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Edited by

Gerard P. Hodgkinson
The University of Leeds, UK

and

J. Kevin Ford
Michigan State University, USA

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ABOUT THE EDITORS

Gerard P. Hodgkinson *Leeds University Business School, The University of Leeds, Leeds LS2 9JT, UK*

J. Kevin Ford *Department of Psychology, 129 Psychology Research Building, Michigan State University, E. Lansing, MI 48824, USA*

Gerard P. Hodgkinson is Professor of Organizational Behaviour and Strategic Management at the University of Leeds, UK. He earned his BA, MSc, and PhD degrees at Wolverhampton Polytechnic and the Universities of Hull and Sheffield, respectively. He has published over 40 articles and chapters and two books on topics of relevance to the field of industrial and organizational psychology and in 2001 he was elected a Fellow of both the British Psychological Society and the British Academy of Management, in recognition of his pioneering contribution to the psychology of strategic management as an emergent field of study. This and related work on managerial and organizational cognition is currently being taken forward (2004–2006) through the award of a Fellowship of the Advanced Institute of Management Research (AIM), the UK's research initiative on management, funded by the Economic and Social Research Council (ESRC) and the Engineering and Physical Sciences Research Council (EPSRC). He is the Editor-in-Chief of the *British Journal of Management* and an Editorial Board Member of the *Academy of Management Review*, the *Journal of Occupational and Organizational Psychology*, and *Organization Science*. A practising chartered occupational psychologist, he has conducted numerous consultancy assignments for leading private and public sector organizations. Further information about Gerard and his work can be found at the following addresses: (1) *http://www.leeds.ac.uk/lubs/*; (2) *http://www.aimresearch.org.*

Kevin Ford is a Professor of Psychology at Michigan State University. His major research interests involve improving training effectiveness through efforts to advance our understanding of training needs assessment, design, evaluation, and transfer. Dr Ford also concentrates on understanding change dynamics in organizational development efforts and building continuous learning and improvement orientations within organizations. He has published over 50 articles and chapters and four books relevant to Industrial and Organizational Psychology. Currently, he serves on the editorial boards of the *Journal of Applied Psychology* and *Human Performance*. He is an active consultant with private industry and the public sector on training, leadership, and organizational change

issues. Kevin is a Fellow of the American Psychological Association and the Society of Industrial and Organizational Psychology. He received his BS in Psychology from the University of Maryland and his MA and PhD in Psychology from the Ohio State University. Further information about Kevin and his research and consulting activities can be found at: *http://www.io.psy.msu.edu/jkf*.

CONTRIBUTORS

John Annett	*Department of Psychology, University of Warwick, Coventry CV4 7AL, UK*
Kamaljit Birdi	*Institute of Work Psychology, University of Sheffield, Mushroom Lane, Sheffield S10 2TN, UK*
Michael J. Burke	*Freeman School of Business, Tulane University, New Orleans, LA 70118, USA*
Catherine Cassell	*Manchester Business School, University of Manchester, Booth Street West, Manchester M15 6PB, UK*
Renée E. DeRouin	*Department of Psychology and Institute for Simulation and Training, University of Central Florida, PO Box 161390, Orlando, FL 32816-1390, USA*
Scott C. Douglas	*School of Business Administration, University of Montana, Missoula, MT 59812, USA*
Paul Harvey	*College of Business, The Florida State University, Tallahassee, FL 32306, USA*
David Holman	*Institute of Work Psychology, University of Sheffield, Mushroom Lane, Sheffield S10 2TN, UK*
Cameron Klein	*Department of Psychology and Institute for Simulation and Training, University of Central Florida, PO Box 161390, Orlando, FL 32816-1390, USA*
Gary P. Latham	*Rotman School of Management, University of Toronto, 105 St George St, Toronto, ON M5S 3E6, Canada*
Karen S. Lyness	*Department of Psychology, Baruch College, City University of New York, One Bernard Baruch Way, New York, NY 10010, USA*
Sara Mann	*Rotman School of Management, University of Toronto, 107 St George St, Toronto, ON M5S 3E6, Canada*
Mark J. Martinko	*College of Business, The Florida State University, Tallahassee, FL 32306, USA*

Eduardo Salas — *Department of Psychology and Institute for Simulation and Training, University of Central Florida, PO Box 161390, Orlando, FL 32816-1390, USA*

Paul R. Sparrow — *Manchester Business School, University of Manchester, Booth Street West, Manchester M15 6PB, UK*

Neville Stanton — *School of Engineering and Design, Brunel University, Uxbridge UB8 3PH, UK*

Gillian Symon — *Department of Organizational Psychology, Birkbeck College, University of London, Malet Street, London WC1E 7HX, UK*

Jolie M.B. Terrazas — *Department of Psychology, Baruch College, City University of New York, One Bernard Baruch Way, New York, NY 10010, USA*

EDITORIAL FOREWORD

This is the twenty-first volume of the *International Review of Industrial and Organizational Psychology*. As with past volumes in the series, we have commissioned a wide-ranging collection of chapters from some of the world's leading researchers, reflecting the rich diversity of advances occurring both within the mainstream and at the leading-edge of the field. Several of the topics covered in the present volume, although well established as areas of theory, research, and application, are new to the series, including workplace interpersonal skills, applications of learning theory to the development of effective health and safety training, attribution theory, and task analysis. Another topic featured for the first time, and worthy of special mention, is qualitative research. In a highly critical survey, Catherine Cassell and Gillian Symon raise a series of issues with which many of our readers are likely to be distinctly uncomfortable, challenging researchers, reviewers, and editors alike to rethink a number of practices now commonplace in the analysis and reporting of quantitative data, but which may be wholly inappropriate in the context of qualitative work. Other chapters (e.g., the chapters on 'Women in Management' by Karen Lyness and Jolie Terrazas, 'Advances in the Science of Performance Appraisal' by Gary Latham and Sara Mann, and 'International Management' by Paul Sparrow) revisit topics covered in previous volumes, offering detailed overviews of the scientific literature amassed over the interim.

