# How Do You Improve Human Performance?

**Summary of Findings Released by the National Research Council Committee on the Enhancement of Human Performance**

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We are in an era when technological advances have expanded our capacities to communicate, to solve problems, to build, and to destroy. Tools are available to speed our work and enlarge our goals. We can now write, rewrite, communicate, and respond with unprecedented speed — sometimes more rapidly than we can think, understand, or phrase our thoughts in coherent fashion. Planes fly with little or no help from human pilots, smart weapons can destroy enemy targets (and, occasionally, friendly forces) with awesome accuracy and destructive power, and other technological advances permit soldiers to fight rather than sleep at night.

Such technological achievements, based on progress in the physical sciences, computer science, and engineering, have not been accompanied by comparable advances in what might be referred to as human technologies. The demands on individuals and teams of individuals to learn and to perform have not, overall, been reduced by high-technology equipment of one kind or another. In fact, that equipment more often than not requires new training, a better educational background, and more rapid and complex problem-solving skills in actual performance situations. We have been slow to learn that technological innovations must be evaluated with the human in the loop, that technical specifications and "bench testing" can greatly overestimate how new equipment will perform in the hands of actual humans and organizations.

The foregoing general considerations are nowhere more apparent than in the U.S. Army. As the largest training institution in the world, the Army faces increasing demands for technical skills. Key Army staff were among the first to realize that psychological techniques to enhance human performance deserve as much emphasis to as engineering techniques to enhance the hardware performance. The Army approached the National Academy of Sciences seven years ago with a request that it assemble — under the auspices of its National Research Council — a committee of experts to evaluate the promise of certain techniques to enhance human performance. Initially, the committee was to focus on a set of unconventional "new age" techniques — claimed by their promoters to be extraordinarily effective, that in some cases had gained a degree of advocacy within the Army, and that had been developed mostly outside the academic research establishment. The committee (chaired by John Swets) analyzed the scientific support, or lack thereof, for several such techniques, and its 1988 report was published by the National Academy Press. Reaction to the report was considerable, in public and professional sectors as well as within the Army, and it became something of a best seller by Academy standards.

With the release of this second report of the Committee on Techniques for the Enhancement of Human Performance we finished the second of three phases of the committee's activities, the agenda for which began to emerge well before the *first* report was completed. But by July, 1989, that agenda was set and we went to work for the next 18 months. The committee examined hundreds of relevant scientific papers, commissioning several review papers by outside specialists where necessary. We made site visits to military and non-military settings, invited consultants and advocates of various types to speak to the committee, and finally arrived at the conclusions summarized below.

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### Areas of Research Examined

In its second phase, the committee's emphasis shifted from unconventional techniques toward a consideration of more basic issues of performance. We *did* examine a few unconventional techniques

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that have enjoyed recent success in the public or corporate marketplace, but our central focus was on innovative applications of basic research findings. The performance issues, though selected to be of concern to the Army, turn out to be relevant to civilians and soldiers alike. These issues fall into three broad categories: **training** to enhance post-training performance in real world settings, **altering mental states** to enhance performance, and **preparing to perform under pressure**.

In the training area, we considered innovations in training programs that might minimize the loss of access to critical skills and knowledge produced by long periods of disuse, or by changes in situational characteristics; we assessed the potential of using models of the expert as a guide to training complex skills; and we

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evaluated self-assessment techniques that are designed to upgrade one's performance over time by fostering successful career development.

Within the domain of altering mental states to improve performance, we examined the efficacy of subliminal self-help audio tapes, meditation, psychological techniques of managing pain, and methods of detecting and hiding deception. Our analysis of deception was motivated by practical concerns within the Army, and by its relevance to understanding the physical manifestations of emotional and mental states. Finally, with respect to the preparation to perform, we examined a variety of sports-psychology techniques designed to sustain performance under pressure, and we took a broad view of issues and factors in team performance.

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## Major Conclusions On Techniques to Enhance Human Performance

So what did the National Research Council Committee conclude? First — though far from universally positive about the specific techniques surveyed — the committee felt overall that advances in basic research, particularly across the last decade or two, *do* provide a basis for improving certain aspects of training and performance. Given the expanding body of relevant research in the cognitive, social, and brain sciences, the potential for such improvements should be even greater in the future.

The conclusions likely to be of broadest interest include:

- With respect to **training**, a recurring problem is that skills and knowledge acquired by trainees are not durable or flexible. At the end of training, trainees may meet rigorous performance standards, but in post-training real world settings, those same individuals may perform poorly, especially when long intervals of disuse of that skill or knowledge have intervened, or when the real world situation differs in certain respects from that present during training. Long periods of disuse are commonplace, and it is probably the rule that real world situations will differ in important ways from the conditions of training.

