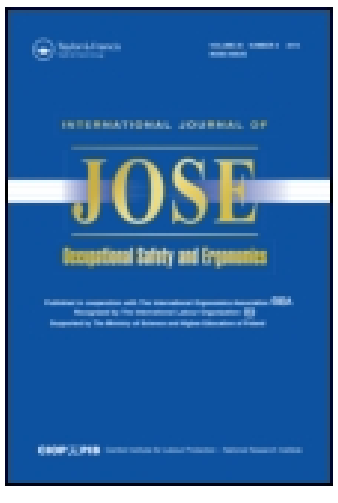

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International Comparison of Occupational Safety and Health Research—A Review Based on Published Articles

Matthias Brueggmann[a], Matthias Roetting[b] & Holger Luczak[a]
[a] Institute of Industrial Engineering and Ergonomics, Aachen University of Technology, Aachen, Germany
[b] Liberty Mutual Research Center for Safety and Health, Hopkinton, MA, USA
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International Comparison of Occupational Safety and Health Research—A Review Based on Published Articles

Matthias Brueggmann

Institute of Industrial Engineering and Ergonomics, Aachen University of Technology, Aachen, Germany

Matthias Roetting

Liberty Mutual Research Center for Safety and Health, Hopkinton, MA, USA

Holger Luczak

Institute of Industrial Engineering and Ergonomics, Aachen University of Technology, Aachen, Germany

A comparison of international literature in occupational safety and health (OSH) research over the years from 1980 to 1998 was conducted. The comparison is based on the different languages of the over 35,000 articles, which were collected from different databases. The distribution of languages in the analyzed data has to be considered carefully with respect to the original purpose of the data collection and the specific role of the international publication language, English. The comparison shows that in several aspects OSH research does not differ in different publication languages. In some methodological aspects, and in specific objects of research, differences between articles published in different languages can be found.

automatic classification international comparison literature database meta-analysis quantitative research

Correspondence and requests for reprints should be sent to Matthias Brueggmann, Aachen University of Technology, Institute of Industrial Engineering and Ergonomics, Bergdriesch 27, 52062 Aachen, Germany. E-mail: <m.brueggmann@iaw.rwth-aachen.de>.

1. INTRODUCTION

Occupational safety and health (OSH) can be defined by combining the definitions of occupation, safety, and health. In different cultures, countries, and times these three notions have had, and continue to have, different meanings. The *Encyclopaedia Britannica Online* (2000) defines "occupation" as an "activity in which one engages." In the context of OSH, "occupation" carries the notion of employed occupation (e.g., International Labour Organization, 1981) and thereby makes the inclusion of military personnel, self-employed, housewives, and other groups open for discussion.

Safety is defined as "those activities that seek either to minimize or to eliminate hazardous conditions that can cause bodily injury" and safety precautions can be either subsumed as occupational safety or public safety (*Encyclopaedia Britannica, Online*, 2000).

In its simplest form "health" means the absence of disease. In 1947 the World Health Organization (WHO) defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (WHO, 2000). Under this broader definition, health protection and health promotion can be discerned.

In combining these three definitions, a continuum of definitions of occupational safety and health can be formed (cf. Luczak, Rötting, & Brueggmann, 2000): For a restricted definition, only selected groups of employed people are included, safety is understood as the minimizing of hazardous effects, and health is defined as the prevention of disease. For the broadest definition, all people following an occupation, regardless of being employed or not, are included, safety is focused on the elimination of hazardous conditions, and health is promoted in the context of the occupation.

Similar to this continuum of definitions, OSH is of varying importance in different countries of the world. This becomes evident when looking at the historical development of OSH-related legislation (e.g., Grieco, Iavicoli, & Belinguer, 1999) and when comparing statistical figures about accidents (see Table 1 for a comparison of accidents at work in the Member States of the European Union) and occupational and work-related diseases.

An estimate by the International Labour Organization (ILO) shows that the fatality rates in Central and Eastern Europe, China, and India are almost double that of advanced industrialized economies. In the Latin America/ Caribbean region they are even higher and are four times as high in the Middle East and Asia (excluding China and India; Takala, 1999).

TABLE 1. Accidents at Work Causing Absences of More Than 3 Days in 1993 in the European Union (EU) per 100,000 Persons Employed in the Six Main Common Branches of Activity: Manufacturing, Construction, Wholesale and Retail Trade, Repairs, Hotels and Restaurants, Financial Intermediation and Real Estate, Renting and Business Activities (European Statistics on Accidents at Work, 1997).

Member State	Standardized Incidence Rate
Sweden	1,054
Ireland	1,168
United Kingdom	1,697
Denmark	2,238
Finland	4,172
Average of 15 EU countries	*4,505*
Belgium	4,516
Austria	4,621
Italy	4,782
The Netherlands	4,849
Germany	5,031
France	5,194
Spain	7,005
Luxembourg	7,465
Portugal	9,532
Greece	not available

This paper tries to analyze if and how these differences are reflected in the OSH research conducted by researchers in different countries and published in different languages.

