumulative load over a full shift (hence the 'fourth', time, dimension). Both indicators have been risk calibrated in epidemiological research (Neumann et al., 1999; Norman et al., 1998). (see www.ahs.uwaterloo.ca/~escs)

ii. **3D SSPP -** The University of Michigan's famous 3D Static Strength Prediction Program allows fast determination of 3D loads for specific work actions . (see www.engin.umich.edu/dept/ioe/3DSSPP)

iii. **BakPak** - University of Windsor model - predicts spinal loads based on reach location inputs. (contact: jpotvin@uwindsor.ca)

Other? submit to: pneumann@ryerson.ca

C. Design Checklists and other Design Tools

This includes 'paper' checklists or working concepts (which may even be implemented in a computer system) that can support the evaluation and application of ergonomics factors in process design. These tools tend to operate at different stages of the design process but share a common strength in that they have potential to connect to existing engineering tools and processes.

i. **Design for Assembly (DfA)** - A generic concept that encourages product designers to consider how easy assembly will be. (see (Helander & Nagamachi, 1992).

ii. **ErgoSAM** - An ergonomic add-on for the Swedish SAM method for standard time allocations (which is a common job planning tool, an MTM system). Provides red-yellow-green determination based on the engineer's determination of task requirements (Laring et al., 2005; Laring et al., 2002).

iii. **ERGONOVA** – Ergonomics addition to the classic 'value stream mapping' tool for production system improvement (Jarebrant et al., 2004).

iv. **FMEA tools** – Failure Mode Effect Analysis; a common risk analysis tool that has been adapted to include ergonomics aspects in product and production process development (Munck-Ulfsfält, 2004).

Other? submit to: pneumann@ryerson.ca

D. Flow Simulation Tools

A number of different discrete event (flow) simulation tools exist on the market. These can be used to assess human factors in terms of time utilised for different activities in the system and can also be used to test how the system performs under different work organisation strategies (Neumann & Medbo, 2005). Flow simulation can also be used in combination with human-biomechanical simulation (or other tools) to predict loading with different configurations (Neumann & Kazmierczak, 2005). Many of these packages are made by the same companies that make human modelling software and/or other types of manufacturing information systems (MIS).

i. **Simul8** – a simple graphically oriented package. (see www.simul8.com)

ii. **Delmia** – see www.delmia.com .

iii. **Technomatix** – see www.ugs.com/products/tecnomatix .

iv. **microSAINT** – see www.maad.com/index.pl/micro_saint.

Other? submit to: pneumann@ryerson.ca

For a more complete list, and evaluation review, of available simulation packages see the excellent simulation software survey in the OR/MS journal of the Institute for Operations Research and Management Science (INFORMS).

E. Tools for Product Design

There appear to be few tools oriented to the determination of ergonomics issues in the design of the product (although the human simulation software listed above can be used in this way). A couple of texts do exist in this area though:

Boothroyd, G., Dewhurst, P. And Knight, W., 2002, Product Design for Manufacture and Assembly (New York: Marcel Dekker).

Helander, M. and Nagamachi, M. (1992) Design for Manufacturability: A systems approach to concurrent engineering and ergonomics, Taylor & Francis.

i. **Quality Function Deployment** – an adaptation of a well known design tool to integrate human factors considerations into early design stages (needs analysis) – provides an example of deboning knife design (Marsot, 2005). The method, based on the 'house of quality' approach supports balanced consideration of varying requirements based on their priority and the extent the criteria is fulfilled by a given design option.

ii. **Kansei Engineering** – More an approach than a tool this method focuses on designing products according to the users´ feelings and impressions. (see www.ikp.liu.se/kansei or (Nagamachi, 2002).

Other? submit to: pneumann@ryerson.ca

3. Instruments for Evaluating Work Environment

Tools in this list are oriented towards the evaluation of individuals while at work. This includes simple tools and sophisticated measuring equipment. A number of manufacturers are named here but these are not the only companies available. Contact your local equipment supplier – they'll be happy to discuss your particular needs.

i. **Tape measure** – a classic but useful tool for reach & fit measures

ii. **Stopwatch** – time remains an important aspect of biomechanical exposures

iii. **Force gauge** – another classic tool; fish-hook type scales are cheapest but a push-pull gauge can be more versatile for measuring forces other than lifting. Multiple manufacturers exist – try your local retailer , or www.nexgenergo.com - a company with many different force gauges and other tools.