Now entering its twenty-second year, the *International Review of Industrial and Organizational Psychology* has become the primary reference work of choice for individuals seeking authoritative, up-to-the-minute coverage of developments around the globe.

GPH
JKF
June 2005

Chapter 1

A WALK ON THE SAFE SIDE: THE IMPLICATIONS OF LEARNING THEORY FOR DEVELOPING EFFECTIVE SAFETY AND HEALTH TRAINING

Michael J. Burke
Freeman School of Business, Tulane University, USA
and
David Holman and Kamaljit Birdi
Institute of Work Psychology, University of Sheffield, UK

Knowledge and motivation represent two broad categories of determinants of safe work behavior in organizations. A considerable amount of research and practice in disciplines as diverse as psychology, occupational medicine, and engineering focus on how safety and health training affects the development of worker characteristics in these domains and the transfer of knowledge to the job (e.g., see Colligan & Cohen, 2004; Johnston, Cattledge, & Collins, 1994). Findings from this large and diverse body of research generally show that safety and health training is sometimes positively associated with knowledge acquisition, safe work behavior, and the reduction of accidents, illnesses, and injuries (Colligan & Cohen, 2004). However, a cursory examination of this literature indicates that not only do the learning theories and theoretical approaches that underlie safety training efforts differ, but also that potentially relevant learning theories and research findings are not necessarily incorporated into the design and conduct of worker safety and health training.

To date, no unified discussion of the implications of learning theory and research for safety and health training research and practice has been presented in a disciplinary literature. This gap in the literature is particularly noteworthy given that the amount of requisite knowledge and skills can be considerable in many types of safety work, and learning research indicates that infrequently performed tasks or complex skills can quickly deteriorate without

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practice (Adams, 1987; Arthur, Bennett, Stanush, & McNelly, 1998). This point can relate to knowledge and skill development or maintenance in work related to many critical skills occupations (e.g., emergency response, firefighting) and work involving infrequent critical incidents (e.g., mining explosions, hazardous waste emissions, and transportation equipment failure). An integrative discussion of the role and relevance of learning theory and research with current safety training research and practice would be helpful for suggesting how best to achieve different types and levels of knowledge acquisition through training and optimize the transfer of training to the job. In particular, an integrative discussion of the learning literature and safety training research would shed light on why and how different methods of safety training, as well as methods of training program evaluation, affect proximal training outcomes (e.g., knowledge, skills, and attitudes) and more distal outcomes (e.g., on-the-job performance and performance outcomes such as accidents, illnesses, and injuries). In addition, an integrative discussion would offer suggestions for improving safety and health training research and practice, especially in relation to work in critical skills occupations affecting the public in an age of terrorism (e.g., emergency response, protective services, transportation security) and occupations involving significant worker injuries (e.g., nursing, construction, mining).

A problem faced in the rapprochement of historically different paradigms and bodies of literature as they might relate to safety knowledge acquisition is where to provisionally begin in terms of a theoretical foundation. For our purposes, we begin with a discussion of the nature of general safety performance, the actions or behaviors that employees exhibit in almost all types of work to promote their own health and safety and that of their coworkers, clients, the public, and the environment. Given that safety knowledge is posited as a direct antecedent of safety performance (Neal & Griffin, 2004), specifying the construct domain of general safety performance will permit a discussion of the nature and content of requisite safety knowledge affected by training. Consistent with Ackerman's (1996) arguments for the importance of systematically inquiring about the content of intellect in particular domains, identifying the content of safety knowledge is not only important for understanding what workers know, but is also critical for studying whether and how that knowledge changes with respect to training applications of particular learning theories. Surprisingly, many training evaluation studies are mute on the specific content of learning and specific attributes associated with this content (e.g., novelty and complexity; Sonnentag, Niessen, & Ohly, 2004). Although the focus of this chapter is on knowledge acquisition in safety training contexts, we will discuss, where appropriate, motivational issues in relation to knowledge and skill acquisition and its transfer to the job.

Subsequent to our discussion of the nature of general safety performance and safety knowledge, we begin our presentation of learning theories with a brief description of a long-standing theoretical approach or paradigm for knowledge

and skill acquisition in the applied psychology literature, which is the stage or phase approach to learning (see Anderson, 1985, 1987; Bryan & Harter, 1899; Fitts, 1962). The discussion of stage approaches is followed by a description of the role and relevance of (a) reinforcement and feedback intervention theories (Geller, 2001; Kluger & DeNisi, 1996; Skinner, 1974), (b) social learning theory (Bandura, 1977), goal-setting theory (Locke & Latham, 1990), and action regulation theory (Hacker, 2003), and (c) experiential-learning theory (Kolb, 1984; Weil & McGill, 1989) and theories of distance learning (Garrison, 2000; Moore, 1993). We have chosen to focus on particular learning theories and selected studies on learning or behavior modification which, in our opinion, are most directly relevant to improving our understanding of knowledge and skill acquisition in safety training contexts and offer the greatest possibility of enhancing safety training research and practice. Our discussion of these clusters of theories is not intended to imply that the various learning theories and approaches are mutually exclusive.

