

MENTAL PRACTICE: SOME OBSERVATIONS AND SPECULATIONS

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ABSTRACT: The use of words such as mental practice, imagery, and rehearsal have great meaning in the psychological, motor learning and sport psychology literature. There exists logic and precedence to simplify terminology and research that utilizes the paradigm where any kind of mental rehearsal is taking place. In fact, there is some justification that such a mechanism is and always have been an integral part of the learning process. A rubric incorporating mental practice into the mainstream of learning is presented. The importance of these mental processes in learning and performing motor skills become evident when characteristics of the cognitive, associative and autonomous learning continuum are considered in conjunction with task novelty. Under the authors' rubric, it is suggested that mental practice can have a significant effect on learning and performance not only for elite performers, but also, from the very onset of learning.

PALABRAS CLAVE: Práctica imaginada, visualización

RESUMEN: El uso de términos tales como práctica imaginada, visualización, y repetición imaginada poseen una gran significación en la literatura psicológica, del aprendizaje motor y de la psicología del deporte. La lógica y los antecedentes imponen simplificar la terminología y la investigación que utiliza el paradigma allí donde se produce cualquier tipo de repetición imaginada. De hecho, está justificado que este mecanismo es y ha sido siempre parte integral del proceso de aprendizaje. Se presenta una sección donde se incorpora la práctica imaginada dentro de la tendencia principal del aprendizaje. La importancia de estos procesos mentales en el aprendizaje y ejecución de las habilidades motoras se hace evidente cuando las características del continuum del aprendizaje cognitivo, asociativo y autónomo se consideran en unión con la novedad de la tarea. Los autores sugieren que la práctica imaginada puede tener un efecto significativo en el aprendizaje y en la ejecución, no sólo para los practicantes de élite, sino, además desde muy al principio del aprendizaje.

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Introductory Comments

The use of such terms as mental practice (MP), imagery and visualization in sport and physical activity domains is in a state of relative confusion at the present time. Different terms represent areas that in fact overlap each other in that mental images are common to all. Adding to this confusion is the research literature that has provided information which can be contradictory depending upon individual differences, motor skill level, and type of physical activity. For example reviews of the mental practice area suggest that MP can be effective for individuals who have a high degree of motor skill and may not be valuable for beginners who are just learning a skill. However, imagery, which in our view may not be substantially different from MP, is recommended for use without regard to skill level. This paper provides a theory and structure for the domain of mental practice. In addition task novelty and learner sophistication problems are presented in a way that allows application of current research information in a comprehensive and systematic fashion.

Defining the domain of "mental" or "imaginary" practice (MP), is a primary problem. If allowed to include any learning which is mediated by imagery, MP encompasses an overwhelming area of literature in learning and memory. For example, there are reliable differences in memorability associated with words which were found independently to evoke strong visual images (Paivio, 1971). In addition there are also reliable benefits from instructions for learners to form images in which to-be-associated elements are mentally visualized in interaction (Bower, 1972; Wollen, Weber & Lowry, 1972). Short-term memory research has demonstrated that rehearsal (an internal, mental process involving the use of visual or acoustic images) is important to control in order to obtain "pure" assessments of memory. Rehearsal allows the subject to form visual or auditory images of the recall information.

We submit that the thinking of earlier scholars should be reconsidered, since it would allow that which is presently classified as "MP" to be placed in a context of other human learning activities. Melton (1964) sought to describe categories of human learning, an extension of his earlier efforts to delineate dimensions of learning activities or materials (as described by McGeoch, 1942). In keeping with McGeoch we can consider a symbolic dimension—with verbal or spatial tasks near one extreme and a rotary pursuit at the other. The dimension is the extent to which responses are overt during acquisition or the degree to which the learning activity requires disparate components to be organized in some meaningful or effective way. It is worth noting that with this approach, recitation of memorized material is treated as a complex motor act rather than an activity having no clear relationship to learning or performance of a skill. In summary all learning involves the use of mental images, or if you will, MP. A person performing a skill for the first time must have a mental image of the skill before an attempt at physical performance can be made. The accuracy of the image will vary, but it is still used in much the same way that children perform by mimicking what is seen on television or a model performance by a trained teacher. In our view the use of a mental image for the beginner is an integral part of the MP domain, just as the skilled performer might use mental images to practice an inward one and a half dive. In the first instance the beginner is using MP in order to create a reference system to compare actual performance that allows learning to take place, while the skilled diver is using MP to literally practice an already highly learned motor skill.