iv. **Counter** – A handheld counting tool that is helpful when counting repetition rates or parts for estimating total loading (available at your hardware store).

v. **Data Loggers** – Advanced data collection system for measuring EMG or posture while working (Hansson et al., 2003). Other companies also sell such equipment.

vi. **MEGA Electronics** – A commercial system for measuring EMG or posture while working (www.meltd.fi). Many other companies sell EMG equipment.

vii. **Lumbar Motion Monitor** – A device for tracking back postures in 3dimensions at work, development headed by Marras at Ohio State (Marras et al., 1995; Stanton et al., 2004).

viii. **SEIP** - Synchronised Exposure and Image Presentation; A tool allowing the presentation of video recordings and synchronised load/force/EMG measurements on a computer screen (Forsman et al., 1999). (contact: mikael.forsman@niwl.se)

ix. **Vibration & Sound meters** – there are many on the market, make sure your tool complies to the latest standards that you wish to conform to. This inventory will not go into further details of available equipment.

Other? submit to: pneumann@ryerson.ca

4. Computer Based Evaluation Tools

This list focuses on tools explicitly oriented to computer use. However many of the 'Checklist' observational tools can (and have) also be implemented onto a computer or handheld PDA type device. Computer implementation can speed use and improve usability – although it can, like any technology, create its own problems!

i. **ALBA** - a tool for evaluation of anthropometric design, biomechanical loads and lifting. In Swedish. (see http://www.ikp.liu.se/iav/Education/TMIA21/index.asp)

ii. **BUMS** – Belastningsergonomisk UtvärderingsMall Saab (BUMS) An ergonomic evaluation tool developed by Saab, originally as a checklist, then integrated into IGRIP geometric simulation software (for info contact Ingrid Svensson or Karin Bergenfeldt Phone +46 520- 78457 ingrid.svensson@se.saab.com)

iii. **ErgoIntelligence & Ergomaster** – Software tools implementing a number of different checklist tools listed in the next section. (see www.nexgenergo.com)

iv. **ERGOMIX** – a method for integrating images of real operators with CAD-drawings to evaluate workstation layout (de Looze et al., 2003).

v. **ERGOWATCH** – A computerised ergonomics 'toolbox' including the Watbak biomechanical model, NIOSH equation, Snook Tables, and a job demands / worker capabilities analysis tool. From the University of Waterloo (www.uwaterloo.ca).

vi. **FIT – Flexible Interface Technology** is a PDA based tool for the observation of work tasks (Held, 2000; Held et al., 1999). (see www.smiledesign.ch)

vii. **HARBO –** A simple computer aided observation method for recording work postures (Wiktorin et al., 1995).

viii. **Job Evaluator Toolbox (JET)** – a commercial package from ErgoWeb collecting a number of tools listed in this inventory. (see www.ergoweb.com/software/jet/)

ix. **MVTA** – Multimedia Video Task Analysis tool for analysing video sequences in terms of postures and task performance. Developed at the University of Wisconson-Maddison and available commercially. (see http://mvta.engr.wisc.edu/)

x. **NIOSH lifting equation** – A well known tool for calculating maximal permissible lifting loads that is frequently (T.R. Waters & Putz-Anderson, 1999; Thomas R. Waters et al., 1993). This tool is often implemented in other software packages (eg Ergowatch above). (full description can be found at the NIOSH web-site http://www.cdc.gov/niosh/94-110.html)

xi. **The Observer XT –** An advanced video analaysis tool suitable for task analysis and usability evaluation, allows PDA based assessment or integration of biophysical signals (force, EMG etc.). (see www.noldus.com)

xii. **PEO – Portable Ergonomics Observation** method for computer supported field observation, developed in Sweden (Fransson-Hall et al., 1995; Fransson-Hall et al., 1993). (see www.arbetslivsinstitutet.se)

xiii. **PostureProgram** – A relatively simple video based approach, allowing quantification of trunk and arm postures and velocities during work (Neumann et al., 2001). (research prototype, now easily reproduced)

xiv. **VIDAR/PSIDAR** – A video based system allowing employees to rate both physical (VIDAR) and psychosocial (PSIDAR) working environment at chosen points in time from the video (Johansson Hanse & Forsman, 2001; Kadefors & Forsman, 2000). (contact mikael.forsman@niwl.se)