2. DESCRIPTION OF THE DATABASE AND CLASSIFICATION METHOD

The following charts represent aspects of the literature database analyzed in the research project ''forum arbeitsschutz—Balance of Occupational Safety and Health Research,'' funded by the German Federal Ministry of Education and Research (grant No. FKZ: 01 HK 9801). The data is based on a large number of electronic data sets of literature published in English, German, and other languages for the years from 1980 to 1998. A filter rule was implemented to identify articles that are related to OSH research. According to this rule, only those articles are included in the analysis that are related to work (or are published in a work-related journal) and related to safety (or are published in a safety-and-health-related journal). This reduced the

initial number of over 65,000 articles sampled from publicly available databases to 35,866, which were used for the analysis reported in this paper.

A classification scheme based on a broader definition of OSH was developed in the project (Luczak & Rötting, 1999). A criteria system with over 270 items was implemented for an automatic categorization of literature abstracts. The collected data sets were classified by a rule-based electronic categorization system. The items are hierarchically grouped into the following main areas:

- Viewpoint of the research (e.g., discipline and the type of institution the author works for);
- Research question (e.g., intention and goal, basic or applied research);
- Research methodology (e.g., theoretical foundation, study design, sample size, measurement technique, and variables);
- Research object (e.g., society at large, actors in the field of OSH, branch of industry, profession, company, management, culture, person, basic physiological and psychological functions, task, working environment).

Figure 1 shows the principle of the classification that was conducted with every article. Whereas, in the research project "forum arbeitsschutz" the focus was oriented towards a comparison of German research with international research (Luczak, Brueggmann, Päßler, Rösler, & Rötting, 2001; Luczak, Rötting, & Brueggmann, 2000), this article will distinguish the international data sets by the language of the articles. It has to be considered that the language of an article itself does not indicate the country of origin of the research. Especially, English publications cannot easily be distinguished into contributions from the United Kingdom and the United States or the publication of research results from other countries.

The electronic databases from which these data sets were derived do not allow for distinguishing between the national origin of English literature because of a lack of information in the data set. In some databases the postal code of the main author is available, but not in all. This problem is found in databases with literature in other languages, too. But the bias in the conclusion that, for example, German articles have their origin in German research is much smaller than for the international English literature. And, for example, Russian articles were analyzed by their English abstracts and therefore can be considered as being native Russian articles. But this shows the need for more standardization of this important information in international literature classifications for meta-analytical research. Especially the important Scandinavian contributions to the research field cannot be shown

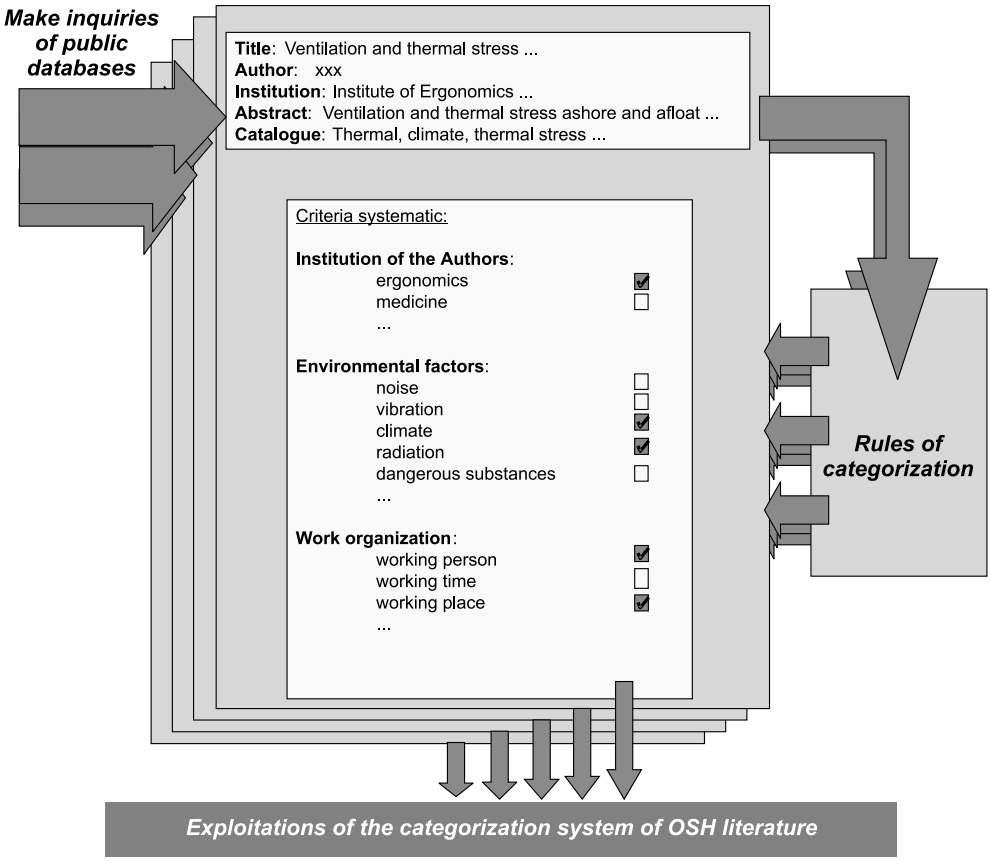

Figure 1. Categorization system of ''forum arbeitsschutz.'' *Notes.* OSH—occupational safety and health.

clearly because Scandinavian journals often chose English as the language of publication.