Following each set of learning theories, we discuss the implications of the respective theories for safety training. Thereafter, we indicate how the various learning theories are being applied to safety training methods and discuss the relative effectiveness of these applications. Our chapter concludes with a focus on selected individual difference, situational, and training process variables, which are concerned with the limits of our current state of knowledge and practice in relation to safety and health training, and offer the most promise for expanding these limits. Finally, while our discussion of learning theories and their implications for safety training often has direct relevance for learning with respect to leader safety behavior and individuals functioning within teams or work groups, our focus is on individual learning per se.

THE NATURE OF GENERAL SAFETY PERFORMANCE AND SAFETY KNOWLEDGE

General Performance

In terms of task-relevant behavior, workers are required to display core, basic safety behaviors to some degree across jobs in most industries, including manufacturing, health care, mining, chemical processing, nuclear power plant operations, and protective services. For the most part, a single-factor model relating to safety compliance has dominated conceptual and empirical research on the nature of safety task performance in these industries and types of work (Cheyne, Cox, Oliver, & Tomas, 1998; Chhokar, 1990; Griffin & Neal, 2000; Hofmann & Stetzer, 1996; Lingard & Rowlinson, 1997; McDonald, Corrigan, Daly, & Cromie, 2000; Neal & Griffin, 2004; Rudmo, 2000). Safety compliance refers to the extent to which employees adhere to required safety procedures and carry out work in a correct and safe manner. Notably, Marchand, Simard, Carpentier-Roy, and Ouellet (1998) found a weak fit for a confirmatory factor

model involving safety compliance, with follow-up analyses indicating that safety compliance is not a consistent dimension.

In a few cases, researchers have argued that multiple performance factors underlie worker safety-related task behavior, including leader safety behavior (see Hofmann & Morgeson, 2004; Simard & Marchand, 1997). Furthermore, in a more general sense, Burke, Sarpy, Tesluk, and Smith-Crowe (2002) confirmed, across 23 jobs, a grounded theoretical model of general safety performance, with four factors labeled (1) using personal protective equipment, (2) engaging in work practices to reduce risk, (3) communicating health and safety information, and (4) exercising employee rights and responsibilities. Notably, these factors were confirmed for individuals working in dyads, work groups, and teams. These four factors are consistent with knowledge content areas and lesson plans (in terms of how safety training is segmented into modules) for a number of major labor unions and organizations (e.g., International Brotherhood of Teamsters, 1993). These findings offer progress toward a taxonomy of general safety performance in so far as safety task performance is concerned, and provide potentially useful categories for describing the content of requisite safety knowledge in a broad set of jobs and types of work. We note that our discussion is not intended to preclude the consideration of more specific safety performance constructs and knowledge areas, including more specific team processes (see Marks, Mathieu, & Zaccaro, 2001), but is intended to identify theoretically meaningful performance and knowledge constructs that help to drive our discussion of the relative effectiveness of safety training interventions.

Drawing on work in the area of contextual performance (Borman & Motowidlo, 1993), a second type of behavior, discretionary or extra-role behavior—referred to as safety participation or safety initiative—has also been studied (e.g., Griffin & Neal, 2000; Marchand et al., 1998; Neal, Griffin, & Hart, 2000). Notably, Marchand et al. found that a two-factor model of safety performance (with factors relating to safety compliance and safety initiative) did not provide a good fit to the data. This result is not surprising, given that the research literature on contextual performance suggests that more specific dimensions underlie discretionary work behaviors (Motowidlo, Borman, & Schmitt, 1997).

Safety Knowledge and Skills

For any task-related safety performance construct, the content of safety knowledge can be characterized in terms of the factual material the trainee needs to acquire (i.e., often referred to as declarative knowledge or verbal information: Gagne & Medsker, 1996; Kraiger, Ford, & Salas, 1993). Trainees in almost all occupational domains will need to acquire declarative knowledge of fundamental information related to using personal protective equipment, engaging in work practices to reduce risk, communicating health and safety information,

and exercising employee rights and responsibilities. The literature is replete with examples of safety training directed toward the development of workers' understanding of fundamental information in each of these broad content domains in industries as diverse as agriculture (Barnett et al., 1984), health care (Foster, 1996), mining (Fiedler, 1987), and transportation (Saari & Nisanen, 1989).

While more advanced knowledge concerning how to undertake cognitive or physical tasks (i.e., often referred to as procedural knowledge and skill and can include mental models: Kraiger et al., 1993) can be described for each general knowledge area, another useful distinction is the type and level of procedural knowledge or skill. For the purpose of our discussion, we will use the term 'skill' interchangeably with the concept of 'procedural knowledge.' Moving beyond the acquisition of fundamental or declarative knowledge, the development of safety and health knowledge in each of the four content domains can be considered with respect to at least two levels of advanced skill: recognition and awareness skills, and analytical and decision-making skills (Baker & Wallerstein, 1998). For the most part, recognition and awareness skills pertain to observing and inspecting the workplace for potential hazards, and properly reporting these hazards. Analytical and decision-making skills focus on controlling hazards and engaging in social action to proactively prevent work-related accidents, illnesses, and injuries. As such, in safety work, the latter skills often have cognitive/intellectual (applying concepts and generating solutions) and motor components (executing physical action with a degree of precision)—occasionally referred to as cognitive-psychomotor skills (Arthur, Bennett, Edens, & Bell, 2003). As we will point out below, particular learning theories and methods of safety and health training are often closely tied to the type and level of knowledge being acquired.