Other? submit to: pneumann@ryerson.ca

5. Checklists for Workplace Evaluation

Many checklist type tools exist both as paper forms and sometimes implemented into computer programs. This list highlights a number of examples that are either well-known or provide potentially useful opportunities for practitioners. It is quite common for practitioners to adopt a checklist for their own needs. It is worthwhile checking library databases (see Appendix) for checklist tools that may have been adapted to your needs.

i. **'Arbetplatsprovaren'** – A Swedish language, internet-based survey of physical and psychosocial aspects of the workplace. (see www.tcodevelopment.com)

ii. **'Arbetsmiljön i skolan'** – A Swedish language checklist tool for improving school work environments. (see www.arbetslivsinstitutet.se)

iii. **Ergonomitermometer** – A Swedish language tool using a 'thermometer' metaphor to help assess risk levels. (see www.prevent.se - this site contains a number of other 'work environment' checklists adapted to various sectors)

iv. **Ergonomiska Checklista Datorarbete –** A simple checklist for evaluation of computer workplaces. (see www.amm.se/fhvmetodik)

v. **Keyserling checklist –** A classic, simple, risk factor checklist easily adapted to users needs (Keyserling et al., 1991).

vi. **MAC – The Manual Handling assessment Chart**, like the NIOSH equiation this allows easy assessment of MMH tasks. (see www.hse.gov.uk/msd/mac)

vii. **ManTRA** – A checklist from the University of Queensland. (see http://ergonomics.uq.edu.au/index.html - available as download from the University of Queensland)

viii. **NIOSH equation** – An approach to calculating a 'maximum' permissible load for different lifting circumstances. Exists in the original 1993 version and a newer 'revised version' (T.R. Waters & Putz-Anderson, 1999; Thomas R. Waters et al., 1993). (see www.hse.gov.uk/msd , full description can be found also at the NIOSH

web-site http://www.cdc.gov/niosh/94-110.html)

ix. **Psychophysical ratings** – A rating made by someone of their own experience ('psycho') of loading ('physical'). A versatile approach pioneered by Borg and broadly applied in various contexts (Borg, 1990).

x. **Psychophysical tables** – An outgrowth of psychophysical ratings, these tables usually provide load or rate limits for material handling based on operators' perception of how much load they believe they can handle under varying conditions of load, frequency, position etc.. Sometimes called 'Snook' tables after the innovator of this approach. A number of studies have been conducted by different researchers to provide load limits under different circumstances (Dahalan & Fernandez, 1993; Potvin et al., 2000; Snook & Cirello, 1991). These tables are sometimes implemented in software versions (e.g. Ergowatch).

xi. **PLIBEL** - A 1-page checklist, mostly of physical risk factors, available in several different languages(Kemmlert, 1994, 1995), (Stanton et al., 2004).

xii. **REBA** – Rapid Entire Body Assessment tool, similar to RULA but with a whole body focus (Hignett & McAtamney, 2000) and also in (Stanton et al., 2004).(see http://ergo.human.cornell.edu/cutools.html or www.hse.gov.uk/msd)

xiii. **Risk Filter –** Also from the UK Health & Safety Executive, this two stage tool focuses on upper limb MSD risk. (see www.hse.gov.uk/msd/risk.htm)

xiv. **RULA** – Rapid Upper Limb Assessment tool provides a 'score' for upper limb demands by McAtamney and Corlett (McTamney & Corlett, 1994) see also (Stanton et al., 2004). (see http://ergo.human.cornell.edu/cutools.html or www.hse.gov.uk/msd)

xv. **The Strain Index** – Combines time, repetition, load, and posture into a single index focused on hand/wrist load (Moore & Garg, 1994) and see also (Stanton et al., 2004).

xvi. **QEC** – The 'Quick Exposure Checklist' for assessing risk factors for work-related musculoskeletal disorders (Stanton et al., 2004). (seehttp://www.sunderland.ac.uk/~ts0gli/QEC.html or www.hse.gov.uk/msd)

xvii. **OCRA** – A 'concise', checklist based, index for assessing risk due to repetitive movements (Occhipinti, 1998; Stanton et al., 2004) (Grieco, 1998).

xviii. **OWAS – The Ovako Working Posture Analysis System** for rapid assessment of postural loads at work. (free software available from www.turva1.me.tut.fi/owas)

xix. **WEST – Work Environment Survey Tool** – provides both traditional ergonomic and occupational hygiene analysis possibilities. From the Swedish Industrial Research and Development Corp. (see www.ivf.se/ivfTemplates/ProductDescription202.aspx)

Other? submit to: pneumann@ryerson.ca

6. Questionnaires on Risk Factor Perceptions

These tools are intended to be used to survey groups of workers on their perception of physical and psychosocial work environment. It is common for these tools to have several questions on a particular factor that are then combined to generate a single index for that factor; so make sure you can get access to a guide that specifies how questions are to be processed once you get your questionnaires back!