The second important aspect is the amount of literature in languages other than English or German. Although a lot of resources were spent in the research project ''forum arbeitsschutz'' for the collection of data sets from different databases, the amount of literature in other languages is very small. This is attributed to the use of English as the language for the international publication of scientific research. The large amount of German literature derives from the fact that special databases were searched that collect practically-oriented articles addressed to actors in OSH. This type of literature can be considered to be less frequent in other languages of the analyzed data. So the large amount of German literature does not simply

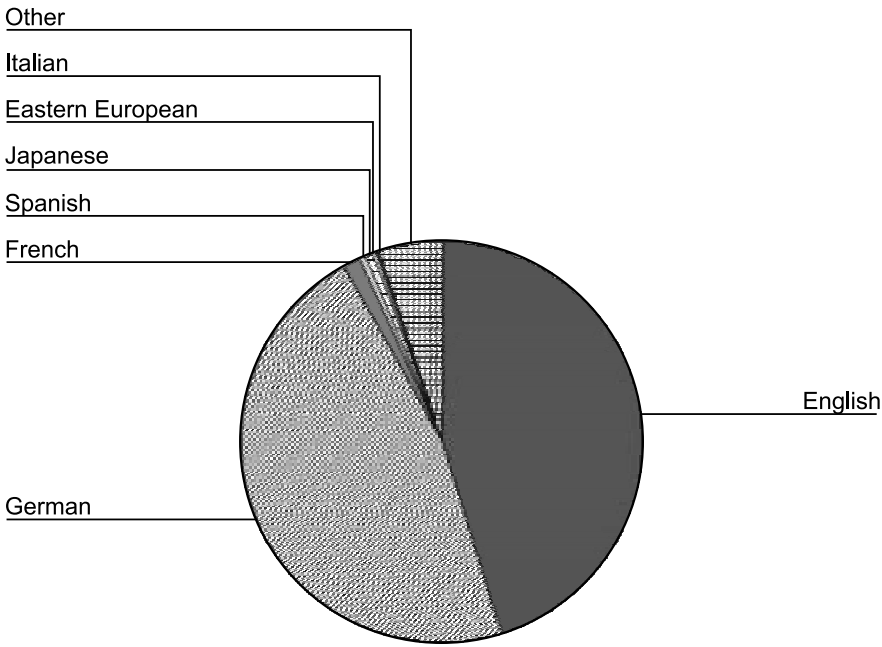

Figure 2. Percentage of different article languages in the analyzed literature data (total *n* = 35,866 articles; Eastern European languages = Russian, Polish, Czech, Serbo-Croatian, Croatian).

indicate the role of German research in international comparison, it is an effect of the focus of the research project "forum arbeitsschutz."

3. METHODOLOGICAL ISSUES

Some of the aspects of the hierarchical classification scheme focus on methodological aspects of the articles. Keywords like "longitudinal study" do not automatically indicate that an article describes a specific longitudinal study but that the article at least reflects this type of analytical method (probably in critical reflection without reference to a specific study). But at least the frequency of methodological keywords shows the amount of reflection of these aspects in the literature written in different languages.

Figure 3 indicates that in all languages aspects of cross-sectional studies can be found most frequently. Japanese and Eastern European articles show a strong reflection of experimental studies. The case control study is found

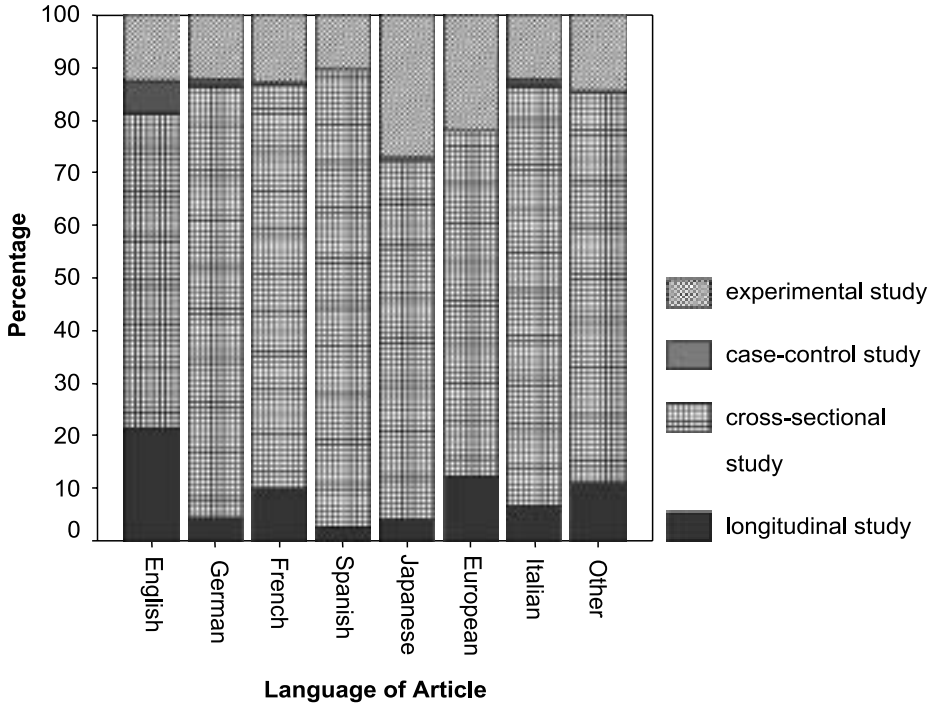

Figure 3. Methodological aspects of study design. *Notes.* OSH—occupational safety and health.

