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TRANSFER OF TRAINING: A REVIEW AND DIRECTIONS FOR FUTURE RESEARCH

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Transfer of training is of paramount concern for training researchers and practitioners. Despite research efforts, there is a growing concern over the "transfer problem." The purpose of this paper is to provide a critique of the existing transfer research and to suggest directions for future research investigations. The conditions of transfer include both the generalization of learned material to the job and the maintenance of trained skills over a period of time on the job. The existing research examining the effects of training design, trainee, and work-environment factors on conditions of transfer is reviewed and critiqued. Research gaps identified from the review include the need to (1) test various operationalizations of training design and work-environment factors that have been posited as having an impact on transfer and (2) develop a framework for conducting research on the effects of trainee characteristics on transfer. Needed advancements in the conceptualization and operationalization of the criterion of transfer are also discussed.

Positive transfer of training is defined as the degree to which trainees effectively apply the knowledge, skills, and attitudes gained in a training context to the job (Newstrom, 1984; Wexley & Latham, 1981). Transfer of training, therefore, is more than a function of original learning in a training program (Atkinson, 1972; Fleishman, 1953). For transfer to have occurred, learned behavior must be generalized to the job context and maintained over a period of time on the job.

There is growing recognition of a "transfer problem" in organizational training today (Michalak, 1981). It is estimated that while American industries annually spend up to $100 billion on training and development, not more than 10% of these expenditures actually result in transfer to the job (Georgenson, 1982). While researchers have similarly concluded that much of the training conducted in organizations fails to transfer to the work

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setting (e.g., I. Goldstein, 1986; Mosel, 1957; Wexley & Latham, 1981), a comprehensive review and critique of the empirical research on transfer has not appeared.

Several researchers have stated that the existing literature on transfer offers little of value to trainers concerned with maximizing positive transfer (Gagne, 1962; Wexley, 1984). On the other hand, Hinrichs (1976) has suggested that trainers often fail to apply the scientific knowledge that does exist. Rather than argue for one viewpoint or the other, it is our belief that it is more beneficial to investigate systematically what we do know about transfer of training and to consider how we can proceed to learn more. Rather than continue to bemoan what is a widely recognized concern, we must begin to specify the type of investigations needed to generate the knowledge base for improving our understanding of transfer issues.

The purpose of this paper is to provide a critique of the existing transfer research and to suggest directions for future research investigations. First, we will provide an organizing framework outlining the factors we believe affect transfer of training. Second, we will review the existing research on factors affecting transfer. Third, we will present a critique of the research and highlight critical research gaps. Finally, we will specify the types of research needed to improve our understanding of the transfer process.

A Framework for Examining Training Transfer

Examination of transfer issues requires a clear understanding of what is meant by transfer as well as the identification of factors that affect transfer. Figure 1 presents a framework for understanding the transfer process. In Figure 1, the transfer process is described in terms of training-input factors, training outcomes, and conditions of transfer. The conditions of transfer include both the (1) generalization of material learned in training to the job context and (2) maintenance of the learned material over a period of time on the job. Training outcomes are defined as the amount of original learning that occurs during the training program and the retention of that material after the program is completed. Training-input factors include training design, trainee characteristics, and work-environment characteristics. The major training-design factors are the incorporation of learning principles (Bass & Vaughan, 1966), the sequencing of training material (Gagne, 1962; Tracy, 1984), and the job relevance of the training content (Campbell, 1971; Ford & Wroten, 1984). Trainee characteristics consist of ability or skill, motivation, and personality factors. Work-environment characteristics include climatic factors such as supervisory or peer support as well as constraints and opportunities to perform learned behaviors on the job.

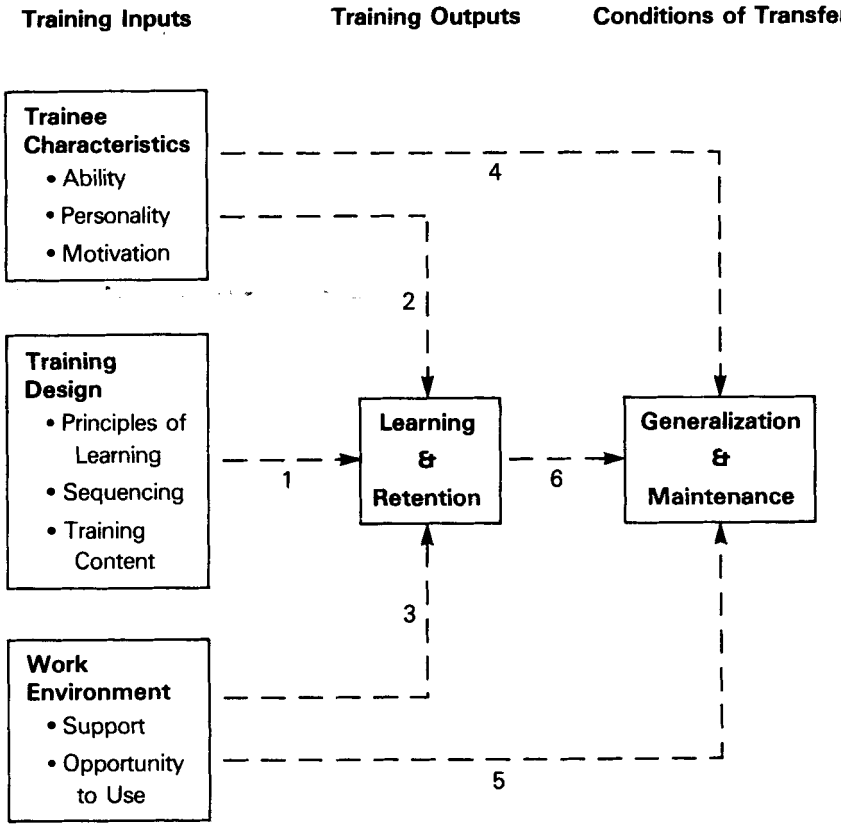

Figure 1: **A Model of the Transfer Process**

As the model indicates, training outcomes and training-input factors are posited to have both direct and indirect effects on conditions of transfer. These effects are specified in terms of six linkages, which are critical for understanding the transfer process. Working backwards in the model, training outcomes of learning and retention are seen as having direct effects on conditions of transfer (Linkage 6). That is, for trained skills to transfer, training material must be learned and retained (Kirkpatrick, 1967). Trainee characteristics and work-environment characteristics are also hypothesized to have direct effects on transfer regardless of initial learning during the training program or retention of the training material (Linkages 4 and 5, respectively). For example, well-learned skills may not be maintained on the job due to lack of motivation or lack of supervisory support. Finally, training outcomes (learning and retention) are viewed as directly affected by the three training inputs of training design, trainee characteristics, and

the work-environment characteristics (Linkages 1, 2, and 3 respectively). These three training inputs, therefore, have an indirect effect on transfer through their impact on training outcomes.

The model in Figure 1 provides a framework for describing the transfer process. The literature examining transfer issues will now be reviewed and then be critiqued in relation to the impact of training-input factors on training outcomes and conditions of transfer.

Literature Review

For this review, empirical studies cited in the major works of the organizational-training literature (e.g., Bass & Vaughan, 1966; Campbell, 1971; Campbell, Dunnette, Lawler & Weick, 1970; Decker & Nathan, 1985; Ellis, 1965; I. Goldstein, 1980, 1986; McGehee & Thayer, 1961; Wexley, 1984; Wexley & Latham, 1981) were examined. Other studies were identified through an extensive literature search and cross-referencing of cited studies. Therefore, this review provides an examination of the transfer-issue research that has been referenced in the organizational-training literature.

The review was based on the framework provided in Figure 1; that is, the research was reviewed in terms of the effects of training design, trainee characteristics, or work-environment factors on either learning and retention of trained material (training outcomes) or generalization and maintenance of training (conditions of transfer). A summary of the findings will be followed by a critique of the existing research.

Training Design

A large proportion of the empirical research on transfer has concentrated on improving the design of training programs through the incorporation of learning principles. Research has centered on four basic principles: (1) identical elements, (2) teaching of general principles, (3) stimulus variability, and (4) various conditions of practice.

Identical elements. The notion of identical elements was originally proposed by Thorndike and Woodworth (1901). They hypothesized that transfer is maximized to the degree that there are identical stimulus and response elements in the training and transfer settings. Empirical research supports the use of identical elements as a means of increasing the retention of both motor (Crafts, 1935; Gagne, Baker, & Foster, 1950) and verbal behaviors (Duncan & Underwood, 1953; Underwood, 1951).

General principles. Teaching through general principles maintains that transfer is facilitated when trainees are taught, not just applicable skills,

but also the general rules and theoretical principles that underlie the training content (McGehee & Thayer, 1961). For example, Judd (1908) and Hendrickson and Schroeder (1941) demonstrated the usefulness of teaching through general principles by using rules of light infraction to improve proficiency in underwater shooting. Crannell (1956), in a series of three studies, showed the value of teaching general principles for problem solving by improving subjects' ability to learn card-sorting tricks. Goldbeck, Bernstein, Hillix, and Marx (1957) found that individuals instructed in the principles of analyzing problems were better able to locate problems with malfunctioning electronic equipment.