A. Physical Risk Factors

i. **DMQ** – The 'Dutch Musculoskeletal Questionnaire' from TNO (Hildebrandt et al., 2001; Stanton et al., 2004). (see www.workandhealth.org)

ii. **Nordic Safety Questionnaire –** A questionnaire tool from Scandinavian researchers with a Safety-culture focus (Kines et al., 2005). (contact: marianne.torner@niwl.se)

iii. **RFQ - Risk Factor Questionnaire** a 25 item questionnaire with a focus on risk factors for low back pain (Halpern et al., 2001).

Other? submit to: pneumann@ryerson.ca

B. Psychosocial & Psychophysical

i. **CopSoq** – The 'Copenhagen Psychosocial Questionnaire' developed by the Danish 'Arbetsmiljöinstitutet'. The instrument includes 3 levels of detail for researchers, consultants, and companies. A brief description , and access to the English version is available from AMI . (see www.ami.dk)

ii. **Job Content Instrument** – perhaps the best-known psychosocial questionnaire. Based on the 'Demand-Control' model by Karasek and later extended to include a 'Support' dimension (R. Karasek et al., 1998; R. Karasek & Theorell, 1990; R. A. Karasek, 1979).

iii. **PAK** – 'psykologisk arbetsmiljökartläggning' a Swedish instrument for psychsocial work surveys (Rubenowitz, 1987, 1991).

iv. **Psykisk Arbejdsmiljø** – A Danish tool for psychological work environment evaluation, also from AMI , with long and short forms available on the web. (see www.ami.dk)

v. **QPS Nordic & QPS34+** – A 123 question (34 question short form) instrument on stressors in the working environment. (see web brochure , http://hesa.etui-rehs.org/uk/newsletter/files/2002-19p45-47.pdf or Svensk information , http://ebib.arbetslivsinstitutet.se/arb/2000/arb2000_19.pdf)

Other? submit to: pneumann@ryerson.ca

7. Questionnaires on Health & Wellbeing

The tools in this category all focus in the *effect work has on the individual*. This might include health outcomes, pain surveys, stress and so forth. The distinction between these and the psychosocial tools above is the change from the experience of the workplace to the effects that workplace has on the individual.

A. Fatigue, Motivation, Satisfaction etc.

i. **SOFI – Swedish Occupational Fatigue Inventory** provides a detailed reporting of employees perceived tiredness at the end of a working day (Elisabeth Åhsberg, 1998; E. Åhsberg et al., 2000; Åsberg, 2000). (report available from www.arbetstlivsinstitutet.se)

ii. **Stress-Energi –** a Swedish psychosocial questionnaire focussing on 'stress' and 'energy' related consequences of work (Kjellberg & Iwanowski, 1989).

iii. **Job Satisfaction** tool (Spector, 1997). One example found is a three question item in (Pousette & Johansson Hanse, 2002).

iv. **NASA-TLX** Task Load Index. This is an assessment of subjectively experienced work load (Hart and Staveland, 1988).

Other? submit to: pneumann@ryerson.ca

B. Pain, Disability & Symptom surveys

i. **DASH** – Disabilities of the Arms Shoulder and Hands, a diagnostic questionnaire from the Institute for Work & Health. (see www.iwh.on.ca)

ii. **NIOSH survey** – a musculoskeletal survey by the US NIOSH (Stanton et al., 2004). (see www.cdc.gov/niosh)

iii. **'Nordic' symptom questionnaire** – A 'standardized' questionnaire that allows description of pain and disability for various body parts (Kuorinka et al., 1987). The tool has since been broadly adapted and applied in research. (see for example www.arbetslivsinstitutet.se)

iv. **SF-36, SF-12** – questionnaires (36 items & a less detailed 12 item version) on general health including physical and mental health (Roland & Morris, 1983; Ware et al., 1993).

v. **Tools for Modified Work** - A process and checklist set supporting efforts of returning injured workers to the workplace with a focus on communications between the workplace and the care-giver. From the Quebec department of Public Health. (see www.santepub-mtl.qc.ca/omrt/tools.html)