often in English literature. Longitudinal studies are mostly reflected in English, French, and Eastern European literature. In other languages, only a very few of these types of studies can be found.

Some German experts demand a more long-term orientation of research funding. This demand is in some aspect supported by this analysis of frequency of keywords related to "longitudinal studies." The analysis indicates that German literature at least does not reflect this type of study in a wider sense. This is remarkable, because, as we can see, there is much more reflection in English literature of this type of method, and these articles are available to German research as well as to researchers in other countries. So, the conclusion can also be that there is probably a lack of reflection in German OSH research of available international research results dealing with this method. Another conclusion can be that these studies are very expensive and, therefore, the funding institutions are looking for a broad distribution of the results. Therefore, publication in English is demanded from those researchers conducting longitudinal studies.

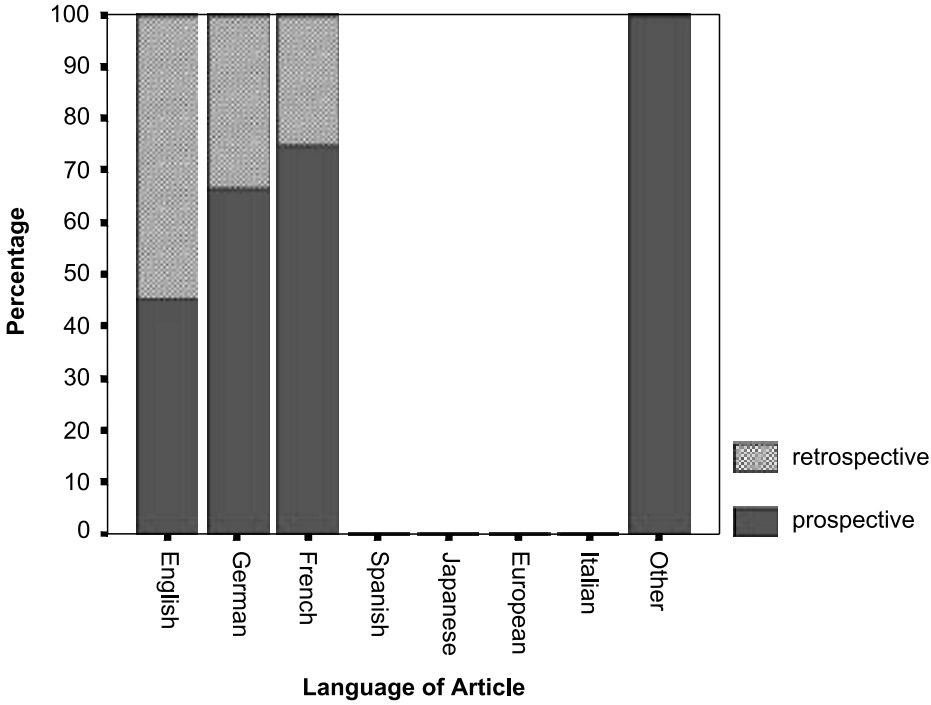

Figure 4. Longitudinal studies—retrospective versus prospective.

Although Figure 3 indicates that in this analysis the keywords related to longitudinal studies can be found in all registered countries, there are no further hints in these articles to the specific temporal orientation of longitudinal studies (Figure 4). Only English, German, and French literature show, in some cases, the temporal orientation of this reflection of the method. In the category "other languages," only prospective longitudinal studies are found.

4. OBJECTS OF RESEARCH IN INTERNATIONAL COMPARISON

Figure 5 shows the level of the object of the analyzed article. The chart shows that from this perspective no specific conclusions can be drawn. There is a great similarity between articles in different languages in the level of the articles' object.

Actors in the OSH system, the working person, and the working environment are the most reflected levels in the articles. It has to be