  What makes this problem especially significant is that what trainers typically see is performance of trainees *during* training, not their subsequent performance in the real world. That is problematic since the conditions of training that enhance performance during training are often *not* the conditions that enhance post-training performance in the long term, or in different contexts. In fact, certain conditions of training that appear to speed acquisition of skills and knowledge are among the poorest conditions in terms of long-term retention and ability to generalize one's training, and other conditions that impair performance during training can be optimal in terms of those criteria.

  A few examples of conditions that retard performance during training but which pay off later include *spacing* rather than *massing* practice over time, inducing variability in the conditions of practice, and decreasing the frequency of external feedback following attempts to execute a given motor skill. These and related manipulations of training introduce difficulties for the learner, but the process of responding to those difficulties appears to produce more durable and flexible learning. [See story on pg. 10 on training.]

- Within the domain of techniques to **enhance career development**, the use of self-assessment instruments was given special emphasis owing to their popularity in the Army and marketplace. These instruments are used by career counseling programs to provide individuals with a way to view themselves in terms of certain intrapersonal and interpersonal styles. The Myers-Briggs Type Indicator (MBTI), for example, probably the most popular such instrument, classifies a given person — based on their answers to a series of questions — in terms of four different indices: Introversion-Extraversion, Sensing-Intuition, Thinking-Feeling, and Judging-Perceiving.

  The MBTI is administered to an estimated 1.7 million individuals each year. Based on a survey carried out by the committee, taking the MBTI is reported to be a valuable experience for counselor and counselee alike. Unfortunately, such personal impressions are not supported by existing research. Until the efficacy of the MBTI is demonstrated in rigorous evaluation, the committee cannot recommend that it be used as the foundation for career choices and career counseling.

- In the domain of **altering mental states** to enhance performance, we examined subliminal self-help tapes, meditation, pain management, and deception detection.

  - Our analysis of **subliminal tapes** also was motivated, in part, by their success in the marketplace. By one estimate, 1988 sales of such tapes exceeded $50 million. Our conclusion, however, is that claims that such tapes can alter behavior and attitudes in desirable ways are unwarranted on both theoretical and empirical grounds. [See the September, 1991, *APS Observer*.] Recent lab experiments *do* suggest that stimulus presentations under certain conditions can influence a subject's later performance in simple laboratory tasks — without the subject's awareness — but such results cannot be taken as evidence that long-term changes in complex actions, cognitions, or emotions (e.g., smoking, self-confidence, or depression) can be affected through subliminal suggestions. To the degree that such tapes do seem to the user to have positive effects, those effects are better explained at present in terms of sociopsychological phenomena such as effort justification and expectancy or placebo effects. The messages on some commercially available tapes, as a matter of fact, appear — upon spectral analysis — not to exist.

  - The committee could also not find support for any special properties of **meditation** as a technique to reduce stress, control arousal, enhance the sense of self-efficacy. That is, the effects of meditation do not appear to exceed those attributable to rest and relaxation training.

  - We were somewhat more positive about psychological **techniques to manage pain**. Available research suggests that people *can* be taught non-pharmacological ways to cope with physical pain; cognitive factors clearly play a role in how intense and manageable is the experience. Procedures known to reduce stress, such as relaxation, providing information about what to expect, and enhancing a person's sense of control, also reduce the subjective experience of pain.

  - With regard to the **detection of deception**, the committee concluded that people *can* learn to detect deception more accurately by monitoring several non-verbal cues from head to toe (e.g., fidgeting of the hands and excessive movement of other body parts). Contrary to intuition, confidence in one's ability to detect deception is not inidicative of *actual* ability; experts claiming high ability but who are not aware of the non-verbal cues rarely perform better than chance. Also, it is easiest to detect deception in those who are highly motivated to deceive (e.g., a spy dealing with high stakes issues).

- Finally, in the domain of techniques to optimize the **preparation to perform**, promising developments emerge from several types of research in sports psychology, neuroscience, and motor behavior. At issue is what one can do to perform well when it matters; that is, after training is complete and necessary skills have been acquired, what can be done to increase one's chances of performing well under pressure? Sports psychology suggests that preparation strategies, such as mental rehearsal and automating pre-performance motor routines, may prime or stabilize cognitive-motor programs that underlie performance. Studies of electrophysiological (e.g., heart rate changes) and neurophysiological correlates (e.g., changes in brain imaging and EEG patterns) of motor skills suggest that certain changes may be correlated with better and worse performance. It may be possible to use such measures during the preparatory period to evaluate the efficacy of different pre-performance routines.

In sum, there is reason to be skeptical of some of the performance-enhancement techniques being promoted to the American public, but there are opportunities to learn from a growing research body and take advantage of some of the effective techniques.

Good intentions and dramatic claims are not enough. We should learn from scientific evidence and apply what has been shown to really work. ◆