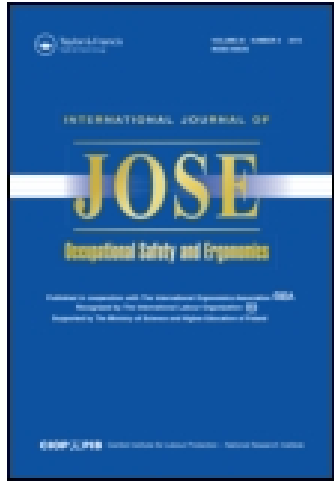


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Psychological Approaches to OSH Research—An Evaluation of 20 Years of Psychological Research on Industrial Safety and Health in Germany

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Psychological Approaches to OSH Research—An Evaluation of 20 Years of Psychological Research on Industrial Safety and Health in Germany

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During the past 20 years of research in occupational safety and health (OSH), major contributions have been made by psychology in general, foremost German work and organizational psychology. This is the result of an empirical study with 216 scientific projects that were analyzed by content, and 32 interviews on OSH with experts on science, as well as in professional occupations and federations. Its sound methodological and theoretical approach has helped work and organizational psychology to embody itself as a driving force of OSH. The research focuses on the development of tools for job analysis, striving for the valid diagnosis of occupational hazards and mental load. Consequently, work and organizational psychology provides a solid foundation for deriving human and personality ameliorating organizational measures. Among the predominant means of intervention are training in coping with stress, behavioral training and modeling, health circles, and the arrangement of environments sensitive to occupational load. Major deficits in the field of research show up within evaluation and transfer as well as within quality control of the developed diagnostic and devices regarding intervention. Future scientific effort by means of application-orientated methods is vital to detect and overcome effectively a mounting mental load in the occupational world.

German OSH research job analysis psychological OSH methods
conditions for application

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1. RESEARCH CONTRACT AND METHODS

The present study was granted by the German Federal Ministry of Research and Technology. It required an evaluation of the performance of (mainly work and organizational) psychology in occupational safety and health (OSH) research in the Federal Republic of Germany that should also provide applicable advice for improving OSH. Put to the test were achievements during the period of 1980 to 2000, because during these decades two conspicuous promotional programs of the Ministry were founded: "Humanization of Working Life" (Humanisierung der Arbeit) and "Work and Technology" (Arbeit und Technik). Most of the involved projects intended a close cooperation with scientists on the one hand and entrepreneurs as well as administrations on the other. This is why these projects were largely prone to application. Their main tasks were to develop theoretically concise concepts and methods in OSH, to implement them in professional services, and to evaluate these efforts.

The present study gathered data from two sources: (a) 216 research reports, which focused on psychological topics of OSH research in Germany and (b) 32 interviews with experts in science, as well as in professional occupations and federations who contributed to 11 projects crucial to the entire program. The research reports were analyzed qualitatively by a systematic classification scheme whereas the interviews were transcribed and analyzed content-specifically.

To begin with, the following section presents the most important results of past and present psychological OSH research concerning theoretical models and concepts as well as the development and adaptation of psychological methods (including analysis, methods of intervention, evaluation). Recommendations for future research in OSH are derived from each of these aspects. For an in-depth report see Sonntag, Mast, and Becker (in press).

2. THEORETICAL MODELS AND IMPORTANT CONCEPTS OF PSYCHOLOGICAL OSH RESEARCH

During the past 20 years, German psychological OSH research has been strongly influenced by different theoretical paradigms, which led to an extension of the technology-oriented view of industrial safety and health protection. Five mainstreams of theory and model development in psychological OSH research can be determined along a certain time axis as depicted in Figure 1.