Occurrences of MP are demonstrated throughout a wide range of activity involving memory of various images. At one extreme we have data obtained from case reports or anecdotal descriptions, such as the elite performer, working individually with a coach

or consultant. Data of this type are often treated as being of limited value, generality or utility. The other extreme is the contrived laboratory experiment, where the learner is attempting to acquire knowledge of activities required in the "real world".

As such, these tasks have a designated form of generalizability. Data from such studies are typically highly structured, engineered to allow strong inference and generalization but to an extremely limited universe. It would seem that MP effects from both of these very different extremes are strong and effective, but their form, evidence, and reportage and documentation are extremely different.

A substantial area in the literature that has capitalized on the use of case-report evidence is the systematic desensitization for focused fears and phobias (Wolpe, 1958; Smith, 1984). In this area the therapist bolsters the vividness of fearful stimuli (through images), and assists the client in confronting images which at times may be supra-normal. The plan is that the client will be more effective in dealing with real-life situations. The implication is that in a practiced client, images may actually be more efficient to use than "actual" external stimuli.. Images can be more quickly and conventionally manipulated. The extinction of the phobia seems quite similar to mastery of a skill: the acquisition of inhibition to permit more effective functioning. The application of this literature in sport psychology was aptly described by Smith (1984).

In fact, as further support for this interpretation, the systematic desensitization process is founded upon successful acquisition of a relaxation response. Most induction processes are founded upon the use of imagery. There are numerous indications that relaxation itself is a skill which, to be effective, must be learned and rehearsed over a prolonged practice period (Nideffer, 1984). Evidence from hypnosis seems to show that individuals gradually gain proficiency in attaining particular

levels of trance states (Nideffer, 1984). We submit that since the rehearsal of these skills is based upon imagery, they qualify as instances of MP. Also, once these skills are mastered and applied to the refinement of other endeavors, are these new activities then deemed "learned through MP"? Is MP exemplified by a study in which subjects are induced to imagine, or to use images in their rehearsal? Is the defining limit of MP a case where the learner forms an image of himself or herself doing something? Is it desirable to have separate categories for "pre-study" —which would involve the novice becoming acquainted with the components of the task— and MP, which would apply only to the sophisticated performer or elite specialist who is examining how to apply acquired skills to a specific set of circumstances?.

Problems

The purpose of this commentary is to discuss major problems that have been previously identified—task novelty and sophistication of the learner. Then we speculate on how MP could be applied effectively, in different forms, at various stages of learning—thus accommodating differences in task novelty and learner sophistication.

It would appear from previous reviews, (Richardson, 1967a; 1967b; Corbin, 1972: & Feltz and Landers, 1983), that MP is fairly well reserved for motor learning and skilled performance, although one recent paper (Swets and Bork, 1990) has demonstrated MP effectiveness in the military. We are talking about repetition or symbolic rehearsal without observable movement with intent to learn. We accept the restriction to motor skills. Problems appear however, in the application of Mp.

While we have no wish to dispute the conclusions provided by Feltz and Landers in their very useful summary and meta-analysis, we do suggest that one of the problems demonstrating sizeable or consistent MP effects

may be due to the variety of applications. Disparate practices are lumped together under the rubric of "mental practice". Corbin (1972), articulated this concern previously. When different studies employing different applications of MP are pooled into a general, common category (meta analysis), this admonition seems worth repetition and elaboration. While development of taxonomic categories seems an unlikely outcome, it is possible to point out different applications where purposes and predicted effectiveness would differ. From our observations, two closely related matters are a major source of disparity: task novelty and sophistication of the learner (i.e. stage of learning and purpose for application of MP).