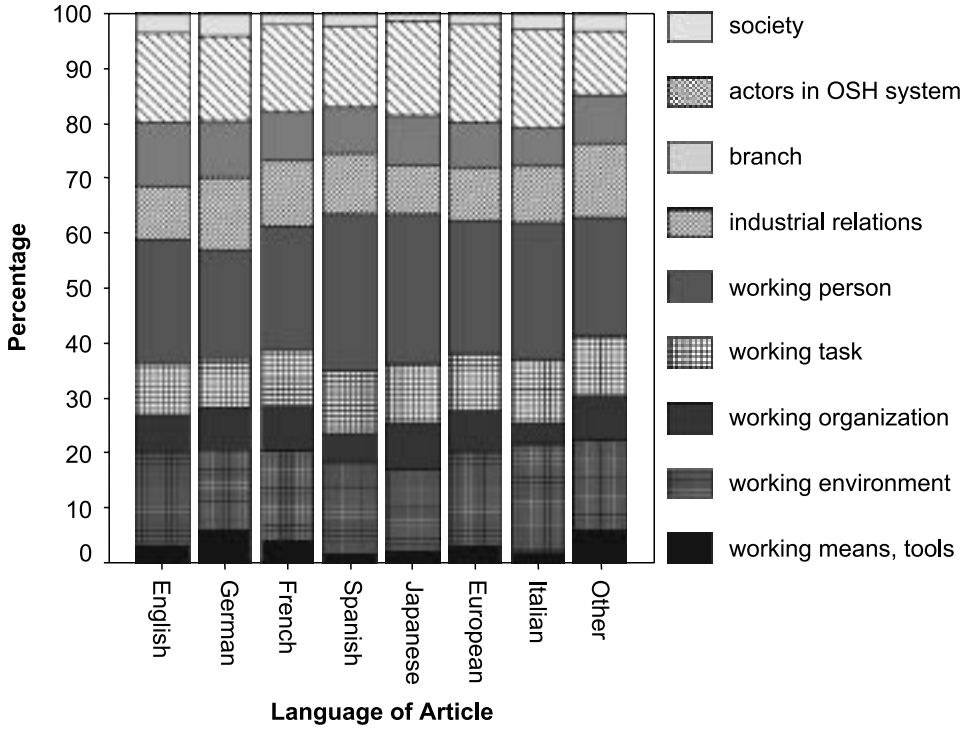

Figure 5. Level of the object of OSH-related international articles. *Notes.* OSH—occupational safety and health.

considered that in this analysis and the following, each article can contribute to more than one aspect on the same level of the classification scheme, that is, an article that reflects the impact of new information technology on the working life in Germany reflects at least the levels "tools and objects of work" and "society."

Specific aspects in the different languages can be highlighted, if the analysis is taken to the finer levels in the branches of the hierarchical classification scheme. The following analyses will guide through some aspects of this classification scheme.

Figure 6 shows in which relation different actors of the OSH system are mentioned. Only German articles show peculiarities. Here institutional actors of the OSH system are mentioned as often as actors in the company. The typical actor mentioned in an OSH-related article is an actor within a company: the worker him- or herself, followed by the management, and actors with medical backgrounds. And again, in the German literature the

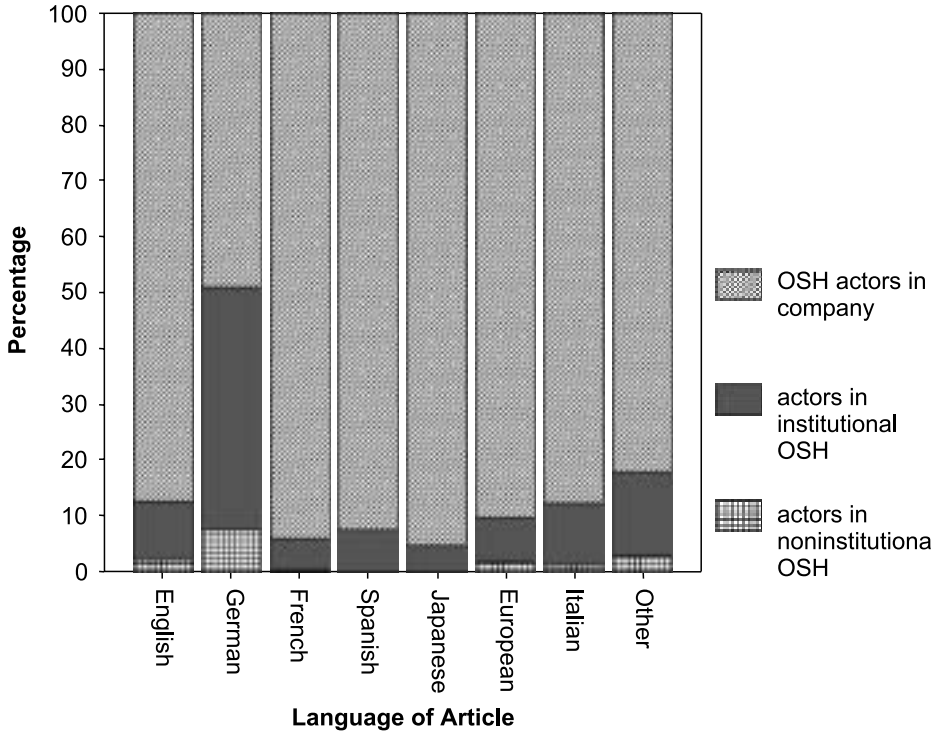

Figure 6. Actors in an OSH system: company, institutional, and noninstitutional. *Notes.* OSH—occupational safety and health.

role of the worker is not as prominent as in articles in other languages, although the worker is most often mentioned among the OSH actors in the companies. In the German literature, management and medical actors play a more important role than in the literature written in other languages.