LEARNING THEORIES AND THEIR IMPLICATIONS FOR SAFETY AND HEALTH TRAINING

All theoretical frameworks that address adult knowledge development describe a process for how learning unfolds with respect to the systematic ordering of concepts that are germane to the respective framework. In addition, the theories can be further differentiated in terms of the extent to which notions of action or behavior, reflection (thinking), feedback (and dialogue), and motivational constructs are incorporated into the framework. We note that individual reflection can be of an abstract or more concrete nature, with more concrete reflection often posited to be associated with actions considered or taken. We also distinguish feedback from dialogue, where the latter refers to discussions with others, including virtual others, and often with respect to actions considered or taken. Feedback refers to information learners receive from either external sources (e.g., trainers, peers, and supervisors) or intrinsically (e.g.,

kinesthetic, tactile, visual, and olfactory) concerning their progress in the acquisition of knowledge or demonstration of behavior.

For each learning theory, we discuss key concepts and their ordering within the theory as well as how the various theories incorporate notions of action, reflection, feedback, dialogue, and motivation. These discussions highlight commonalities and differences among the theories, and set the stage for a discussion of how safety training is based on each theory. Table 1.1 provides a summary of the key features of each approach and the implications of each learning theory for knowledge development and its transfer, which are detailed below.

Stage-learning Theories

Historically, many learning theorists (e.g., Bryan & Harter, 1899; Fitts, 1962) have described knowledge acquisition in terms of stages that delineate different aspects of the learning process. For instance, Anderson (1985) and Kanfer and Ackerman (1989) segment learning into three phases: acquisition of declarative knowledge, followed by knowledge compilation, and, subsequently, the proceduralization of knowledge. Declarative knowledge refers to one's mastery of factual material (i.e., knowledge of facts and things), whereas procedural knowledge concerns the routines for undertaking cognitive or physical tasks (i.e., knowledge about how to perform a task).

In the declarative knowledge phase, the learner is viewed as a non-autonomous consumer of information delivered by one or more experts. An important aspect of the declarative knowledge phase is that knowledge acquisition requires substantial attentional resources. For instance, a hazardous waste worker learning how to use air respirators needs to devote considerable cognitive and motor resources to acquire facts and routines related to components of the task (e.g., selecting the appropriate air respirator, properly fitting the respirator, cleaning the respirator). As a result, when an individual is confronted with information-processing requirements that are tangential to the task or learning goal related to using an air respirator (e.g., communicating health and safety information), he or she is often unable to devote attention to such a secondary task (e.g., see Nissen & Bullemer, 1987). Consequently, declarative knowledge acquisition is slow and error prone.

Once the learner has developed an adequate cognitive representation of the task, he or she progresses to the knowledge compilation phase. During the knowledge compilation phase, with practice, the learner is posited to integrate the sequences of cognitive and motor processes necessary for engaging in the task. The attentional demands are reduced and the learner moves acquired knowledge from short-term to long-term memory. The notion of moving knowledge acquired through action and practice into long-term memory or knowledge structures is analogous to the development of an 'operative imaging system' (the sum of internal long-term representations of stimulus–response–consequence relations) through acting as described within action-regulation theory (see Frese & Zapf, 1994; Hacker, 2003).

Table 1.1 Prominent features of learning theories

Learning theory emphases and features	Stage theories	Reinforcement	Feedback intervention	Social learning	Action regulation	Experiential learning	Distance learning
Knowledge development							
Development of declarative knowledge is considered	●				●	●	●
Content of knowledge is important					●		
Multiple methods (e.g., lecture, case studies) are employed	●			●		●	
Aids for retention of observed skills (e.g., notes, guides) are provided				●			
Action/Behavior							
Development of procedural knowledge and skill is emphasized	●			●	●	●	
Physical practice is encouraged	●			●	●	●	
Error training is used to aid transfer					●		
Motivation							
Development of learning valence beliefs is encouraged				●			●
Rewards/punishment are used to reinforce behaviors		●		●			
Goal setting is used as an aid to transfer			●	●	●		
Self-management strategies (e.g., relapse prevention) are taught				●		●	
Feedback							
Specific actions are targeted		●		●			
Informational feedback is provided	●	●	●	●	●		
Feedback is considered better as task grows subjectively familiar or objectively simple			●				
Feedback is recommended on task rather than person			●				
Dialogue and reflection							
Reflection considered important for knowledge development				●	●	●	●
Action-focused reflection is viewed as critical to knowledge development					●	●	
Dialogue is considered important					●	●	●
Role of teacher in facilitating reflection and dialogue is considered						●	●
Learning strategies are considered—deep learning is encouraged						●	●
Mental practice is used				●			
Small group, collaborative learning is considered						●	
Contextualization							
Importance is placed on learning skills in context					●	●	
Individuals build upon their experiences	●				●	●	
Experiential methods (e.g., problem-based learning, project work, role plays, simulations) are promoted						●	
Learning in non-redundant contexts is encouraged for transfer					●	●	

In the final phase, procedural knowledge and skills are acquired when the learner can perform the task with little attentional resources—that is, the task is said to be automated or proceduralized, such that once a signal or stimulus is presented, the task is performed with little conscious activity. In many respects, advanced proceduralized knowledge is analogous to notions of implicit knowledge (Broadbent, Fitzgerald, & Broadbent, 1986; Gardener, Chmiel, & Wall, 1996), that is, knowledge that is developed through action and cannot necessarily be verbalized. For tasks that are infrequently carried out (such as responding to an emergency), extra learning opportunities subsequent to the proceduralization of knowledge have been found to have positive effects on procedural knowledge retention (Driskell, Willis, & Copper, 1992; Wagner, 1997). Also, as would be expected from stage theories of learning, meta-analytic research has shown stronger associations between post-training levels of procedural knowledge and performance than between post-training levels of declarative knowledge and performance (see Alliger, Tannenbaum, Bennett, Traver, & Shotland, 1997; Colquitt, LePine, & Noe, 2000).