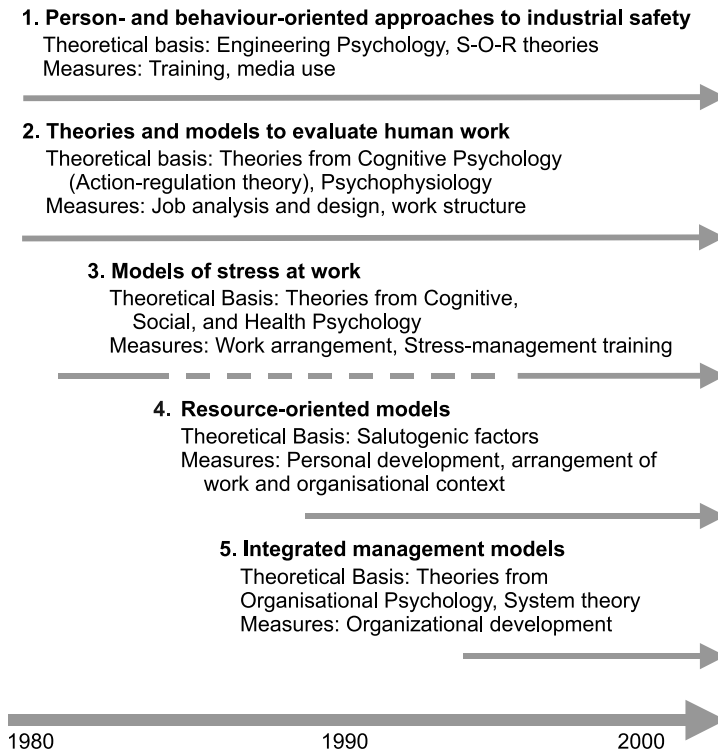


Figure 1. Development of basic theories and models in psychological research of industrial safety and health. *Notes.* S-O-R—Stimulus-Organism-Reaction.

2.1. Person- and Behavior-Orientated Beginnings in Industrial Safety

Initially, psychological industrial safety research was aligned behaviorally with human behavior taken into focal point. Psychological engineering perspectives (e.g., Hoyos & Zimolong, 1990) and Stimulus-Organism-Reaction (S-O-R) theories formed the basis of scientifically well-proven assertions concerning safety behavior at the workplace. The subjects of interventions thus derived were behavior modification and maintenance of motivation. Research often followed the classical ergonomic concept of occupational stress versus strain (Rohmert, 1984; Schmidtke, 1981), which, due to its unpretentious assumptions, was suitable for simple experimental settings in the research of these two concepts. However, it completely failed to account for complex human professional activity with its determining cognitive and situational variables.

2.2. Theories and Models of Human Work

In the 1980s, substantial aspects of the working life, thus also industrial safety and health protection, were examined under the “Humanization of Working Life” program. Within this line of research, certain criteria of human work have been identified as important with regard to a person’s well-being: Research concentrates on whether work is (a) feasible, (b) preventing harm, (c) reasonable, and (d) promoting personality development.

(a) Work is called feasible, if the worker fulfills the physical and psychological demands in his or her given working environment reliably and is able to perform a result (operating devices have to be accessible, signs must be hearable, screen commands readable, etc.). (b) Work prevents harm, if long-term health risks, resulting from the current task, can be avoided. Health damage or injuries can either be physical (caused by the work environment or physical misdemands, e.g., intervertebral disc damage or hardness of hearing) or resulting from a psychosomatic disorder (e.g., gastric ulcer, intestinal or chronic heart disease, caused by psychosocial stress, e.g., permanent time-pressure, isolated work). (c) Work is reasonable, if not only chronic illness, but also short-term damage to health and well-being can be avoided (e.g., headache, nervousness, etc.). (d) Finally, work promotes the development of personality if it enables a person to use and enlarge his or her abilities and interests in order to perform a result. Content of work and aspects like scope of and room for action, completeness of action, variety of demand, and cooperation with colleagues are crucial factors that also contribute to the development of personality.