Other? submit to: pneumann@ryerson.ca

8. Economic Models

Economic models can help one understand the costs of work related disability (including factors like absenteeism, worker replacement, and staff turnover) and the benefits (including for example productivity improvements and quality improvements) of a particular intervention that you might be considering. While economic models are not common a number of tools do exist

i. **WorkAbility model** – A tool to help ergonomists and engineers evaluate the costs of disability and the financial benefits of an intervention. A basic version of the software is included in the book by Oxenburgh et al. (Oxenburgh et al., 2004).

ii. **PREVIA model** – A comprehensive model produced by a Swedish Company Health and Safety consulting company. (for information on this model please contact Bo Hansson [bo.hansson@ipf.se])

Other? submit to: pneumann@ryerson.ca

Other Sources of Information

If you are looking for tools to help you in your ergonomics work consider checking on the web (university, national and state research institutes, Workers' compensation boards, unions, etc.) for further tips. I list here a number of sites that can provide extra information both on evaluation tools and on work environment issues more generally.

Consider available ergonomics standards - many of these include both guidelines for process as well as methods to support the given process. For an overview of standards see (Dul et al., 2004).

Check out available standards at:

www.sis.se – Swedish Standards Institute

www.iso.org – International Standards Organisation

www.cenorm.be – The European Committee for Standardisation

In addition a number of excellent books exist that include description of evaluation tools. These include:

Charlton, S. G. and O'brien, T. G. (Eds.) (2002) *Handbook of human factors testing and evaluation.* Lawrence Erlbaum Assoc., London. This book provides an overview of evaluation approaches – including discussions of how and when to evaluate - for a wide range of industries and needs.

Stanton, N. A., Hedge, A., Brookhuis, K., Salas, E. and Hendrick, H. (2004) *Handbook of human factors and ergonomics methods.* CRC Press, London. 0-415-28700-6.

Wilson, J. R. and Corlett, E. N. (Eds.) (2005) *Evaluation of Human Work.* Taylor & Francis, London.

Jordan, P. W. (1998). *An Introduction to Usability*. London: Taylor and Francis.

Databases of Scientific Journals

www.sciencedirect.com - The Elsevier database covering hundreds of journals.

www.pubmed.com - The worlds foremost 'medical' database includes journals from multiple publishers while focusing on human and public health issues.

http://portal01.isiknowledge.com/portal.cgi - 'Web of Science' databases

www.tandf.co.uk/ergo-abs - 'Ergonomics Abstracts' database managed by Taylor and Francis. (also a large science publisher: see also www.tandf.co.uk/journals)

www.emerald-library.com/Insight - 'Emerald' is another large scientific database specializing in engineering, business and management.

www.google.scholar.com - searches multiple academic databases simultaneously.

(submit site to: pneumann@ryerson.ca)

Governmental Web Sites & Institutes

www.arbetslivsinstitutet.se - Sweden's National Institute for working life (funder of this inventory!) has information in both Swedish and English. Check out the online library.

www.arbetsmiljoupplysningen.se - A Swedish language site with information and links to tools for 'work environment work' (search for 'verktyg').

www.cdc.gov/niosh/homepage.html - USA's National Institute for Health and Safety (NIOSH) website with lots of reports & information available.

www.av.se – The Swedish Work Environment Authority

www.osha.gov - US Department of Labour's Occupational Safety and Health Administration

www.ivl.se - Swedish environmental research institute Ltd

www.ivf.se - Swedish Industrial Research and Development Corporation

www.ami.dk - Denmark's National Institute for Working Life

www.workandhealth.org - The 'Work and Health' web-site from the Dutch TNO institute

hesa.etui-rehs.org - The European Trade Union Institute's Health and Safety at Work web site.

www.hse.gov.uk – The UK Health and Safety Executive. Has information and links to a number of tools (e.g. OWAS, QEC, RULA etc.).

Other? submit to: pneumann@ryerson.ca

University Sites

http://ergo.human.cornell.edu/cutools.html - Cornell University's ergonomics tools list (also has more ergonomics information).

http://ergonomics.uq.edu.au/index.html - University of Queensland's site.

http://hsc.usf.edu/~tbernard/ergotools - A collection of free checklists and XL tools from the University of South Florida.

Other? submit to: pneumann@ryerson.ca

Companies & Other

www.ergoweb.com - a consulting company with a big web presence in the Ergonomics community.

www.nexgenergo.com - a company dealing in a broad range of products (including many of those listed in this inventory).

Other? submit to: pneumann@ryerson.ca

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