Implications of stage-learning theories for safety training

For training objectives related to the acquisition of procedural knowledge, stage-learning theories imply that safety training for individuals and work groups begin with the standardized presentation of factual material, possibly via a lecture-based format by a recognized expert, followed by opportunities for substantial practice. This point is in line with Atherley and Robertson's (1998) observation that a stage approach to learning calls for the use of multiple training methods or instructional techniques for the development of different levels of safety knowledge. These points are also consistent with Halpern and Hakel's (2003) arguments that substantial practice during training under varied conditions will promote long-term retention and transfer of knowledge. In addition, stage-learning theorists emphasize expert feedback, often of a unidirectional nature throughout the learning process. Notably, the theoretical role of dialogue (within and between trainers and trainees) in the development of knowledge structures is typically not considered in stage-learning theories. Furthermore, stage-learning theorists allude to reflection or thinking via the notion of knowledge compilation, but the process for how knowledge compilation occurs or can be stimulated is rather vaguely described. Finally, with the notable exception of Kanfer and Ackerman's (1989) work, stage-learning theorists have not emphasized the role of motivational variables.

Reinforcement and Feedback Theories

Behaviorists, such as Skinner (1974), propose that learning results from the association between behaviors (actions) and rewards (consequences). The basic premise is that actions are controlled by the immediate consequences; that is,

individual or team behavior can be increased, suppressed, or decreased depending on what happens immediately after its occurrence. A key focus of behavior modification is on positive reinforcement, following a desired behavior with a reward (praise, recognition, cash reward, etc.) so as to increase its probability of occurrence. As a learning mechanism, positive reinforcement is useful in pointing out when the desired action is demonstrated, and has been shown to be effective in increasing individual and team task performance across a wide range of working populations and work settings (see reviews by Hackman & Wageman, 2005; Stajkovic & Luthans, 1997, 2001).

Feedback intervention theory (Kluger & DeNisi, 1996, 1998) has been proposed as a related framework for understanding why and how worker behavior changes as a result of external consequences. The three basic arguments of feedback intervention theory are (a) behavior is regulated by comparisons of feedback with goals or standards (and the identification of gaps between the two), (b) attentional resources are limited, and only those feedback-goal gaps that receive attention affect self-regulation, and (c) feedback interventions change the locus of attention (self versus task) and thus behavior. For example, feedback interventions that direct attention to the self on complex tasks are seen as depleting the resources needed for adequate performance. In contrast, feedback interventions that direct attention to the self on simple tasks may increase performance. Notably, Kluger and DeNisi's (1998) meta-analytic findings indicate that the effects of feedback interventions grow more positive either as the task becomes more subjectively familiar (e.g., skills for engaging in the task are proceduralized) or objectively simple.

Implications of behavior-based safety and feedback intervention theory for modifying safety performance

For modifying safety-related behavior, behavior-based safety implies that interventions must always target specific actions. For the most part, targeting specific behaviors implies that workers know how to engage in the action (i.e., the skill is proceduralized) or that the action is relatively simple. Feedback intervention theory also suggests that simple actions or complex actions (which are proceduralized) are most likely to be positively affected by feedback interventions. In addition, feedback intervention theory suggests that targeting simple actions or actions related to proceduralized skills should be accompanied by goal setting in order to further motivate behavioral change (Kluger & DeNisi, 1998).

Clearly, the emphasis in reinforcement theory is on *acting workers into thinking differently* rather than targeting internal individual differences (such as declarative knowledge or attitudinal variables) in order to *think people into acting differently* (Geller, 2001). Although not denying the existence of internal states, reinforcement theory implies that trainers or others (e.g., supervisors) should look for external factors (positive as opposed to negative consequences) to

improve worker safety performance. This position leads to a lack of emphasis placed on reflection about actions taken. Rather, emphasis is placed on identifying signals that activate behavior and expert unidirectional feedback to modify worker actions. Likewise, feedback intervention theory stresses unidirectional, external feedback related to task behavior (as opposed to the self as the locus of attention).

Social-learning and Action-regulation Theories

Social-learning theory (Bandura, 1977) within the Anglo-American tradition and action-regulation theory (Hacker, 2003) within German psychology developed as alternatives to behaviorist approaches. Below, we discuss the two approaches and then provide an integrated discussion of the implications of these social-cognitive theories for safety and health training.

Social-learning theorists believe that behavior is a result of continual, dynamic, and reciprocal interaction between the person and the environment. Similar to behaviorists, they consider that response consequences, such as rewards or punishments, will influence the likelihood of a behavior occurring in a given situation. However, the key difference with behaviorists is the proposed active role of cognition in mediating between stimulus and response, and the view that learning not only takes place through direct experience (enactive learning) but can also occur vicariously through watching others (observational learning). In terms of workplace learning, the most influential of this school of theorists is Albert Bandura (Bandura, 1977, 2001; Bandura & Locke, 2003; Wood & Bandura, 1989). The three most relevant contributions of this theory are, with regards to the operation of observational learning, the focus on active *self-management* of the individual, and the acknowledged importance of factors such as *motivation* and *self-efficacy* in influencing learning and behavior.