Stimulus variability. Stimulus variability is the notion that positive transfer is maximized when a variety of relevant training stimuli are employed (Ellis, 1965). Proponents state that several examples of a concept to be learned strengthen the trainee's understanding so that he/she is more likely to see the applicability of a concept in a new situation (Duncan, 1958; Ellis, 1965). The principle of stimulus variability has received empirical support with respect to training outcomes. For example, Shore and Sechrest (1961) found that using a moderate number of different examples that were repeated a few times each was more effective in enhancing learning than using one example repeatedly.

Conditions of practice. Conditions of practice include a number of specific design issues, including massed or distributed training, whole or part training, feedback, and overlearning. Massed versus distributed training is the issue of whether or not to divide training into segments. Research evidence suggests that material learned under distributed practice is generally retained longer than material learned by massed practice (Briggs & Naylor, 1962; Naylor & Briggs, 1963). There is also evidence that difficult and complex tasks result in higher performance when massed practice sessions are given first, followed by briefer sessions with more frequent rest intervals (Holding, 1965).

Whole versus part training concerns the relative efficiency of practice with all the material as opposed to practice on one part at a time. Evidence suggests that the whole method is advantageous for enhancing training outcomes when (1) the intelligence of the learner is high, (2) practice is distributed rather than massed, and (3) the training material is high in task organization but low in task complexity (Naylor & Briggs, 1963).

Feedback, or knowledge of results, refers to information provided to trainees about their performance. Evidence shows that feedback is a critical element in achieving learning and that timing and specificity are critical variables in determining its effects (e.g., Wexley & Thornton, 1972). Some authors have suggested that the optimal specificity of feedback may be dependent on the trainee and the stage of learning (Blum & Naylor, 1968), although empirical evidence is lacking.

Overlearning refers to the process of providing trainees with continued practice far beyond the point when the task has been performed successfully (McGehee & Thayer, 1961). Research indicates that the greater the amount of overlearning, the greater the subsequent retention of the trained material (Atwater, 1953; Gagne & Foster, 1949; Mandler, 1954). More recently, Hagman and Rose (1983) reported the results of several studies sponsored by the Army Research Institute that provide empirical support for the value of overlearning on retention in military training contexts.

While researchers have also stressed the importance of design issues such as sequencing and the relevance of training content, (e.g., Gagne, 1962), empirical research is lacking. One exception is the work of Decker (1980, 1982), who has explored the effects of different types of learning points on the reproduction and generalization of skills taught in behavior-modeling programs.

Trainee Characteristics

A wide variety of trainee characteristics thought to affect transfer have been suggested in the practitioner literature (e.g., Robinson, 1984; Trost, 1982); however, empirical investigations of ability, personality, and motivational effects on training and transfer outcomes are quite limited.

Existing research evidence shows that trainee success in early stages of training or on training samples predicts transfer on some training tasks (Downs, 1970; L. Gordon, 1955; M. Gordon & Cohen, 1973; McGehee, 1948). And investigations of a variety of ability and aptitude tests also show moderate success for such measures as predictors of trainability (e.g., M. Gordon & Kleiman, 1976; Neel & Dunn, 1960; Robertson & Downs, 1979; Ryman & Biersner, 1975; M. Smith & Downs, 1975; C. Taylor, 1952; E. Taylor & Tajen, 1948; Tubiana & Ben-Shakhar, 1982). But Ghiselli's (1966) review of the literature in the area characterized the typical predictive power of aptitude tests for the prediction of trainability as "far from impressive" (p. 125).

With respect to personality variables, Noe and Schmitt (1986) found limited support for the effects of locus of control on pretraining motivation and learning. Baumgartel, Reynolds, and Pathan (1984) found that managers high in need for achievement and having an internal locus of control were more likely to apply new knowledge gained in training to work settings. On the other hand, Miles (1965), in a study of a sensitivity program, concluded that personality factors had no direct effect on transfer.

Several studies have investigated the effects of motivational factors on transfer. Ryman and Biersner (1975) found a significant relation between trainee confidence in the successful completion of a Navy diving training

program and subsequent class success and dropout rate. Tubiana and Ben-Shakhar (1982) found a significant relation between motivation to succeed in training and a composite criterion of training performance, a probability assessment of promotion potential, and a sociometric measure of the trainee's popularity with peers. Results from a study by Hicks and Klimoski (1987) show that a trainee's perception that he/she had a choice to attend (or not attend) a managerial-skills training program influenced motivation to learn and subsequent learning in the program. Noe and Schmitt (1986) found that trainees with high job involvement were more motivated to learn and transfer skills to the work setting. Baumgartel et al. (1984) showed that managers who believed in the value of training were more likely to apply skills learned in training. Finally, Eden and colleagues (Eden & Ravid, 1982; Eden & Shani, 1982) found that higher self-expectancies led to higher training performance in two studies of military personnel.

Post-training interventions such as goal setting and feedback have been used to increase the motivation of the trainee to transfer skills learned in training. For example, Wexley and Nemeroff (1975) found that trainees assigned goals after a management development program were significantly better at applying their learning than were members of a control group. Reber and Wallin (1984) showed that both feedback and goal setting produced higher levels of skill transfer to the work setting than did either approach separately.

Work-environment Characteristics

While the practitioner literature on training (e.g., Eddy, Glad, & Wilkins, 1967) stresses that positive transfer is highly contingent on factors in the trainee's work environment, empirical evidence is sparse. Baumgartel and his associates (Baumgartel & Jeanpierre, 1972; Baumgartel et al., 1984; Baumgartel, Sullivan, & Dunn, 1978) have conducted a line of research indicating that managers in favorable organizational climates (with freedom to set goals and a supportive environment) are more likely to apply new knowledge to work settings. And Hand, Richards, and Slocum (1973) concluded that positive changes in human-relations skills 18 months after training were due to organizational decisions such as salary and promotions that reinforced the attitudes learned in training. Huczynski and Lewis (1980) found that a management style that included pre-course discussion with one's boss and subsequent boss sponsorship contributed most to the transfer of skills.

Critique of the Existing Literature

Tables 1, 2, and 3 present outlines of the research on the effects of training design, trainee characteristics, and work-environment characteristics, respectively. The next section provides a critique of the research to identify what is known about transfer and to aid in the specification of the type of research needed to improve our understanding of the transfer process.

Training-input Factors

Table 1 presents the studies referenced by training researchers (e.g., I. Goldstein, 1986; Wexley & Latham, 1981) as the empirical basis for what is known with respect to training design and learning principles. An examination of the table reveals that the research on learning principles was typically completed before 1970. The sample used for most of the studies was composed of college students completing relatively straightforward memory and psychomotor-skills tasks. For example, to examine the impact of identical elements, Underwood (1951) used a sample of 54 college students, whose task was to pair adjectives. In a more recent study, Schendel and Hagman (1982) had 38 soldiers disassemble machine guns under various conditions of overlearning.

The criterion measure of interest for all the studies was oriented toward training outcome. Typically, measures of retention were taken immediately after completion of the training task. Mandler and Heinemann (1956), for example, used the number of correct trials immediately after training to examine the effects of overlearning on retention. The research indicates that learning principles have an effect on learning and immediate retention of training material. Nevertheless, attempts to examine retention over time or the effects of retention on the generalization and maintenance of skills have been rare.

To summarize, Table 1 shows that studies examining training-design factors have used college students working on simple memory and motor tasks, with immediate learning or retention as the criterion of interest (Linkage 1 of the transfer model in Figure 1). From an examination of these study characteristics, two basic limitations of the existing research become evident.

First, the tasks used limit generalizability of the results to short-term, simple motor tasks and memory-skills training. The use of such tasks is problematic, given that organizational training is often conducted to enhance individual competence on long-term, complex skills such as interpersonal communication and managerial problem solving. The effect of

TABLE 1

Empirical Studies of Transfer of Training—Training Input Factors: Design of Training

Author(s)	Sample	Task or training content	Variables	Design[a]	Criteria
Adams (1955)	127 Military trainees	Distinguishing spatial arrangements of a stimulus pair	Stimulus variability	E	Immediate[b] proficiency on an arrangement task
Atwater (1953)	32 College students	Pairing words	Conditions of practice (overlearning)	E	Immediate proficiency in pairing words correctly
Baldwin (1987)	72 College students	Behavior modeling of assertive skills	Stimulus variability	E	Immediate measure of learning; immediate reproduction of skills; generalization of skills to a novel context four weeks later; unobstrusive measure of skill use four weeks later
Briggs & Naylor (1962)	144 College Students	Maintaining control of a compensatory tracking system	Conditions of practice (whole vs. part)	E	Immediate measure of tracking proficiency
Briggs & Waters (1958)	160 ROTC college students	Pilot training; simulator tracking task	Conditions of practice (whole vs. part)	E	Immediate measure of total number of errors in sorting cards to illustrate understanding
Callentine & Warren (1955)	120 College students	Concept attainment with geometric figures	Stimulus variability	E	Immediate measure of total number of errors in sorting cards to illustrate understanding
Cominsky (1982)	34 Graduate students	Teaching reflection of feeling	General principles and stimulus variability	Q-E	Taped role plays, immediately after program completion
Crafts (1935)	64 College students	Card sorting	Identical elements	E	Immediate ability on test card sorting task
Crannel (1956) reports results of three experiments	248 College students	Card trick problems	General principles	E	Immediate measure of number of problems completed in one hour (Experiments 1 & 2); 6-week measure of whether two problems could be completed in 10 minutes (Experiment 3)

[a] E=Experimental; Q–E = Quasi-experimental.