Whereas the first two criteria refer to the ergonomic analysis of contextual conditions, the inherent characteristics of reasonableness and particularly promoting personality development, point at the content-related component of professional activities. In order to be able to design and change workplaces, a set of psychological methods of analysis was developed by German work psychologists (see Table 1 in section 3.1). Negative consequences of workload, as, for instance, monotonousness and psychological saturation, are documented from both a person-centered (subjective) and a condition-centered (objective) view. These methods concentrate heavily on psychological strain and mental load. Due to changes of working demands in the occupational world, for example, the increased use of information technology, the analysis of cognitive demands of professional activity has been and still remains of high relevance. The developed methods of psychological analysis are founded on action-related, profes-

sional-activity-related, and information-related theories (for summary see Frieling & Sonntag, 1999; see also Table 1 in section 3.1).

Psychological instruments of job analysis delivered the cause for an abundance of measures, dedicated to the organization of personality favorable work design and personnel development. It becomes clear that research in the area of humanization of work represents a milestone of psychological OSH research. During this period, numerous psychological concepts, readily applicable to professional services, have been evolved.

2.3. Models of Stress at the Workplace

Terms such as stress, strain, and stress-inducing factors have gained importance in psychological OSH research since 1980. Different models and theories focusing on stress (e.g., stress-management model of strain, Karasek, 1979; concept of role conflict and ambiguity, Kahn, 1978; person-environment-fit-model, Caplan, 1983) have been discussed. These models have been enlarged and empirically tested (see Kannheiser, 1984; Semmer, 1984) on the basis of the theory of action regulation (Handlungsregulationstheorie) and activity theory (Tätigkeitstheorie). These concepts aim at grasping the effect of specific condition-related stress-inducing factors on the individual experience of stress. Subjective evaluations and coping strategies should be subject of research as well as individual resources (e.g., control, self-concept), resources in the social environment (e.g., superiors, colleagues, peers), or task-inherent resources (e.g., task variety and completeness, scope of and room for action).

2.4. Resource-Oriented Models

Not only the analysis of pathogenic factors, but also the study of health-promoting factors (salutogenic factors) has been subject of a remarkable development in psychological OSH research since the 1990s. One of the incidents that has had crucial impact on the significance of factors conducive to health was the Ottawa Charter of the World Health Organization (WHO) in 1986. Health promotion was defined as the “process that enables people to reach a higher level of self-determination in order to strengthen their health”. In this context, research on resources (sensu Antonowsky, 1987) plays a central role. A model that integrates the results

obtained by research on stress is the model of conservation of resources (Hobfoll, 1988). According to this model, people aim at building up and maintaining valuable resources. The composition of resources goes hand in hand with well-being and health; on the contrary, the potential or actual loss of resources has a threatening impact. The translation of this model has been particularly effective in the context of technical-organizational change in companies. As has been shown in a comprehensive empirical study in a large international German car manufacturing company, stress-inducing factors can be minimized by supporting the building up of resources (Sonntag, Benz, Edelmann, & Kipfmüller, 2001).

2.5. Integrated Management Models

Health management systems represent a crucial approach in the latest psychological OSH research. These systems encompass leadership and management concepts that include aspects relevant to safety and health, and are deeply linked to entrepreneurial areas of strategic human resource management. Long duration and high efficiency of transformation of OSH measures of analysis, intervention, and evaluation on a company's operative level can thus be guaranteed. This transformation process integrates methods and approaches of management research, of work and organizational psychology, as well as health science.

3. DEVELOPMENT OF PSYCHOLOGICAL OSH METHODS

Psychological methods include instruments for job analysis assessing work contents and working conditions as well as intervention measures that allow the implementation in the identified problem areas. As a third aspect, evaluation of interventions that were put into practice has a significant impact on quality assurance of psychological methods in OSH. As the interviews with experts from science have indicated, the main purpose of psychological research in the area of OSH was the development of methods for analysis and its execution (see Figure 2). This statement can be proved by the quantitative data obtained from the classification of projects. Figure 2 shows that analysis frames the focal point in the context of psychological research projects, whereby combinations with intervention and evaluation

techniques occurred necessarily. Nevertheless, the data show that evaluation and quality assurance of methods and measures that were developed and realized have been blatantly neglected.