Many formal laboratory tests or applications involve the "naive" learner trying to cope with a task which has been selected or devised to have unique features. During such learning, much of the learner's prior experience is of limited use, so acquisition involves the learning of the skill itself plus the development of attendant images (at least visual and kinesthetic for most tasks; perhaps tactile and auditory, in addition to others). With MP imposed, interspersed, or substituted for physical practice during such acquisition, the learner practices less than ideal motor behavior while making use of partially formed, vague and incomplete imagery. It is understandable that MP, which makes use of such shabby components, has produced limited and unreliable effects. The main point is that mastery of the task has been muddled with the development of imagery. If imagery were fully developed or if the performance elements were mastered, then strong MP effects might have a chance to be demonstrated with some reliability.

Perhaps the most clear-cut conclusion from Feltz & Landers is that MP effects are strongest when there are symbolic or conceptual attributes to the required behavior. Once again, these studies tend to test relatively inexperienced

learners on fairly new tasks. After some modest level of performance is reached, the learner is thanked and dismissed. But in application, and in many striking anecdotes concerning MP, the "learner" is scarcely involved in *learning* and *motor skill development*; instead, attention is devoted to the *task to be performed*. It is here (cognitive/symbolic task attributes), that MP seems to particular importance. As an example, consider an elite downhill skier who has developed strength and skills, and whose history of learning has laid down patterns of vivid and manipulable images. Allowing such a sophisticated athlete the opportunity to walk through a race course and identify locations of gates, changes in elevation, patterns of turns and changes in snow conditions should permit that individual to mentally construct the run and the course. Such memorization is in keeping with mnemonic devices which, are also based upon images, but often are verbal or visual only. The skier determines the line of the course, which allows him or her to ski the entire course mentally. The necessary skills are readily accessible, which allow the skier to make the turns in the appropriate manner, automatically adjusting for steepness of the terrain and sharpness of the turns. In a similar fashion, a concert pianist can inspect a musical score and not just commit it to memory but mentally practice the composition using visual, tactile, kinesthetic and auditory imagery. The performer is not really adding new motor skills, but using imagery to practice mentally a collection of previously acquired knowledge structures to a particular set of circumstances.

Such examples would be proliferated with ease: football or basketball players mentally practicing guarding a player having certain designated skills and propensities; a golfer examining a fairway and mentally hitting an optimal shot. It is interesting to note that what many of us thought was daydreaming, might in reality have been practice. These examples and countless others are instances in which MP has

been utilized and continues to be used and trusted as an effective mechanism. All are instances in which performers previously have attained considerable degrees of mastery of skills in consort with a rich and accurate supply of appropriate images which related directly to the motor activity. This is in contrast to the MP literature, where it is rare to find "subjects" who have highly developed motor skills in addition to concomitant imagery.

It is suggested that MP effects which are based upon proficient performers, must be given reasonable attention and should be segregated from studies in which MP is intended to aid in the acquisition of basic skills. Similarly, or more generally, it is suggested that it may be inadvisable to combine results of studies in which MP is by design or idiosyncratic application, serving different purposes. Perhaps it would be advantageous as well to reserve the term "mental practice" to refer expressly to a particular class of imagery applications, and to use other language to designate other activities, such as general task familiarization or attentional preparation, which serve other purposes at other stages of learning.

Suggested orientation and applications

In spite of the diversity noted above, we are proposing that MP can serve a useful role at each phase of the learning process, from initial acquisition of skill components to performance and execution of highly skilled automatized performance. The general skill sequence regimen that we are proposing can serve a variety of purposes, e.g., classifying extant MP studies, allowing speculation on where, in the learning process, MP may be most effective and why, and how MP can serve different purposes. Finally this scheme might serve as a framework from which testable research predictions may be derived or to which outcomes from laboratories or applied settings may be referred.