As macroeconomic statistics suggest, OSH-related articles are mostly related to the third (services) sector of the economy (Figure 7). In this sector the majority of workers in most of the related industrialized countries are working. This reflects the change in the working world from production of goods to handling services and information. The higher the number of articles in a language related to the third economic sector, the higher the number of psychological functions mentioned in the articles (Figure 8). This underlines the shift of task loads of typical jobs in the third sector and the anticipation of this effect by the research society.

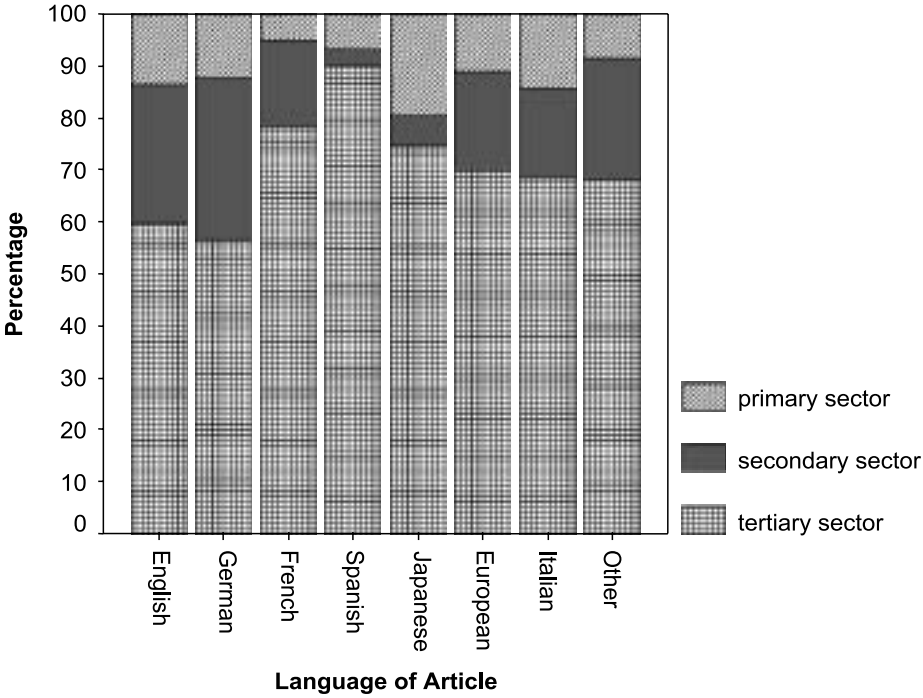

Figure 7. Distribution of keywords reflecting the economical sector.

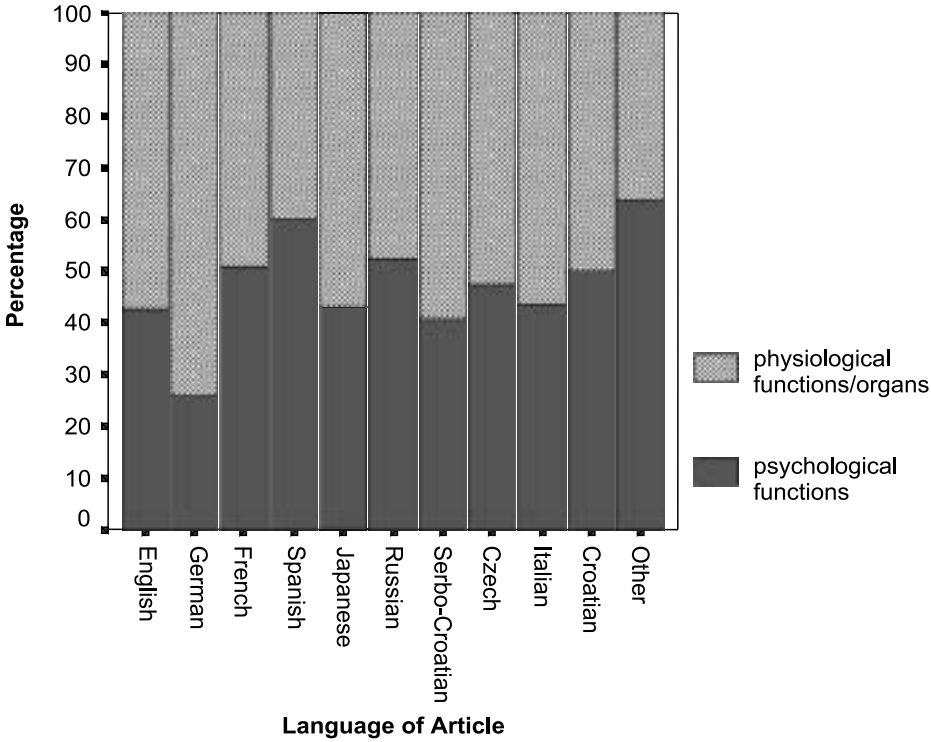

Figure 8. Physiological versus psychological functions.