[b] In this context, the term immediate denotes a period directly after the training took place; that is, no significant time elapsed between training and measurement of trained skills

TABLE 1 (continued)

Author(s)	Sample	Task or training content	Variables	Design[a]	Criteria
Decker (1980)	90 College students	Behavioral modeling of assertive skills	Type of learning points	E	Immediate reproduction of skills; immediate generalization of skills
Decker (1982)	24 First-line supervisors	Coaching and handling employee complaints	Type of learning points	Q-E	Immediate reproduction of skills; immediate generalization of skills
Digman (1959)	41 College students	Hitting a target button with rotor	Conditions of practice (massed vs. spaced)	E	Immediate task proficiency
Duncan (1958)	600 College students	Movement of a lever into one of 13 slots	Stimulus variability	E	Two proficiency tests given: (1) 24 hours after training, (2) 48 hours after training
Duncan & Underwood (1953)	186 College students	Moving a lever into slots in response to color-light stimuli	Identical elements	E	Retention of learning 24 hours and 14 months after acquisition
Forgus & Schwartz (1957)	39 Female college students	Learning a new alphabet	General principles	E	Immediate recall, simple transposition, and a measure of problem solving proficiency
Fryer & Edgerton (1950)	334 Military trainees	Gunnery training	Conditions of practice (massed vs. spaced) (instruction methods)	E	Immediate test of learning and retention of learning after 2 months
Gagne & Foster (1949)	145 Enlisted navy men	Reaction to light by pressing control panel switch	Conditions of practice (overlearning)	E	Immediate measures of (1) amount of time to complete trials, (2) no. of errors
Goldbeck, Bernstein, Hillix, & Marx (1957)	40 Male college students	Troubleshooting problems with electronic equipment	General principles	E	Immediate test of troubleshooting proficiency

Hagman & Rose (1983) results of 13 experiments	Military personnel	Variety of military tasks	Conditions of practice	Q-E/E	Both immediate proficiency and retention over time
Haselrud & Meyers (1958)	76 College students	Deciphering word codes (taught coding rules)	General principles	E	Immediate number of correct codings
Hendrickson & Schroeder (1941)	90 Eighth grade boys	Shooting an air gun at submerged underwater targets (taught principle of light infraction)	General principles	E	Immediate measure of accuracy on hitting underwater targets
Hilgard, Irvine, & Whipple (1953)	60 High-school students	Card trick problems	General principles	E	(1) Overnight measure of retention; (2) proficiency on simple transposition task; (3) proficiency on three problem-solving tasks
Hilgard, Edren, & Irvine (1954)	150 High-school students	Card trick problems	General principles	E	Overnight retention, number and type of errors made
Judd (1908)	Unspecified number of fifth and sixth grade boys	Shooting darts at submerged underwater targets (taught principle of light infraction)	General principles	E	Immediate accuracy on hitting underwater target with depth charge
Macpherson, Dees, & Grindley (1948)	200 College students	Line drawing, pushing a lever, pressing a Morse key	Feedback	E	Immediate task proficiency
Mandler (1954)	60 College students	Operating hand switches in sequences on a switchboard having six switches arranged in a hexagon; stimuli were letters of the alphabet	Conditions of practice (overlearning)	E	Immediate errorless trials
Mandler & Heinemann (1956)	60 College students	Assembly of verbal units from nonsense syllables	Conditions of practice (overlearning)	E	Immediate number of correct trials

TABLE 1 (continued)

Author(s)	Sample	Task or training content	Variables	Design[a]	Criteria
Morrisett & Hovland (1959)	63 High-school students	Discriminating pairs of geometric figures	Stimulus variability	E	Immediate ability to discriminate between pairs
Naylor & Briggs (1963)	112 Female college students	Markov prediction task	Conditions of practice (whole vs. part)	E	Immediate number of correct predictions
Reynolds & Bilodeau (1952)	612 Basic trainee airmen	(1) Rudder control, (2) complex coordination, (3) rotary pursuit	Conditions of practice (massed vs. spaced)	E	Immediate proficiency and retention after 10 weeks
Schendel & Hagman (1982)	38 Reserve soldiers	Disassembly/assembly of M60 machine gun	Conditons of practice (overlearning)	E	8-week Retention interval
Shore & Sechrest (1961)	64 College students	Concept attainment	Stimulus variability	E	Immediate number of correct tests of concept attainment
Thorndike (1927)	24 People varying in age from 20 to 42+	Estimating length of paper strips blindfolded	Feedback	E	Immediate accuracy of length estimates
Thorndike & Woodworth (1901)	5 College students	Observing words for certain characteristics	Identical elements	E	Immediate speed and accuracy in word recognition
Trowbridge & Cason (1932)	60 College students	Drawing lines blindfolded	Feedback	E	Immediate proficiency of line drawing
Underwood (1951)	54 College students	Pairing adjectives	Identical elements	E	Immediate number of correct responses
Wexley & Thornton (1972)	261 College students	Introductory psychology course	Feedback	E	Course exams
Woodrow (1927)	76 College students	Memorization tasks (taught memory rules)	General Principles	E	Immediate memory scores

these learning principles on training outcomes for more complex and interrelated tasks is unknown. While it is relatively straightforward to operationalize principles such as overlearning in controlled experimental settings with motor or memory tasks, the appropriate operationalization of learning principles in more complex organizational-training programs is problematic. For example, there is no empirical data regarding how much and in what ways a trainer should incorporate learning principles such as stimulus variability into a behavior-modeling program to enhance the transfer of managerial skills. In addition, W. Schneider (1985) suggests that several training-design maxims (e.g., practice makes perfect) are fallacious when training for "high performance" skills.

Second, the criterion measures of interest in these studies have been learning and short-term retention. While these measures are certainly appropriate, given the goals of the original research, any claims by training researchers regarding the implications of these "robust" findings for enhancing transfer of training must be made with caution. Training outcomes of learning and retention constitute necessary but not sufficient conditions for generalization and maintenance of skills. Therefore, we need research that explicitly examines the direct effects of training-design factors on training outcomes (Linkage 1) and then examines the effects of training outcomes on conditions of transfer (Linkage 6).

Trainee Characteristics

Table 2 presents the studies that have examined the relation of trainee characteristics to transfer of training. There are fewer such studies, but they are more recent than those focusing on training-design characteristics. Examination of the table reveals a variety of different samples, training tasks, and designs used. The sample includes managers, college students, and line personnel. The training tasks range from general interpersonal skills such as human-relations training to specific skills programs such as time management.

The criterion measure typically used in these studies was retention of the learned material (Linkage 2). Retention was commonly measured through written tests, which asked trainees to recall trained material immediately or shortly after completion of the training program (see, for example, Wexley & Baldwin, 1986). In some studies, information on generalization and maintenance of trained skills to the job (Linkage 5) was also gathered. The major source of information about behavioral change was the trainee him/herself, with such information being gathered soon after completion of the training program. For example, upon completion of a network-analysis training program, Huczynski and Lewis (1980) asked trainees about their intentions to transfer skills learned. Four months later they asked them for

TABLE 2

Empirical Studies of Transfer of Training—Training Input Factors: Trainee Characteristics

Author(s)	Sample	Training content	Variables	Criteria	
				Source & (timing)	Measures & Results
Baumgartel & Jeanpierre (1972)	240 Indian managers	Management development program	Demographic (educ., age, job-income level); motivation (value & relevance of training); personality (composite scale)	Self (immediate)[a]	*Effort to apply*—41% of respondents indicated some intended effort to apply. Significantly related to job income but no other significant relationship with trainee characteristics.
				Self (unknown)	*Perceived success in transferring*—Of those indicating effort to apply, 47% indicated high success, 38% medium, and 15% low or no success. No *r*'s with trainee characteristics reported.
				Supervisor (unknown)	*Attempt to Use*—21% of bosses indicated some subordinate attempt to use. No *r*'s with trainee characteristics reported.
Baumgartel, Reynolds, & Pathan (1984) Study 1	260 American managers	Human relations	Demographic (rank-job level); Motivation (value of training); personality (locus of control)	Self (immediate)	*Effort to apply*—Significantly related to locus of control. Relation with other trainee characteristics measured was n.s.[b]
				Self (unknown)	*Perceived success in transferring*—Significantly related to belief in the value of training. Relation with other trainee charasteristics measured was n.s.
Baumgartel, Reynolds, & Pathan (1984) Study 2	246 Indian managers	Management development program	Personality (locus of control, need to achieve)	Self (immediate)	*Effort to appply*—Significantly related to locus of control and need achievement. Others were n.s.