Bandura's theoretical position on observational learning considers four interrelated processes. The first necessary condition for modeling to occur is that the learner needs to attend to the model (*attentional* processes). An individual's level of attention can be affected by many factors including the characteristics of the behavior, the model characteristics, and their own distractedness or tiredness. Greater modeling occurs where the behavior is demonstrated in a clear and specific manner by an identified and trusted model (Goldstein & Ford, 2002). Second, observed activities are transformed into symbolic mental representations (as images or semantic code), which guide subsequent behavior (*retention* processes). Factors that aid long-term memory (e.g., repetition of modeled behavior) or help with the recovery of information (e.g., contextual cues) will influence the degree of modeling (Weeks & Anderson, 2000). The third phase involves the translation of what has been observed and coded into covert behavior (*production* processes). Individuals compare their conceptions of what should be produced with what they are actually producing. Abilities

improve with direct practice and even usage of mental rehearsal (e.g., Davis & Yi, 2004; Driskell, Copper, & Moran, 1994; Salas & Cannon-Bowers, 2001). Feedback is also an important component here in helping individuals to identify the discrepancy between target and actual behaviors and allowing the gap to be closed (Smith-Jentsch, Salas, & Baker, 1996). The fourth aspect concerns the role of *motivational* processes. Individuals may learn how to do certain behaviors but they also need to be motivated or confident enough to display the behavior (Tannenbaum & Yukl, 1992). Social-learning theory considers that motivation can be influenced by the individual being directly reinforced through tangible rewards and punishments, by observing the reinforcement of others, or engaging in self-reinforcement (e.g., through self-praise or self-reproach).

One popular organizational application of social-learning theory has been the development of behavior-modeling training, which utilizes the processes described above to operationalize an observational-learning methodology. In practice, behavior-modeling training has three main steps, which apply to individual trainees or trainees as a work group or team. First, a model (e.g., an expert) demonstrates the behavior and skills the trainee has to learn. Second, the trainee is encouraged to rehearse and practice the model's behavior. Third, feedback or reinforcement from the trainer, and possibly other trainees, is provided as the trainee's behavior approximates closer to the behavior of the model. This approach has been widely used and shown to effect with respect to a wide range of training topics including computer software use (e.g., Bolt, Killough, & Koh, 2001; Chou, 2001; Gist, Schwoerer, & Rosen, 1989; Simon, Grover, Teng, & Whitcomb, 1996; Simon & Werner, 1996), negotiation skills (Nadler, Thomson, & van Boven, 2003), job search skills (Eden & Aviram, 1993), and innovative problem solving (Gist, 1989). Notably, behavior-modeling training has been found to be more effective than traditional lecture-based methods in improving immediate knowledge, skill outcomes, and, to a lesser extent, work performance outcomes (Burke et al., in press; Callahan, Kiker, & Cross, 2003; Goldstein & Ford, 2002). Finally, in a meta-analysis of 117 behavior-modeling studies, Taylor, Russ-Eft, and Chan (in press) found that transfer was greatest when mixed models (positive and negative models, see Baldwin, 1992), as opposed to only positive models, were presented, when practice included trainee-generated scenarios, when trainees' superiors were also trained, and when rewards/sanctions were instituted in the trainees' work environment.

Another key aspect of Bandura's agentic approach is that individuals undertake extensive self-reflection on their experience and the adequacy of their thoughts and actions. With respect to this point, he highlights the importance of self-efficacy, defined as people's judgments of their ability to perform specific activities to a designated standard (Bandura, 1986). It is thought to be significant that the greater the sense of self-efficacy, the greater will be the effort, persistence, and resilience of the individual in performing a behavior (Gist & Mitchell, 1992).

Self-efficacy has been shown to relate to training effectiveness measures, such as knowledge acquisition and work performance itself (see Colquitt et al., 2000; Ford, Quinones, Sego, & Sorra, 1992; Gist & Mitchell, 1992; Mathieu, Martineau, & Tannenbaum, 1993; McNatt & Judge, 2004). In addition, a number of studies have demonstrated relationships between post-training levels of self-efficacy and transfer (Ford, Smith, Weissbein, Gully, & Salas, 1998; Frayne & Latham, 1987; Morin & Latham, 2000; Warr, Allan, & Birdi, 1999). Furthermore, Colquitt et al.'s (2000) training meta-analysis showed that post-training self-efficacy had a significant relationship with transfer over and above levels of declarative knowledge, skill acquisition, and reactions to the training.

Bandura's highlighting of self-management by individuals and the role of motivation and self-efficacy in influencing learning outcomes has contributed to two other types of interventions designed to improve these aspects and, in particular, to improve the transfer of training: relapse prevention/behavioral self-management and goal-setting approaches. Relapse prevention was introduced into the training context by Marx (1982), who proposed a theoretical process to describe how some individuals may fail to transfer their skills to the workplace. He suggested that early in the post-training period, if individuals failed to apply their skills in a challenging situation, they would suffer a decline in self-efficacy and a subsequent reduced likelihood of using their learned skills (i.e., an increased probability of relapse). The relapse prevention approach involves teaching participants a set of self-control strategies including behavioral coping skills (anxiety reduction, stress management, assertion training) and cognitive strategies for reinterpreting negative and irrational outcomes to help trainees to become successful in their transfer (e.g., see Marx & Ivey, 1988).