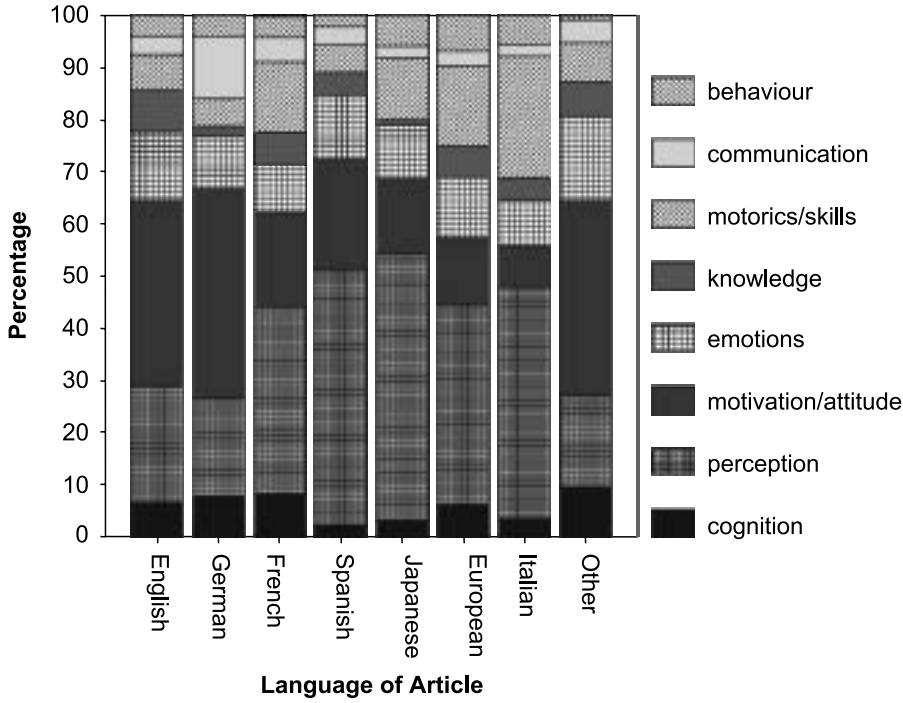

Figure 9. Psychological functions.

Within these articles, which are related to psychological aspects, certain patterns of reflection of the psychological functions can be found (Figure 9). Articles written in English, German, and unidentified languages mention motivational and attitudinal aspects most frequently, whereas in articles written in other languages the aspects of the perceptional functions prevail.

The reflected aspects of work organization differ more obviously (Figure 10). English, German, and Spanish articles very often deal with aspects of the working place. Articles in French, Italian, Japanese, and the Eastern European languages discuss aspect of working hours more extensively.

Within the aspects of the working environment there are some remarkable differences, too (Figure 11). English and German articles very often deal with dangerous substances, whereas the focus in most other languages is set on noise, vibration, or both. Aspects of illumination are represented more in French and Spanish articles and the Japanese articles show the greatest amount of spatial requirement discussion.

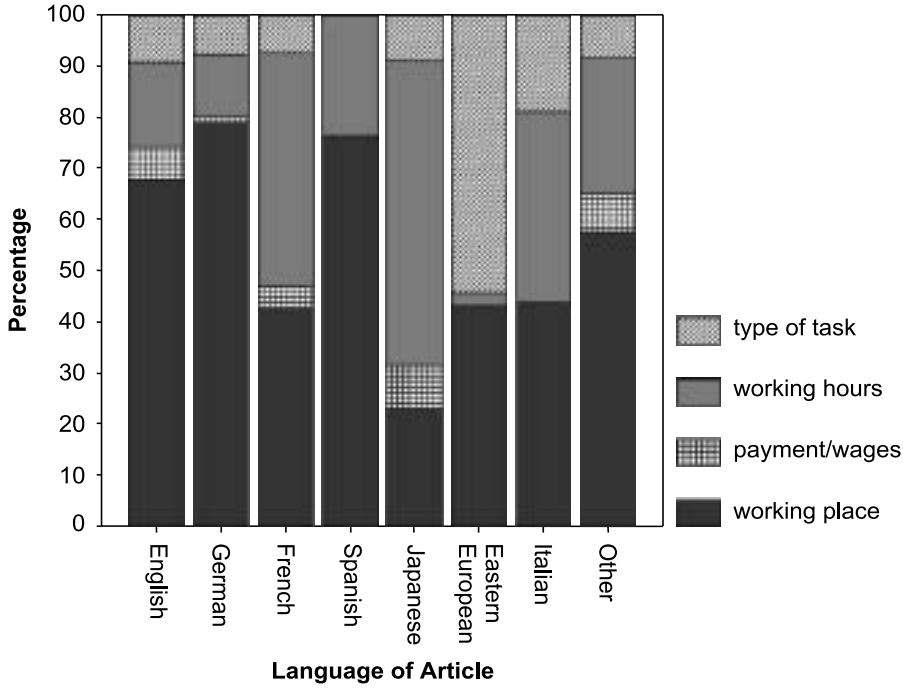

Figure 10. Aspects of the work organization.