Downs (1970)	82 Sewing machinists	Sewing machine training	Ability (training sample)	Instructor (immediate)	*Final instructor rating*—Significantly related (r = .50) to score on training sample.
Eden & Ravid (1982)	60 Military personnel	Clerical skills	Motivation (self & instructor expectancy)	Instructor (immediate)	*Learning exams*—Significant main effect for self-expectancy. High expectancy conditions had greater exam score average than controls. 27–30% of variance explained by self-expectancy.
Eden & Shani (1982)	105 Military personnel	Military combat command course	Motivation (instructor expectancy)	Instructor (immediate)	*Learning exams*—Significant main effect for instructor expectancy. High expectancy conditions had greater exam score average than controls. Instructor expectancy explained 73% of variance in learning exam performance.
Fleishman (1953)	122 Manufacturing foremen	Leadership training	Demographic (age, educ., tenure, number of subordinates)	Self (before training & varied from 2–24 after training)	*Leader behaviors (LBDQ)*—All relationships with trainee characteristics were n.s.
Gordon (1955)	400 Military recruits	Radio code training	Ability (early training time required)	Instructor (immediate)	*Radio code test score*—Significantly related to early training time required for three separate groups varying in previous radio code exposure.
Gordon & Cohen (1973)	58 Welding program trainees	Plate welding	Ability (early training performance)	Instructor (immediate)	*Time required to complete training*—Significantly related to early training performance on each of the first four tasks in training.
Gordon & Kleiman (1976)	101 Police trainees	Fundamentals of police work	Ability (training sample, IQ)	Instructor (immediate)	*Sum of graded exercises*—Significantly related to both work sample tests and IQ tests but the work sample tests yielded significantly higher r's in most cases.

[a] Immediate denotes that no significant time elapsed between training and measurement of trained skills.
[b] n.s. denotes statistically nonsignificant.

TABLE 2 (continued)

Author(s)	Sample	Training content	Variables	Criteria: Source & (timing)	Criteria: Measures & Results
Hicks & Klimoski (1987)	85 Managers	Two-day performance review training	Motivation (degree of choice to select training, realistic preview)	Self (immediate)	*Appropriateness of training*—Main effects for degree of choice and type of prior info.
				Self (immediate)	*Profit from training*—Main effects for degree of choice and type of prior info.
				Self (immediate)	*Satisfaction w/ training*—Main effects for degree of choice.
				Self (immediate)	*Learning*—Main effects for degree of choice.
				Instructor (immediate)	*Achievement test*—Main effects for degree of choice.
				Trained observers (immediate)	*Role play*—No significant effects.
Huczynski & Lewis (1980)	48 Electronic managers	Three-day network analysis training program	Motivation (attend on own, value of training, prior course discussion)	Self (4 months after training	*Attempt to transfer*—35% of respondents made some attempt to transfer. Those who attempted transfer were more likely to have (1) attended the course on their own initiative, (2) believed the course would be beneficial, and (3) had prior discussions of the course.
Komaki, Heinzemann, & Lawson (1980)	55 Vehicle maintenance personnel	One-hour safety training	Motivation (reinforcing feedback)	Trained observers (weekly up to 40 weeks)	*Safety behaviors exhibited*—Significant increases in safety performance occurred when training was combined with feedback (15% over training only and 26% over baseline).

McGehee (1948)	21 Rug-mill trainees	Preparation of rug-spools	Ability (initial effectiveness in OJT training)	Instructor (immediate)	*Time required to attain acceptable average production*—Significantly related to time required to complete, early training periods. Most significant increase in prediction was from 1st to 2nd period.
Miles (1965)	34 Elementary school principals	Two-week human relations	Demographic (tenure, no. of subs); personality (ego strength, flexibility, need affiliation)	Self (immediate)	*Perceived change from training*—Significantly related to feedback received. Relation with all other personality and motivation variables was n.s.
			motivation (desire for change, feedback received, involvement, unfreezing)	Peer (immediate)	*Perceived change from training*—Significantly related to unfreezing, involvement, and feedback received. Relation with desire for change and other variables was n.s.
				Self (8 months after training)	*On-the-job change*—Significantly related to unfreezing. Relation with other variables was n.s.
Neel & Dunn (1960)	32 Supervisory trainees	10-week supervisory skills training	Ability (IQ-Wonderlic); personality ("How Supervise", authoritarianism)	Instructor (immediate)	*Course examinations*—Significantly related to Wonderlic (r = .25), "How Supervise" scale (r = .69), and authoritarianism (r = .39).
Noe & Schmitt (1986)	60 School educators	Managerial skills	Motivation (expectancies, motive to learn, exploratory behavior, job involvement); personality (locus of control)	Trained Raters (immediate)	*Learning (in-basket exercises)*—Relation with all trainee characteristics n.s. Rresidual value for job involvement = (.41).
				Self (varied 1–3–4 mos. after training)	*Motivation to transfer*—Relation with all trainee characteristics n.s.
				Supervisor (3 mos. after training)	*Behavior*—Relation with all trainee characteristics n.s.

TABLE 2 (continued)

Author(s)	Sample	Training content	Variables	Criteria: Source & (timing)	Criteria: Measures & Results
				Peers (3 mos. after training)	*Behavior (peer)* Relation with all trainee characteristics n.s.
Reber & Wallin (1984)	105 Farm machinery workers	Safety procedures	Motivation (reinforcing feedback and goals)	Trained observers (weekly up to 40 weeks)	*Safety behaviors exhibited*—Main effects for each of three interventions: (1) safety rule training alone, (2) goal setting, (3) feedback and goal setting. Percentage of safety behaviors exhibited varied such that (control) 62.80%, (1) 70.85%, (2) 77.54%, (3) 95.39%.
Ryman & Biersner (1975)	548 Military personnel	Technical (diving & underwater) skills	Motivation (course expectations, confidence, leadership efficacy, concern); personality (conformity)	File data (immediate)	*Program graduation*—Across 3 programs, successful graduation had a significant positive relationship with training motivation, leadership, and conformity and was negatively related to training concerns.
Smith & Downs (1975)	236 Shipbuilding apprentices	Variety of shipbuilding skills	Ability (trainability assessment)	Instructor (3–12 months after trainability assessment)	*Performance test*—Trainability assessments were successful in predicting performance after a 3-month period in the skill for which they were designed. They were less successful after a 12-month period and no single assessment predicted performance for all skills.
Taylor (1952)	120 Automotive mechanic trainees	Mechanic skills	Ability (aptitude test battery)	Instructor (immediate)	*Performance test*—Aptitude test battery was effective in identifying trainees who had the necessary knowledge and skills to skip the first four weeks to training and still do approximately as well as those who took the whole course.
Taylor & Tajen (1948)	313 Clerical trainees	Clerical, record-keeping skills	Ability (numeric score on test battery)	Instructor (immediate)	*Performance test*—Individuals' performance test scores on IBM punch card equipment were predicted with a one-hour pretraining test battery such that 70% of the selected trainees did better than the average unselected trainee.

Tubiana & Shakhar (1982)	459 Israeli military	Basic military training	Demographic (education); ability (language test, 2 IQ tests); motivation (motive to serve in combat); personality (activeness, sociability, responsibility, independence, & promptness)	Superior officer (immediate)	*Performance potential*—Officer rating of potential had a significant positive relationship to education (r = .21), language test scores (r = .24), intelligence (r = .32) and composite of personality & motivation (r = .33).
Wexley & Baldwin (1986)	256 College students	Time management	Motivation (goal setting, relapse prevention)	Instructor (immediate)	*Learning*—Main effect for assigned goal setting.
				Self (8 weeks after training)	*Behavior*—Main effects for assigned & participative goal setting.
				Observer (8 weeks after training) *Behavior*—No significant effects observed.	
Wexley & Nemeroff (1975)	27 Health care managers	Two-day supervisory skills program	Motivation (goal setting)	Self (60 days after training)	*Behavior*—Goal setting treatments were significantly more effective than a control group in improving the leader behavior of managers.
				Subordinate (60 days after training)	*Behavior*—Assigned goal-setting group was most effective in increasing subordinate work satisfaction.

their perceptions of their success in transferring skills from the training program. Few studies used behavioral ratings (Noe & Schmitt, 1986) or observed and recorded actual behaviors (e.g., Komacki, Heinzemann, & Lawson, 1980; Reber & Wallin, 1984) to evaluate the extent of transfer.

The research on trainee characteristics has two critical problems, which reduce its usefulness for understanding the factors affecting the transfer process. The first problem is the lack of theoretical frameworks to guide research. A number of individual-difference factors have been examined, including job involvement (Noe & Schmitt, 1986), need for achievement (Baumgartel & Jeanpierre, 1972; Baumgartel et al., 1984), belief in the value of training (Baumgartel et al. 1984; Ryman & Biersner, 1975), and intelligence level (Tubiana & Ben-Shakhar, 1982). Some motivational strategies have also been examined for their impact on transfer; they include goal setting (Reber & Wallin, 1984; Wexley & Baldwin, 1986; Wexley & Nemeroff, 1975), feedback (Komaki et al., 1980; Reber & Wallin, 1984), choice in attending training (Hicks & Klimoski, 1987; Huczynski & Lewis, 1980), realistic information about the training program (Hicks & Klimoski, 1987), and relapse prevention (Wexley & Baldwin, 1986). Despite these efforts, the lack of a systematic approach to this area has resulted in minimal improvements in our understanding of the transfer process. Systematic research is needed in which models would be developed, tested, and revised on the basis of empirical research. Noe (1986) has provided an initial attempt to identify key personality and motivational factors that affect transfer and to hypothesize expected linkages and relationships among these factors and transfer. More efforts at model development are needed.