Reviews of research in clinical and penal contexts (Dowden, Antonowicz, & Andrews, 2003; Mueser et al., 2002) have shown that the teaching of relapse prevention strategies has had a measure of success. Several authors have recommended the use of relapse prevention or self-management strategies for training (e.g., Noe, 1986) and some empirical research has been done on the method in work settings—that is, studies by Burke and Baldwin (1999), Frayne and Latham (1987), Frayne and Geringer (2000), Godat and Brigham (1999), and Hickman and Geller (2003) have shown that self-management training can lead to greater changes in workplace behavior compared to those not provided with self-management strategies.

Another approach for improving motivation is through the setting of goals that are specific, challenging, and accepted by the individual (Locke & Latham, 1990). Goals can be operationalized through behavioral checklists, action plans, or learning contracts. Most training studies on the topic have shown that goal setting can help to improve the transfer of training (e.g., Cheng & Ho, 2001; Shoenfelt, 1996); yet, inconsistent results have been reported (e.g., Morin & Latham, 2000; Murtada & Haccoun, 1996). In addition, several

studies have attempted to directly compare the relative effectiveness of relapse prevention or self-management methods with goal-setting techniques. Although results have been mixed, they do suggest that goal setting promotes effort and persistence toward a particular target outcome and that self-management approaches may be particularly helpful in aiding skill mastery and transfer of skills to new and difficult situations (Gist & Stevens, 1998).

Action-regulation theory

Action-regulation theory is another cognitive, information-processing theory concerned with goals and the processes that intervene between environmental input and actions of workers (Frese & Zapf, 1994; Hacker, 2003). Action-regulation theory focuses on various stages or phases of action regulation, which begin with action preparation (goal development and orienting oneself to the characteristics of the situation under which a goal must be accomplished), implementing the goal (which includes feedback on goal progress), and evaluation of the final outcome. The most important aspect of action regulation is that actions are controlled by goals—anticipations of the results that one or more individuals in the case of teams intend to achieve (Hacker, 2003). From a motivational perspective, the goals can be viewed as intentions. Furthermore, the goals are posited to be stored in memory until the action is completed.

An important characteristic of this theory is the development of the 'operative-imaging system.' The operative-imaging system is the sum of the internal, long-term representations of condition–action–consequence relations. Importantly, these associations in the operative-imaging system, and thus knowledge, are regarded as content specific (Hacker, 2003). Also, action theorists regard substantial parts of knowledge (which would include portions of procedural knowledge in any content area) as being implicit, unarticulated pieces of knowledge that cannot be elicited by questioning alone. The operative-imaging system is the cognitive base incorporating all knowledge gained, analogous to notions of long-term memory, which enables a person to act. Operative-imaging systems also bear some relation to mental models in that the information they store is not viewed as a true copy of reality. Yet, the concept of a mental model is more an internal model of an external system, whereas an operative-imaging system is built up or learned through acting.

Along with acting, experiencing errors is believed to be helpful in the construction of realistic operative-imaging systems and learning (Frese & Zapf, 1994), and can be successfully incorporated into training efforts (Heimbeck, Frese, Sonnentag, & Keith, 2003; Ivancic & Hesketh, 2000). Experiencing errors and acting in non-redundant, dynamic environments is expected to prevent premature routinization of action. In addition, Bransford, Brown, and Cocking (2000) caution that knowledge that is overly contextualized can reduce the transfer of knowledge. These points are relevant not only for individuals, but

also for teams that may need to deal with crisis events, where updating and deviating from planned action may be necessary (Doerner, 1996). Furthermore, while feedback is regarded as important, dialogue with a real or virtual partner concerning actions is regarded as critical to learning and the development of the operative-imaging system. The reason for this effect is that dialogue is expected to initiate and stimulate reflection concerning actions taken. In effect, action theorists argue that workers learn and *think in and by action*.

The implications of social-learning and action-regulation theories for safety training

For training objectives relating to the development of procedural knowledge, observational modeling should improve safety training beyond just lecturing. With observational-learning approaches, the model or models must be credible, trusted, and demonstrate the desired behavior in a clear and precise manner. As with stage theories of learning, both social-learning theory and action-regulation theory argue that trainees must be given the opportunity to practice the behavior a number of times, with appropriate levels of feedback. For routine tasks, repetitive practice and feedback not only help to consolidate the requisite knowledge and skill, but also help in the development of task self-efficacy, which is known to influence learning and work behavior. However, as pointed out by action theory and social-learning theory, trainees would potentially benefit from the incorporation of error training or positive and negative role models into the training effort and possibly acting in non-redundant and dynamic (where relevant) contexts to enhance learning (e.g., with respect to different training props and changing scenarios as is done in hands-on emergency responder training; see Smith-Crowe, Burke, & Landis, 2003). The latter features are not only expected to aid in the development of a cognitive operating system, but may also facilitate anticipatory thinking and the development of strategies for handling non-routine and dynamic emergency events or critical incidents. This conclusion is consistent with the assertions of Wall, Cordery, and Clegg (2002) and Kozlowski et al. (2001) that knowledge application facilitates knowledge development, and that both foster more proactive and adaptive orientations. Also, see Ford and Schmidt (2000) for a related discussion of how training might be conducted to enhance the generalization of knowledge acquired through training to deal with non-routine events involving teams.