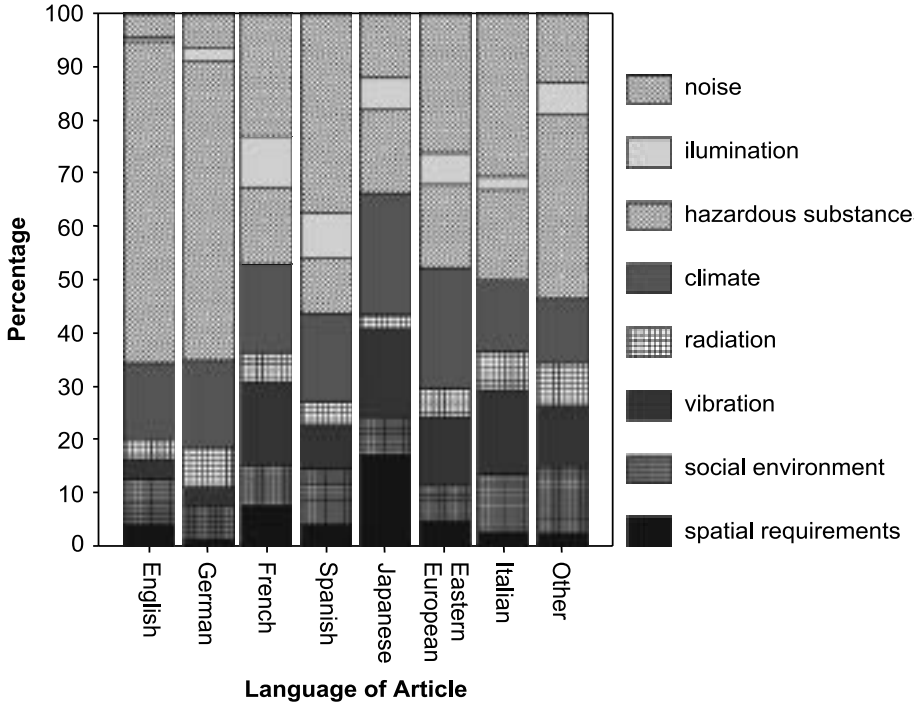

Figure 11. Aspects of the working environment.

5. CONCLUSION

The lack of a standardized notation of basic identifying information in literature databases increases problems in meta-analytical research. International comparisons of research topics on the basis of the language of an article must be considered as the second best way (with respect to the affordable resources). No specific pattern can be found, which indicates a great lack of discussion in different languages. The greatest variation of OSH topics can be expected in English articles. The greater the number of articles that are collected in a language, the more this characteristic variation between topics can be found. Further research with this method requires many more data sets in the different languages or a better matching of the national origin by standardized keywords. This is the basic requirement for substantial conclusions on the field of research in international comparisons. It can be formulated as an objective to the research society of OSH to introduce and discuss such standards that would facilitate meta-analytical research. Medical databases with OSH-related keywords show this intercompatibily more clearly than other databases. This is probably driven by the research strategy used by medical researchers. This article should demonstrate the possibilities of international research comparisons on the basis of automatically reviewed literature. On the other hand the methodological restrictions are shown due to incompatible keyword-structures between different databases.

REFERENCES

Encyclopaedia Britannica online. (2000). Available: http://www.eb.com

European Statistics on Accidents at Work. (1997). *Accidents at work in the European Union in 1993*. Available: http://europa.eu.int/comm/employment_social/h&s/figures/accidents93_en.htm

Grieco, A., Iavicoli, S., & Belinguer, G. (Eds.). (1999). *Contributions to the history of occupational and environmental prevention.* Amsterdam, The Netherlands: Elsevier.

International Labour Organization (ILO). (1981). *Occupational safety and health convention.* Geneva, Switzerland: Author.

Luczak, H., Brueggmann, M., Päßler, K., Rösler, D., & Rötting, M. (2001). Struktur der Arbeitsschutzforschung—Quantitativer Vergleich der nationalen und internationalen Literatur sowie der nationalen Forschungsförderung [Structure of occupational safety and health research—A guantitative comparison of the national and international literature as well as of the German national research funding]. In H. Luczak & M. Rötting (Eds.), *forum arbeitsschutz—Bilanz und Zukunftsperspektiven des Forschungsfeldes*. Bremerhaven, Germany: Wirtschaftsverlag NW.

Luczak, H., & Rötting M. (1999). Balance of occupational safety and health research in Germany—The use of WWW-based tools. In P. Mondelo, M. Mattila, & W. Karwowski

(Eds.), *Proceedings of CAES '99—Computer Aided Ergonomics and Safety, Barcelona, May 19th–21st, 1999* [CD-ROM]. Barcelona, Spain: Universitat Politecnica de Catalunya.

Luczak, H., Rötting, M., & Brueggmann, M. (2000). International comparison of OSH research. In *Proceedings of the IEA 2000/HFES 2000 Congress. July 29–August 4, 2000, San Diego, California USA* (pp. 4-652-4-655). Santa Monica, CA, USA: Human Factors and Ergonomic Society.

Takala, J. (1999). *Introducory report of the International Labour Office.* Paper presenteed at the 15th World Congress on Occupational Safety and Health. São Paulo, Brazil. Available: http://www.ilo.org/public/english/protection/safework/cis/oshworld/xvwc/intrep.htm,accessed on October 15, 2001.

World Health Organization (WHO). (2000). *Definition of health*. Available: http://www.who.int/aboutwho/en/definition.html