A second critical issue is the lack of adequate criterion measures of transfer in the studies examining the effects of trainee characteristics. Self-report measures of transfer are not adequate for developing a data base regarding the relation of trainee characteristics to transfer or for determining which interventions have the greatest effect on transfer. For example, Wexley and Baldwin's (1986) conclusion that a post-training goal-setting intervention was more effective than a relapse-prevention intervention must be tempered by the fact that the conclusion was based solely on self-reported generalization of skills and not on actual behavioral changes.

Environmental Characteristics

Table 3 presents information about the seven studies that have examined the relation of environmental characteristics to transfer of training. We located no studies in which an intervention was made to change the work environment and the effects of those changes on the extent of transfer was examined. Instead, studies used large-scale surveys to examine the relationships of correlates such as work climate (Baumgartel et al., 1984),

TABLE 3

Empirical Studies of Transfer of Training—Environmental Factors

Author(s)	Sample	Training content	Variables	Criteria	
				Source & (timing)	Measures & Results
Baumgartel & Jeanpierre (1972)	240 Indian managers	Management development program	Perceptions of transfer climate	Self (immediate)[a]	*Effort to apply*—Favorable organization climate perceptions were significantly and positively related to effort to apply.
Baumgartel, Reynolds, & Pathan (1984) (Study 1)	260 American managers	Human relations	Perceptions of transfer climate	Self (immediate)	*Effort to apply*—Favorable organization climate perceptions were significantly and positively related to effort to apply; the most favorable organization climate was characterized by high appreciation for performance and innovation, encouragement of risk taking and freedom to set own performance goals.
Baumgartel, Reynolds, & Pathan (1984) (Study 2)	246 Indian managers	Management development program	Perceptions of transfer climate	Self (immediate)	*Effort to apply*—Favorable organization climate perceptions were significantly and positively related to effort to apply. The most favorable organization climate was characterized by high appreciation for performance and innovation, a climate of freedom, a rational reward system, and openness in relationships among managers.
Fleishman (1953)	122 Manufacturing foremen	Leadership training	Perceptions of leadership climate	Self (varied (2–24 mos. after training)	*Leader behavior (LBDQ)*—Leader behavior was significantly affected by the leadership climate in the trainee's work environment. Trainees who returned to supervisors high in consideration exhibited more consideration. No such change occurred for those returning to supervisors lower in consideration.

[a]Immediate denotes that no significant time elapsed between training and measurement of trained skills.

Table 3 (continued)

Author(s)	Sample	Training content	Variables	Criteria: Source & (timing)	Criteria: Measures & Results
Hand, Richards & Slocum (1973)	21 Middle managers	Human relations training	Perceptions of transfer climate	Self (3 & 18 mos. after training)	*3-Month evaluation*—No significant changes in attitudes or behaviors of trainees were observed. *18-Month evaluation*—Significant positive changes in attitudes were observed in the experimental group; negative changes existed in the control group. Three climate perceptions (whether the organization favors participation by subordinates, innovative behavior, and independence of thought), moderated the findings.
Huczynski & Lewis (1980)	48 Electronic managers	Three-day network analysis training program	Supervisor support & perceptions of transfer climate	Self (4 mos. after training)	*Attempt to transfer*—Transfer attempts were more likely when the trainees had pre-training discussions with boss and where the boss "sponsored" the new idea. The management style and attitudes of the trainee's boss were found to be the most important factor in attempt to transfer.
Miles (1965)	34 Elementary school principals	Two-week human relations program	Perceptions of transfer climate	Self (8 mos. after training)	*Perceived on-the-job change*—Organizational factors (security, autonomy, power, & problem-solving adequacy) mediated the perceived change associated with laboratory training.

leadership climate (Fleishman, 1953) and supervisory support (Huczynski & Lewis, 1980) to transfer criteria.

Most of the training programs studied were interpersonal-skills (human-relations) programs. Given that behavioral changes in interpersonal relations are difficult to operationalize, it is not surprising that the transfer criterion measure frequently used was a self-reported measure of effort to transfer (e.g., Baumgartel & Jeanpierre, 1972, Baumgartel et al., 1984). Many of the measures were gathered immediately or soon after the training program was completed. A few studies, such as Hand et al., (1973), collected self- and supervisor reports of behavior change at more than one point in time after completion of the training program.

There are two major problems with the research examining work-environment characteristics and transfer. The first issue is the static nature of the research in relation to the dynamic nature of the transfer process. The "strong" support for the importance of environmental characteristics to transfer is based solely on correlational studies in which causality can not be inferred. What is needed is the identification of key work-environment variables and the operationalization of these variables. For example, while research suggests that supervisory support is an important component affecting transfer, there is little attempt to understand the supervisory behaviors that lead to perceptions of support by trainees. Only by clearly operationalizing work characteristics such as support can interventions be developed and their effects on generalization and maintenance of training be examined.

A second issue is the criterion problem. The studies on environmental characteristics have typically used self-reports of behavioral change as the major measure of transfer. In fact, Baumgartel and his associates have often used an "intention to transfer" measure, which is actually a "motivation to transfer" measure rather than a measure of the extent of generalization and maintenance of trained skills. Only one study, Hand et al. (1973), examined maintenance of trained behaviors across time as they measured self-reports and supervisory reports of behavior 3 months and 18 months after completion of the training program. The results indicated no change in behavior at 3 months but changes in behavior after 18 months. Given only two data points in time and the fact that process measures were not taken, it is impossible to determine why these results were found. Research is needed in which measures are taken at multiple intervals to examine the interactive effects of work characteristics and time on skill utilization and skill decrements after completion of a training program.

Overall Critique of the Research

While the limited number and the fragmented nature of the studies examining transfer are disturbing by themselves, a critical review of the existing research reveals that the samples, tasks, designs, and criteria used limit even further our ability to understand the transfer process. This review and critique of the research brings to mind a quote by Campbell (1971) that "we know a few things but not very much" (p. 593). Yet the review and critique has also led to the identification of specific problems with research conducted in this area. The next section provides a more specific and detailed discussion of needed future directions for research into the transfer process.

Future Research Directions

The critique of the transfer literature indicates that there are a number of research gaps that need to be addressed. The following section suggests needed future research directions regarding training design, trainee characteristics, work environment, and criterion issues relevant to transfer.

Training Design

Of the transfer research completed, it is clear that the experimental work on improving the training process is the most developed and rigorously researched. The results of research on the effects of the learning principles of identical elements, general principles, conditions of practice, and stimulus variability on retention has been quite robust. Nevertheless, we are still confronted with the problem of generalizing from these results to actual organizational-training settings.

In this section, several salient operational questions associated with the learning principles will be identified and illustrated with the use of a common organizational-training example. For this purpose, the case of training a new sales representative to sell computer equipment will be used. The salient operational questions will lead to a discussion of needed research questions. For illustrative purposes, operational issues relevant to principles of identical elements and stimulus variability will be highlighted.

Identical elements. The principle of identical elements predicts that transfer will be maximized to the degree that there are identical stimulus and response elements in the training and transfer settings. The critical operational problem is: "What, specifically, in the training program must be made identical to the actual work environment to facilitate learning, retention, and transfer?" One aspect of similarity is the degree to which

the actual conditions of the training program (surroundings, tasks, equipment) match the work environment (physical fidelity). A second aspect of similarity is the degree to which trainees attach similar meanings in the training and organizational context (psychological fidelity). While there is some evidence that physical fidelity is less important than psychological fidelity (Berkowitz & Donnerstein, 1982), the concepts and their relative importance for different training content and skills have been neglected in the industrial-training literature.

To use the example of the new sales representative, one training tactic might be to replicate the relevant physical characteristics of the sales context exactly, including products, types of clients, office surroundings, and common distractions. Or, the training could focus on creating accurate reproduction of behavioral and cognitive processes that are necessary for performing the sales job. One could create training stimuli that necessitate the same responses and decision-making processes that the trainee should use in real sales situations. Research is needed to explore the type and level of fidelity needed to maximize transfer, given time and resource constraints. Unfortunately, the industrial-training literature does not provide specifications for what constitutes optimal levels of physical and psychological fidelity in various types of industrial-training programs. It is necessary to understand the type of learning involved and the instructional events being considered before it is possible to choose the most effective learning procedures, or operationalization of principles.

Stimulus variability. Maximizing stimulus variability is based on the notion that transfer is maximized when a variety of relevant training stimuli are employed (e.g., Ellis, 1965). Kazdin (1975) has noted that transfer is enhanced by developing a variety of situations or by using differentially reinforced stimuli to avoid the problem of training becoming attached to a narrow range of stimuli and responses. In this way, variability can serve to strengthen understanding of the applicability of the training to new situations (Duncan, 1958) and to foster innovation and generalization of skills (Bandura, 1977).