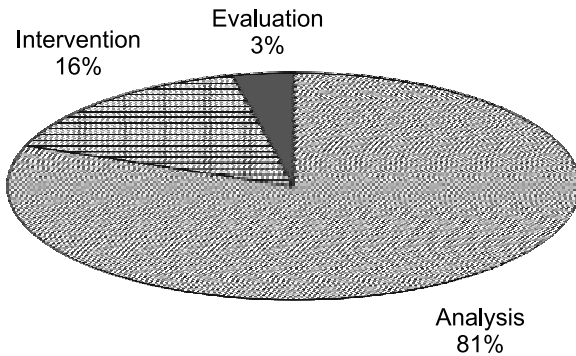


Figure 2. Methodical emphasis of classified projects ($N = 216$).

3.1. Content and Evaluation of Psychological Methods of Job Analysis

The application of psychological methods of job analysis in OSH aims at analyzing and evaluating potentially dangerous conditions as well as physical and psychological strain at the workplace. Job analysis facilitates well-founded concepts for creating health-supporting work-structures and conditions as well as actions for intervention at workers' level (e.g., stress management training).

The classified psychological projects have attached importance to methods such as systematic task analysis and job description, and have made use of standardized instruments of job analysis. A share of 32% of standardized and systematic instruments of job analysis out of all methods employed in the classified projects, stresses the significance of method-relatedness in psychological research, as it has been portrayed by experts from science. Nineteen percent of the standardized methods of job analysis were condition-related, whereas only 5% were person-related. A combination of condition- and person-related approaches could be found in 8% of the cases (see Figure 3).

Job analysis methods can be separated into condition-centered approaches and person-centered approaches and a combination of both. Condition-centered

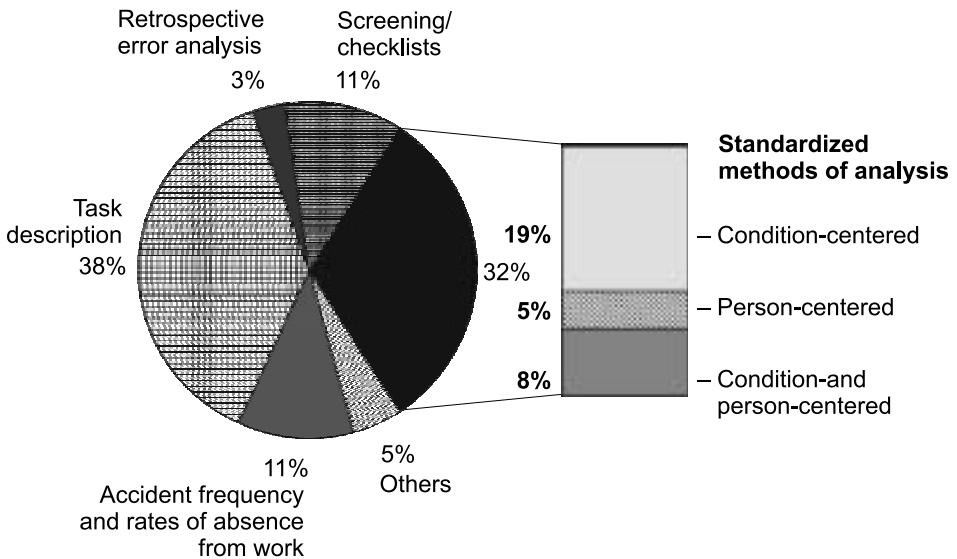


Figure 3. Method and frequency of analysis used in classified projects (N = 199).