Attending to the motivational and self-efficacy needs of trainees is also important within both social-learning and action-regulation theories (Frese & Zapf, 1994; Machin & Fogarty, 2003). The use of goal setting should aid the transfer of training (especially for routine safety behavior) and this can be done through usage of behavioral checklists, action plans, or learning contracts. In addition, self-efficacy can be developed through four types of experience, each of which relates to many potential aspects of safety training activities: mastery

(e.g., direct attempts to try out skills in a class setting or real or virtual simulations); vicarious learning (e.g., learning by watching others such as facilitators or workers demonstrating procedural skills); verbal persuasion (e.g., being instructed and encouraged by course facilitators, peers, and supervisors); and positive emotional arousal (e.g., increasing feelings of comfort during training related to dealing with actual hazards). Furthermore, the teaching of self-regulatory strategies, which help trainees to monitor their own behaviour and anticipate and cope with difficult situations, should also prove beneficial in improving the transfer of training. This effect is partly (along with well-developed cognitive strategies) a result of helping trainees to maintain their self-efficacy in challenging contexts.

Beliefs about the potential value of training have also been indicated as influencing training success (Tannenbaum, Mathieu, Salas, & Cannon-Bowers, 1991) and participation in learning activities in the first place (Tharenou, 2001). In fact, Colquitt et al.'s (2000) meta-analytic results indicated that there was a strong relationship between valence beliefs and the motivation to learn. Therefore, it may be reasonable to assume that safety training programs that emphasize the value of performing the behaviors (e.g., showing or allowing trainees to experience the negative consequences of not performing the correct safety procedures) should improve the motivation of trainees to learn the content and transfer it to the job. In effect, directly or indirectly experiencing the negative consequence of unsafe behavior or error training may have not only cognitive, but also motivational benefits for safety trainees. More research is needed to address these issues in safety and health training contexts.

Experiential-learning and Distance Education Theories

Theories of experiential learning posit that the learning process ideally involves the following key activities: (a) integrating new knowledge and experiences into existing experience, i.e., the personal knowledge derived from direct participation in the world; (b) constructing more complex and differentiated understandings of self (e.g., one's skills, abilities) and the world; (c) applying experience and new understandings to real-life or life-like situations and problems; and (d) reflecting on experience (Weil & McGill, 1989). These activities are often viewed as a cycle and Kolb's (1984) definition of the learning cycle has been particularly influential in organizational research and practice. Kolb argues that there are four relatively independent stages in a learning cycle, namely, concrete experience, reflective observation, abstract conceptualization, and active experimentation. Notably, learning involves reflecting on experience. From the insight gained, new concepts, theories, or plans can be constructed, which in turn are subsequently tested out in action, leading to further concrete experience. Others place less emphasis on the learning process as a cycle of distinct stages, arguing that the different aspects of learning can be combined or occur in different orders (Marsick & Watkins, 1997; Mezirow, 1990).

Like action-regulation theorists, Schön (1983), for example, suggests that an important aspect of learning is reflection-in-action.

Historically, experiential-learning theorists have emphasized the internal cognitive aspects of learning. More recently, sociocultural and dialogical approaches to experiential learning have begun to highlight the social and contextually situated nature of the learning process (Cunliffe, 2002; Dixon, 1994; Fenwick, 2000; Holman, 2000a; Holman, Pavlica, & Thorpe, 1997; Schein, 1993). Learning is social, not only in the obvious sense that individuals learn from others, but also because social interaction mediates the learning process (Lave & Wenger, 1991; Vygotsky, 1987). For example, a teacher's questioning can enable students to reflect on their experience, as can the discussion generated by receiving feedback from others, and group discussion can help to clarify understanding and develop new perspectives (Webb, Troper, & Fall, 1995). As a result, not only are the process and outcomes of learning improved in any one instance, but these external patterns of dialogue and interaction may also be internalized and lead to an improvement in the individual's learning skills and capabilities, e.g., more critical reflection, and better ability to construct meaning. As such, cognitive acts of learning and learning skills can be seen to originate within social interaction.

Learning is also viewed as contextually situated, as knowing how to act properly within a context requires the learner to develop an understanding of the rules, shared meanings, values, relationships, types of language, and technologies that exist within that context (Lave & Wenger, 1991). An implication is that knowledge is embedded within a context, and that the transfer of knowledge from one context to another may be problematic (Wilson, 1992; see also Anderson, Reder, & Simon, 1996, for a critique of this position). Recognizing that learning occurs within a context, Halpern and Hakel (2003) discuss how increasing variability or novelty of stimuli during learning may not only make the learning process more effortful, but also make the memory 'trace' more durable and resistant to forgetting. We will return to a discussion of the more specific implications of contextual aspects of learning, especially in relation to the development of observational and awareness skills needed for identifying and dealing with workplace hazards.

The learning process in experiential-learning theory is normally seen as having specific and general aims (Holman, 2000b). Specific aims include the development of knowledge *and* skill. Indeed, a hallmark of learning in experiential-learning theory is not simply the development of theoretical or experiential knowledge but the development of a person's ability to take effective, skilled action. Emphasis is also placed on learning skills, e.g., critical thinking, planning, self-directedness. As noted, these skills are thought to be developed through engagement in the experiential-learning process itself and are recognized as crucial to meeting the general aims of experiential learning, namely, individual responsibility for learning and personal autonomy (Brookfield, 1987; Mezirow, 1990).