Operationalization of stimulus variability in organizational-training programs is problematic. Consider the example of developing models for a behavior-modeling program on building interpersonal skills for a new sales representative. Modeling is intended to provide the majority of the cognitive aspects of the training, including attention to a modeling display, mental coding, and mental rehearsal (Decker & Nathan, 1985; A. Goldstein & Sorcher, 1974). Yet, in behavior-modeling training, models are typically very simple and often redundant, and trainees are conditioned to think that the specific behaviors modeled and reinforced are universally applicable in handling problem situations on the job (Parry & Reich, 1984).

Three options for increasing stimulus variability in the modeling component of behavior-modeling training are character, situational, and model-competence variability. With character variability, a variety of different model characteristics (age, sex, organizational level) can be displayed. A second direction is to vary the situations modeled. For example, if one modeling tape entitled "assertive communication" portrays a salesperson assertively requesting a customer to reconsider a product, a second model could be shown that portrays a salesperson assertively requesting that the order department fill his/her order as soon as possible. A third way to increase variability is to vary the competence of the models. Models might be varied in terms of the extent to which they correctly demonstrate the key behaviors (high to low competence). Current behavior-modeling programs typically use effective models that are repeatedly shown. Yet, concept formation and problem-solving research suggest that negative models, in addition to positive models, can improve the process of retention and generalizability of skills (e.g., Bourne, 1970; Bourne & Guy, 1968; Craik & Lockhart, 1972).

Consequently, in the sales example, variability can be increased via different models, situations, and/or levels of model effectiveness. Also, while the focus in this section has been on the model displays, it should be noted that behavior modeling is a multi-stage process that should also include instructor input, role playing, and feedback. Thus, stimulus variability might also be introduced by the instructor (e.g., by providing varied examples or experiences) or by participants themselves in the role-playing scenarios. Unfortunately, at the present time, decisions regarding the focus and extent of stimulus variability in organizational-training programs such as behavior modeling must be based on intuition and conjecture rather than empirical support.

Baldwin (1987) has begun applied work examining the impact of stimulus variability within a behavior-modeling program. Variability has been operationalized in terms of the inclusion of different situations and different levels of effectiveness (effective or ineffective modeling) for assertive behaviors displayed by a videotaped model. Results suggest that increases in the variability of model competence enhance trainee generalization of learned skills. Similarly, in a counseling setting, Cominsky (1982) used different therapists (character variability) for the same patient rather than continuous work with one therapist and found that the increased stimulus variability led to enhanced treatment gains.

It is evident that there is much to be learned about the operationalization of training-design principles. Extending beyond the domain of organizational-training literature, recent research in the areas of information processing and instructional theory holds promise for furthering our understanding of training-design issues.

Cormier (1984) contends that an information-processing perspective has implications for training design. He points out that the principle of identical elements can be reconceptualized by using what we know about encoding and retrieval processes. More specifically, a training stimulus is conceptualized as a collection of attributes or elements (E. Smith, Shoben, & Rips, 1974; Underwood, 1969) that vary in terms of redintegrative capacity (Flexser & Tulving, 1978). Redintegration refers to the capacity of one part of a stimulus complex to re-evoke or cue the entire complex (Cormier, 1984). The redintegrative value of the available retrieval information is the critical determinant of its effectiveness. Applying this notion to transfer of training suggests that transfer should be the highest when the stimulus attributes with the highest redintegrative capacity are present in the task. In this view, it is not fidelity (either physical or psychological) per se that contributes to high positive transfer, but rather, the presence of retrieval information that has a high redintegrative capacity. Even low-fidelity training stimuli can be effective in producing transfer by providing the trainee with the essential cuing relationships between the stimulus attributes of the task environment and the appropriate responses.

While the task of identifying which attributes in training environments have high or low redintegrative value remains, the value of this conceptualization and framework for training is relatively straightforward. The fidelity of a training stimulus to the actual stimuli can be based on those attributes with high redintegrative value for correct responses. Those attributes with lower redintegrative value can be modified or eliminated without substantial loss of transfer (Cormier, 1984). These suggestions have considerable practical implications since high fidelity is often very difficult and expensive to create.

Research on information processing also suggests new avenues for better understanding the design principle of stimulus variability. An information-processing perspective suggests that when individuals are exposed to a variety of related or similar material across different presentations, they can more easily integrate new material with that already in memory into a common representation. From this perspective, stimulus variability is thought to aid transfer by providing a means by which an individual distinguishes relevant from irrelevant attributes (abstraction) and by enhancing the probability that additional relevant attributes are encoded into the functional representation of the to-be-remembered item. Therefore, research on the extent to which variability induces the formation of higher-order concepts or facilitates the abstraction of critical dimensions of task performance and stimulus recognition is needed.

The work of instructional theorists such as Gagne and Briggs (1979) is also relevant for transfer researchers interested in training-design issues. Gagne and Briggs developed a set of learning categories that permits them

to analyze tasks and code behavior into one of several learning outcomes (e.g. intellectual skills, motor skills, cognitive strategies). Further, they have begun to examine each of the outcomes and determine the conditions of learning and instructional events that best support that learning outcome. While Gagne and Briggs (1979) focus on learning outcomes, a logical extension of the model would be the inclusion of the transfer outcomes of generalization and maintenance discussed earlier.

To further illustrate this point, consider that much of the conduct being modeled in training programs designed to teach motor skills is exactly prescribed. Therefore, it is desirable for trainees to adopt the modeled behaviors in essentially the same form as they are portrayed (Bandura, 1977). For example, there is little leeway permitted in the proper way to safely operate a power tool or perform a surgical operation. Consequently, the objective is to have trainees mimic behavior as closely as possible. In the case of interpersonal or supervisory skills, however, the objective is more to inculcate generalizable rules or concepts (specifying a class of behaviors to be used, given certain stimuli) and not simply to enable the trainee to reproduce only those behaviors specifically modeled. In fact, in the training of interpersonal and supervisory skills, the title "behavior" modeling is perhaps a misnomer. The training objective is to have observers extract the common attributes exemplified in modeled responses and formulate the rules for generating behavior with similar structural characteristics. Stated simply, the ultimate goal in complex skill-modeling training is to teach the trainee one or more principles (not strictly a list of behaviors) that will allow him/her to learn, generalize, and apply behaviors different from those modeled. It is clear that investigation directed at building a contingency model of transfer-oriented instructional design would provide information important for developing training environments more conducive to positive transfer.

Trainee Characteristics

A limited amount of research has examined ability, motivational, and personality characteristics for their effects on transfer. We need research that more clearly identifies the important trainee characteristics and applies them in organizational settings. An interactive approach to research is also needed to begin testing for optimal matches between trainee characteristics and training-program design and content.

The research on ability and personality characteristics has failed to identify those factors that are most critical in a training context. In addition, the focus of this research has been on distinguishing between individuals who are successful and those who are unsuccessful in transferring skills

rather than on placing individuals into programs that optimally match their characteristics.

Empirical evidence suggests that need for achievement (Baumgartel & Jeanpierre, 1972; Baumgartel et al., 1984), locus of control (Noe & Schmitt, 1986), and general intelligence (Neel & Dunn, 1960; Robertson & Downs, 1979) can be factors in learning and transferring skills. While further identification of key individual-difference variables is needed, there is a critical need for the development of a research perspective that attempts to understand the relationships of trainee characteristics and training-program design to transfer. The major application of the existing research on stable indivdual differences is that transfer can be facilitated by carefully selecting individuals who have certain personality and/or ability characteristics for the training program.

Given that in many organizations selection of trainees is not a viable option (everyone must be trained), researchers must begin a program of research on placement, rather than selection, of individuals into the type of program that is optimal (in terms of transfer), given certain trainee characteristics. The existing research does not speak to the issue of placement because the instructional methodology (e.g., lecture, case study, discussion) of specific types of training programs (e.g., assertiveness, human relations, time management) have been held constant in the studies completed. Studies are needed in which personality/ability factors are measured and individuals placed into training programs under different conditions of instructional methodology to determine which "types" of individuals best match which types of programs for effective transfer of skills to the job.

Cronbach and Snow (1977) have labelled this concern for providing each trainee with the appropriate model of instruction the "aptitude–treatment interaction." When an aptitude–treatment interaction is found, trainees should be assigned differentially to alternative training methods to maximize the probability of transfer. Similarly, we posit that a "personality–treatment interaction" would call for assigning trainees with external locus of control, for example, to a different method of instruction than trainees with an internal locus of control. As noted by I. Goldstein (1986), the examination of how individual differences moderate the effectiveness of different training methods requires refinement of individual-difference measures and the development of a typology of instructional methodology of the sort proposed by Gagne and Briggs (1979) discussed earlier.

Research examining motivational issues of transfer lacks a coherent framework for understanding factors affecting the transfer process. We propose that the expectancy model (Lawler, 1973; Vroom, 1964) provides just such a useful heuristic for integrating research on transfer motivation and for leading to new directions for transfer research.