TABLE 1. Psychological Job Analysis Methods to Register Psychological Stress and Strain at Work

Method	Authors	Description
<i>Person-centered approaches (subjective)</i>		
BMS	Plath & Richter (1984)	Analysis of perceived consequences of strain (e.g., stress, saturation)
<i>Condition-centered approaches (objective)</i>		
TBS	Hacker Fritsche, Richter, & Iwanowa (1995)	Activity evaluation system; analysis of task structure, communication and cooperation, and so forth
VERA/RHIA	Oesterreich & Volpert (1991); Leitner et al. (1987)	Identification of regulation requirements and cognitive demands, identification of regulation obstacles in industrial work
<i>Combined approaches</i>		
ISTA	Semmer (1984); Semmer & Dunckel (1991)	Instrument for stress-oriented job analysis focusing on work conditions (e.g., communication demands), stress inducing factors (e.g., low or excessive demands), and resources (e.g., social support)
TAI	Frieling, Facaoaru, Benedix, Pfaus, & Sonntag (1993)	Includes four parts (emotional and informational strain, qualification demands, and organizational change), match with minimum profiles

approaches focus on the analysis and description of work characteristics that are independent from the individual (objective approach; the analyst is an expert from outside the company; combined observation and questioning). Person-centered approaches on the other hand concentrate on individual differences between the worker and his or her perception and interpretation of work (subjective approach; the analyst is the worker him- or herself; mainly questioning). During the 20 years' duration when classified studies were conducted, some important psychological research instruments have been evolved (see Table 1).

The development of these instruments was theoretically guided and was based on the criteria of objectivity, reliability, and validity.

Interviewees identified the following difficulties during the generation of the aforementioned instruments: (a) Dilemma between scientific generation and practical application. Critics on the practical use and value of the instruments refer to the dilemma between scientific claim on the one hand and practical use on the other hand. Experts demand a stronger practical orientation and a higher efficiency in actually carrying out the research. (b) Lack of international orientation. Job analysis methods in the German language are not sufficiently noticed. According to the experts, the underlying theoretical approaches particularly lack international reputation. This is to be regretted, especially because the underlying approaches represent a holistic view of the individual in the working context as opposed to the behavioral approaches in the Anglo-American community that are still preferred.

3.2. Content and Evaluation of Psychological Intervention

There are various psychological methods for intervention in OSH research. Again, the analysis differentiates between actions that concern the arrangement of structures, contents, and conditions of work and actions that impart knowledge or change behavior in order to promote health and well-being. The results (see Figure 4) show that a combination of condition- and person-centered intervention methods predominates.

The interventions and their intentions presented in Table 2 can be assigned to condition- and person-centered approaches.

Future demands on psychological intervention in the area of OSH are (a) integration of work arrangement and personal approaches—a better agreement of individual and institutional possibilities and matters of work

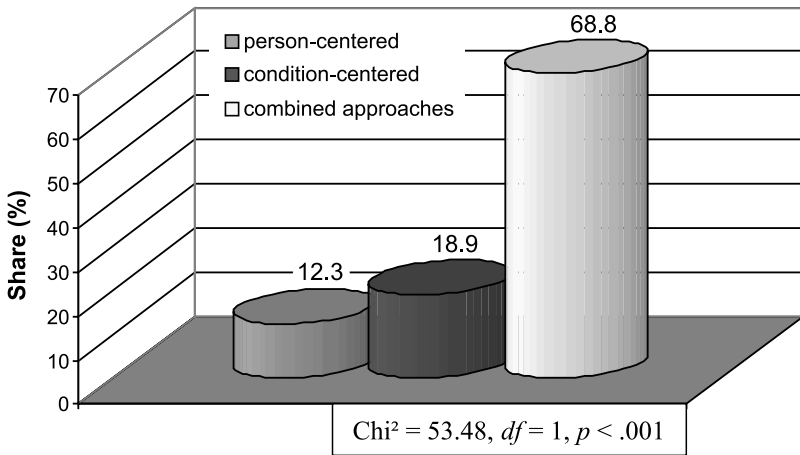


Figure 4. Significance of combined intervention approaches in psychological research projects ($N = 108$).