The expectancy model provides a useful heuristic for understanding transfer because of its interactive perspective on motivation. Perceptions—and therefore motivation—are affected by both individual and work-environment factors, which must be interpreted by an individual and translated into choices among various behavioral options. This perspective has not been adequately acknowledged in the transfer literature: few studies have attempted to examine multiple influences on motivation to learn or motivation to transfer skills. From the expectancy framework (Lawler, 1973), it can be seen that there are numerous factors (locus of control, self esteem, past experience, communications from others) that need to be examined for their relevance to the transfer process. For example, social interaction regarding the usefulness of a training program may affect an individual's expectancies regarding the relationship between doing well in the program and attaining valued outcomes.

Second, the expectancy framework stresses the importance of a dynamic perspective on motivation. Individuals are seen as active information processors who adapt their attitudes, behaviors, and beliefs to their social context and to their own past experiences. Organizational procedures and reward systems, as well as information obtained from interactions with peers and superiors in the work environment, affect an individual's construction of the reality within the work setting, including perceptions of expectancies (Daft & Weick, 1984). This implies that new experiences, once integrated into a person's construction of reality, can result in changes in these expectancies. Unfortunately, most studies examining motivational factors and transfer have examined motivation from a static perspective, gathering information at one period of time. Similarly, all the research on motivational effects on transfer has focused on the effects within a single training program. Given that expectancies can change over time, important issues that have not been researched are the cumulative effects of past training experiences on an individual's expectancies and subsequent motivation to transfer currently trained skills to the job.

Environmental Characteristics

Progress in the research on environmental characteristics requires the operationalization of key variables such as climate and supervisory support at a level of specificity that allows for the development of interventions for changing environmental characteristics and testing their effects on transfer of training. I. Goldstein (1985) has discussed environmental characteristics as either facilitating or inhibiting the transfer of training, and more research is needed to identify and operationalize variables that significantly facilitate or inhibit transfer. Also needed is research that examines the effects of environmental characteristics from a levels-of-analysis perspective. Such a

perspective would lead to the examination of the effects of differences in climate or support across workgroups, and even across organizations.

Supervisory support. Supervisory support for training has been cited as a key work-environment variable affecting the transfer process (e.g., see Fleishman, 1953; House, 1968). Employees look towards their supervisor for important information regarding how to work successfully within the social environment of the organization. As Huczynski & Lewis (1980), state, employees who perceive that a training program is important to the supervisor will be more motivated to attend, learn, and transfer trained skills to the job. While support is critical, development of a concept of what is meant by support has lagged far behind anecdotal evidence of the importance of support. In addition, those trained skills and behaviors most affected by supervisory support have not been examined.

Supervisory support is clearly a multidimensional construct, which could include encouragement to attend, goal-setting activities, reinforcement activities, and modeling of behaviors (Baumgartel et al., 1984; Eddy, Glad, & Wilkins, 1967; Huczynski & Lewis, 1980; Maddox, 1987). A supervisor can demonstrate encouragement to attend through both verbal and nonverbal cues. For example, a supervisor may demonstrate a lack of knowledge about the content of the training program or show his/her reluctance to allow subordinates to attend by rescheduling training when minor crises arise in the department. In relation to goal setting, supervisors can discuss the content and benefits of the program and set goals prior to (focus on improving these skills) and subsequent to (action plans for applying skills) attendance in the program (Wexley & Baldwin, 1986). Reinforcement refers to the provision of rewards for using behaviors developed in the training program. Supervisors can first insure that trainees have the opportunity to use the new skills in which they are trained. Then, the supervisor can provide praise, better assignments, and other extrinsic rewards for trainees who utilize their new skills. Reinforcement processes can also work in reverse; for example, a supervisor who ignores the use of a new skill or actively attacks the use of new skills can cause the trained behaviors to "extinguish." Finally, modeling has been shown to be a powerful force in affecting behavioral change (Sims & Manz, 1982). Employees tend to imitate supervisors who have power over them in order to gain rewards. Therefore, the extent to which the supervisor behaves in ways congruent with the training objectives will have a major impact on transfer of trained skills by subordinates.

Empirical work is needed so that the supervisory-support factors that have the greatest impact on transfer can be identified. With this information, interventions can be developed to change managerial behaviors to increase supervisory support prior to subordinate attendance in a specific training program.

Levels-of-analysis issues. The existing research on influences of the work environment on transfer has been correlational in nature. Perceptions of supervisory support by individual trainees are correlated with self- or other reports of transfer of trained skills to the job. Such measures, which are often collected soon after completion of the training program, are clearly inadequate for developing a base of knowledge about the transfer process. In addition to serious criterion problems, this type of study is problematic as it focuses solely on the individual level of analysis.

The literature describing research into climate (B. Schneider, 1983) indicates that there are often reliable differences in level of support and other climate factors across workgroups within an organization as well as across different organizations. Organizations and departments within organizations can be differentiated in terms of goal orientation, time orientation, formality of structure, and interpersonal orientation (Lawrence & Lorsch, 1969). For example, an organization's philosophy about its people (interpersonal orientation) can have important implications for the transferring of skills from a human-relations training program. This perspective calls for research at the organizational level of analysis in which the same training program is offered across multiple organizations. Similarly, from a group level of analysis, a research and development department with a long time perspective may be more supportive of interpersonal-skills training programs that do not have immediate, objective payoffs while production departments under time pressures would be less supportive of such programs.

Consequently, an organization-wide training program for improving interpersonal skills will most likely lead to different amounts of transfer across departments, depending on the support or congruence of the training program with the climate or philosophy of the various departments within the organization. An examination of the transfer literature reveals no existing attempts to empirically examine the effects of work environmental characteristics on transfer from a levels-of-analysis perspective.

Criterion Issues

The conditions of transfer include generalization of skills or behaviors learned in the training program and the maintenance of those skills and behaviors over a specified period of time. The review of the transfer literature reveals that research has concentrated on the training-input factors that might affect transfer rather than focusing on the appropriate measurement of the conditions of transfer. This neglect of criterion issues is surprising, given the long-standing concern of applied psychologists over the "criterion problem" (Cascio, 1982; Wallace, 1965). The usefulness of the empirical research on transfer is severely limited by the use of criterion measures

that are deficient and contaminated. Advancement in criterion measurement requires a greater appreciation of the issues relevant to measuring generalization and maintenance of skills and behaviors.

Generalization. To examine the successful generalization of trained skills or behaviors, a clear identification of the knowledge, skills, and behaviors expected to be transferred to the job is needed. Then a systematic collection of the appropriate information is needed to make effective training decisions related to the value of various training programs (I. Goldstein, 1986) and to systematically reassess training needs for possible redesign of the training program (Ford & Wroten, 1984).

To develop appropriate measures of generalization requires a linkage of needs-assessment information, the specification of training objectives, and the determination of criteria to use to determine how much of the knowledge, skills, and behaviors learned in training are transferred to the actual job. In addition, the relevance of the skills learned for effective job performance must be determined. While these suggested linkages are certainly not new, few attempts have been made in the transfer literature to list the criteria of success that one should expect on the basis of training objectives and training evaluation criteria. Such an approach is critical to the development of an empirical base regarding transfer.

Once the knowledge, skills, and behaviors that should be exhibited on the job are specified, the next step is to determine baselines that describe how often we can expect trainees to exhibit those knowledges, skills, and behaviors on the job. A task analysis is needed to detail the importance and frequency of the tasks performed on the job. The tasks that are affected by the trained behaviors and skills can then be identified. Other analysis techniques, such as the collection of critical incidents, can help provide a taxonomy of situations that call for the use of the trained skills or behaviors. The combination of task importance and frequency and a taxonomy of situations can provide a baseline for determining how often one should expect trained behaviors to be exhibited on the job. This would force the explicit recognition that an important component in developing transfer measures of generalization is the identification of how often and in what situations a trainee could reasonably be expected to demonstrate the trained behaviors or skills.

Maintenance. While generalization refers to the extent to which trained skills and behaviors are exhibited in the transfer setting, maintenance concerns the length of time that trained skills and behaviors continue to be used on the job. Decreases in the use of trained skills on the job could be a result of skill decrements over time. Or, the decrease in use could be a result of decreased motivation to use the skills due to constraints in the work environment or a lack of rewards for using the skills. Regardless,

this perspective requires a highly dynamic approach to the study of transfer that is lacking in the literature.

Such a dynamic perspective has been taken in research examining the amount of learning that occurs in training or educational settings over time. Researchers in the learning field have represented the dynamic process of learning in the form of "learning curves" (e.g., see Bass & Vaughan, 1966). Learning curves represent how well a certain skill is learned and the speed with which an individual acquires that skill. The kind of task being trained, the design of the training program, and the characteristics of the trainee have been found to have major impacts on how quickly an individual attains the level of performance that meets established standards (Blum & Naylor, 1968).

Similarly, we posit that a useful way to think about maintenance of trained knowledge, skills, and behaviors is through the use of "maintenance curves," which represent the changes that occur in the level of knowledge, skills, or behaviors exhibited in the transfer setting as a function of time elapsed from completion of the training program. The development of a maintenance curve requires the consideration of three issues. First, a baseline of the level of knowledge, skill, or behavior that a trainee exhibits prior to and at the end of the training program must be established. The amount of differentiation between pre- and post-training levels indicates the decrement that must occur to return to the pre-training baseline. Second, an adequate time interval that allows for the determination of overall trends or variations in skill or behavior levels must be established. Third, at multiple time intervals, measurements must be taken to examine changes in the shape and slope of the maintenance curve over time.

The five types of maintenance curve presented in Figure 2 illustrate the points made above. Type A demonstrates a curve in which there is a slow tapering off of a trained skill over time towards the pre-training baseline. This indicates the successful transfer of skills that is maintained over time but is in need of a "booster" session at some point to return to post-training baseline conditions. Type B indicates a failure in transfer as the post-training level drops immediately upon returning to the work site. In this case the person has demonstrated an ability to use the skill appropriately (based on performance in the training) but immediately reverts back to old ways of doing things on the job, for whatever reason. The third example, Type C, demonstrates an attempt by the trainee to use the skills trained on the job for a period of time, which is followed by a sharp decline in the use of a skill towards the pre-training baseline. This decline could occur due to the lack of success in using a trained skill on the job, perceived lack of support for using the skill, or some combination. Type D highlights the situation in which a trainee's learning and retention of trained material was minimal. In this case, there is little chance for the skills to generalize

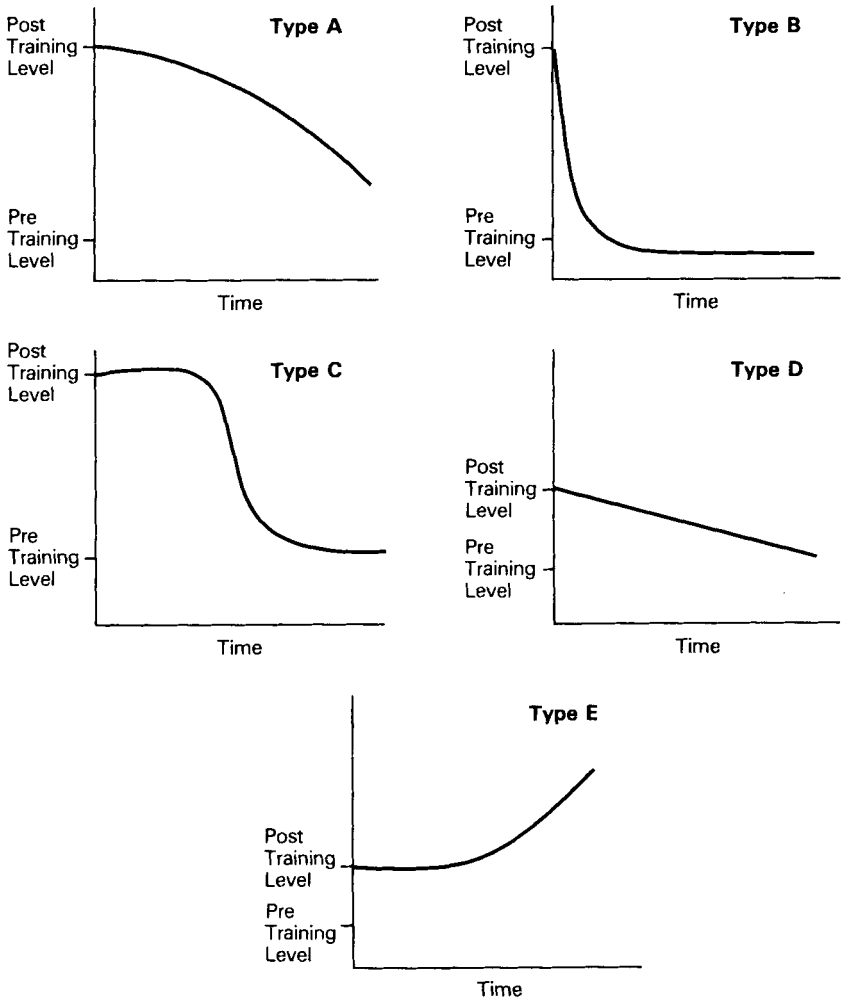

Figure 2: **Types of Transfer Maintenance Curves**

and be exhibited on the job. Finally, Type E demonstrates a situation in which the skill level actually increases over time once back on the job. For example, a supervisor may learn some behavioral modeling skills in giving performance feedback. Positive reactions by subordinates to the skills exhibited by the trainee once back on the job may result in more opportunities to exhibit those behaviors and an increase in the level of performance of those behaviors over time.

It is highly probable that the shape or "type" of maintenance curve found is affected by the type of skills trained (e.g., behavioral, psychomotor, cognitive), the proficiency level or amount of material retained by trainees at the completion of training, and supportiveness in the work environment for applying the new skill. For example, it might be predicted that psychomotor skills (other factors being constant) will be maintained over a longer period of time than will behavioral skills. In addition, maintenance curves can be examined at the individual level or the group level of analysis. For example, similarity of individual maintenance curves within a department would suggest a work-environment effect. Given reliable measures, a large variance in maintenance curves across individuals within a department would suggest individual-characteristics effects. Similarly, maintenance curves for different departments undergoing the same training program could be examined to identify differences in patterns. Then factors in the work environment that have systematic effects on the patterns found through the maintenance curves could be identified.

Conclusion

This paper has provided a review and critique of the transfer research reported in the organizational-training literature. Future research to increase our understanding of the factors affecting transfer has been outlined, and it has been stated that we must take into account a variety of factors and linkages that, to date, have not been adequately examined. One important step in doing this would be to take a more eclectic orientation toward transfer by focusing on a number of other literatures neglected by industrial-training researchers.

For example, with respect to the issue of conducive transfer environments, the literatures in the areas of counseling (Spevak, 1981), and psychotherapy (A. Goldstein & Kanfer, 1979) are potentially rich sources of ideas for testing and application to organizational settings. To illustrate, researchers in those areas have investigated the value of "buddy systems" for facilitating transfer (Barrett, 1978; Karol & Richards, 1978). A buddy system refers to two trainees being paired to reinforce each other in order to maintain learning, provide advice, and be alert for signs of relapse in themselves and the buddy. In a study of habitual smoking reduction,

Karol and Richards (1978) found that the buddy system condition exhibited substantially less relapse to smoking than did a control condition.

Another strategy investigated in a counseling context has been that of "booster sessions" (Ashby & Wilson, 1977; Kingsley & Wilson, 1977). A booster session is an extension of training and usually involves periodic face-to-face contact of either a planned or unplanned nature between trainee and trainer. An obesity study by Kingsley and Wilson (1977) found that the inclusion of booster sessions at 2-, 3-, 4-, and 5-week intervals induced a significantly greater percentage of maintained weight loss than did the absence of boosters.

Marx (1982) has begun a program of research adapting a transfer strategy termed "relapse prevention," which was originally designed and successfully implemented in the treatment of addictive behaviors (Marlatt & J. Gordon, 1980; Perri, Shapiro, Ludwig, Twentyman, & McAdoo, 1984) to industrial settings. As Marx has noted, this approach seems particularly applicable as a post-training transfer strategy for industrial training. The relapse prevention model consists of both cognitive and behavioral components designed to facilitate the long-term maintenance of learned behaviors by teaching individuals to understand and cope with the problem of relapse.

In the area of educational psychology, Wlodkowski (1985) recently presented a comprehensive list of strategies for enhancing adult motivation to learn. While the author's focus was primarily on learning (not transfer) outcomes, and empirical evidence presented was quite limited, such work could serve as a departure point for empirical investigations aimed at investigating transfer in organizational contexts.

Aside from exploring other literatures, it is also readily apparent that we need to begin research that takes a more interactive perspective. Most of the existing research has focused exclusively on one input factor (design, trainee, work environment) rather than attempting to develop and test a framework that incorporates the more complex interactions among these training inputs. Consequently, we have a quite limited knowledge base about which input factors have the greatest impact on transfer under various conditions (such as type of organization and type of training program). A recent paper by I. Goldstein and Musicante (1985) is one of the first attempts to bring together several of the different factors usually examined independently (principles of learning, environment characteristics) and apply them together to an organizationally relevant (rater training) context.

In addition, training research cannot continue to ignore the job relevance of the training content as a critical factor affecting what is learned, retained, and transferred to the work setting. Transfer research has implicitly assumed the job relevance of the training content without attempting to specify what the desired skills or behaviors are or what the training content should be to insure skill acquisition. When training content is not valid,

trainees may actually be successful in learning and transferring knowledge and skills that are inappropriate for effective job performance. Ford and Wroten (1984) and I. Goldstein (1986) have developed techniques for examining the content validity of training programs. Information from these analyses can then be used to refine training content and to increase the job relevance of the training program. In future studies on transfer, researchers should provide evidence of the job relevance of the training material before examining the effects of other input factors on generalization and maintenance of trained skills.

Perhaps most importantly for the present, there is a critical need to conduct research on transfer with more relevent criterion measures of generalization and maintenance. Conclusions from the existing research are problematic, given the relatively short-term, single-source, perceptual data base that has been created. It is hoped that the model presented, the review conducted, and the suggestions given in this paper will help spur further efforts at examining transfer from a broader and more dynamic perspective.

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