TABLE 2. Interventions and Their Intentions in Psychological Research on Industrial Safety and Health

Intervention Approaches	Intentions
<p><i>Condition-centered approach</i></p> <ul style="list-style-type: none"> • Concepts of work structure (e.g., variability, complexity) • Arrangement of working time (e.g., flexible working time, shift work) • Ergonomic orientation (e.g., lifting help, noise prevention) • Health circles 	<ul style="list-style-type: none"> • Reduction of harming and impairing conditions • Establishment of potentials that support health and learning • Enhancement of performance by reducing stress and strain and optimize resources
<p><i>Person-centered approach</i></p> <ul style="list-style-type: none"> • Training in competencies (e.g., problem solving, cooperation) • Leadership training (e.g., reintegration and development talks) • Behavior modification (e.g. team development) • Physiological training (e.g., progressive relaxation, fitness) • Stress management approaches • Coaching and mentoring (e.g., consulting, supervision) • Computer-assisted approaches (e.g., simulation, multimedia learning) 	<ul style="list-style-type: none"> • Development of personal and social competencies and expertise • Conversation techniques • Support of safety and health awareness • Flexible access to different coping strategies • Reflection of behavior and attitudes

organization to activate and motivate workers; (b) development of new concepts of consulting—concepts of action and consulting that enlarge the self-responsibility of workers are to be developed; (c) development of new concepts and methods for learning—self-guided learning is seen as a leading concept of future intervention research in the area of OSH; and (d) development of new media—the use of newly development information technologies, for example, simulation training or computer- or web-based training with multimedia support is seen as a crucial part of intervention by experts.

3.3. Development of Psychological Evaluation Methods

Projects have only rarely been focusing on evaluation, as Figure 2 shows. Interview partners justified that evaluation has been and still is being benevolently neglected (a) by companies, because it saves time, expenditure, and modification of a once induced action; (b) by institutions supporting projects on a financial basis, because it saves grants; (c) by scientists, because one might be confronted with less fruitful results.

In order to avoid such serious shortcomings in the evaluation of psychological OSH research, intervening experts have named the following recommendations.

1. Criteria for evaluation: Science has to explicate soft criteria for measuring success. Accident frequencies or rates of absence from work are not valid enough.
2. Evaluation models: Summative and formative ways of evaluation or combinations of both should be applied in accordance to research intention and design.
3. Longitudinal studies: More longitudinal studies are required in future research in order to gather knowledge about underlying processes in OSH and support entrepreneurial changes.

4. CONDITIONS FOR APPLICATION OF PSYCHOLOGICAL OSH RESEARCH

To sum up, results from expert interviews concerning an improved translation of psychological concepts and methods into organizational practice are

portrayed. Translation means the implementation of measures in participating companies as well as transfer and lasting effects.

The following areas of problems were mentioned:

1. Cooperation of science and practice: A more proficient project management is demanded; scientists, representatives of management and of the company's OSH should be equally featured to ensure efficiency in OSH measures.
2. Interdisciplinary approach to knowledge management: The exchange of knowledge between work psychologists, engineers, and specialists in industrial medicine ensures a shared language use and matching concepts for practice.
3. Leaders as promoters: The translation of psychological OSH research depends largely on ruling powers in the company. Top management and leaders have to provide basic conditions as early as in the planning phase to warrant a successful project realization.
4. Embedding into strategic management: Psychological OSH concepts have to be integrated into a holistic health management system. Competence and know-how of human resource management have to be linked with the knowledge of OSH experts.
5. Distinguishing of psychologists in the area of OSH: The understanding of the roles of psychologists in the area of OSH should be enlarged. A psychologist working in this area should be a scientist to analyze coherence and to develop concepts, he or she should be a creator to accelerate the progress of translation and to take measures for intervention and he or she should be a consultant at the same time in order to provide problem solving ideas and support change processes. University education should prepare psychologists for work in the area of OSH.

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