Since our purpose is to generate a practical and useful system, we wish to avoid any strong

affiliation with a "fixed" theoretical orientation. However, our approach is similar to that utilized by Guthrie (Hilgard & Bower, 1975). The basic orientation is that what you do is what you learn. In addition, we suggest that Mackay's (1981) system, which incorporates mental rehearsal processes to a basic and general orientation to learning, has considerable breadth of application and flexibility.

Since learner sophistication and task novelty seem to be closely-related factors that determine effectiveness of MP, it would seem most logical to divide acquisition into stages. While we see limited practical merit in assigning learning to three distinct stages, as described by Fitts & Posner (1967), we do subscribe to the concept that attentional focus shifts as learning progresses. Over the course of learning, limited attentional resources are allocated differently, and for different purposes. Norman & Shallice (1980) have suggested that attention shifts from creating a mental image or template, during early learning, to modifying incorrect behaviors at a later phase. When highly skilled behavior has been achieved, very little attention is required for actual execution of the skill. When higher levels of skill have been achieved limited attentional resources are available for other needs.

During the initial stage of learning, the learner establishes a mental image or performance template of the skill to be performed. It is this image or template that the learner then uses to compare actual performance feedback for correctness. It is our contention that MP serves a primary role in the development of such an image. As an illustration, suppose that a novice wishes to learn the golf swing. During this initial phase, MP would be limited to viewing a skilled model performing the golf swing correctly. When combined with an immediate chance to practice the actual swing, modifications can be made until the correct template is established. Attention during MP can then be shifted to actual skill sequence

components that require modification. This procedure can be followed until performance occurs without use of limited attentional resources. While this particular application may not seem to be MP, the inclusion of such procedures under the rubric of MP is justified: the learners are creating mental images in the absence of physical practice."Transitory experiences leave lasting effects by being coded and stored in a symbolic for memory representation. Internal representations of behavior, constructed from observed examples and from informative response consequences, serve as guides to overt actions on later occasions." (Bandura, 1977, p.179). In some circumstances, the value of the images may appear to be limited, in that they may be external rather than internal. We suggest that external images of ideal performance are preferable to self-generated but less-than-ideal images of the cognitive learning stage (Mahoney and Avenier, 1977).

Since this application of MP to the very outset of learning may seem unusual, let us illustrate, using a method that has been very successful in the development of skill for many years. While there are many features to Suzuki music training procedures that look like thoughtful applied psychology (despite different forms of development), the one feature that is most pertinent is listening. Before a child has an initial lesson, parents are provided a tape recording of perfect renditions of the initial set of repertoire. The child is exposed to these auditory presentations daily, ideally for a number of months. The child then observes a few lessons before actually having a first lesson with an instrument. The result of this extended listening is an acoustic template, an auditory model, of ideal, terminal performance. It is a set of images which remains available throughout the learning of that group of compositions and which stands as an optimal set of sounds against which all physical attempts can be compared and toward which performance can be aimed.

At this stage of learning, as well, there typically is some sort of social modeling or imitational effects during lessons. Such a factor would serve a motivational function for the golfer as well since he or she might be viewing performance of a known athlete, held in high esteem by the learner.

While these examples and strategies may seem to be an unusual application of MP, they have an extremely special and important feature. These motivational or attentional manipulations, aimed at ingrain ideal performance images, are intended to supplement other training devices, such as "crutch" cues and other temporary discriminating stimuli, to guide error free performance. It is our contention that if commission of performance errors can be obviated, then mistakes will not be learned. The result is virtual elimination of the lengthy, frustrating and emotional process of having to eradicate learned errors or to adjust to incorrect motor programs. The beginning stages of acquisition are where the greatest behavior changes take place. We submit that this is the point at which the greatest stimulus control—to include establishment of performance images—is crucial. We need only reflect on how much of our efforts are expended toward correction and elimination of learned errors to emphasize the importance of this point. How much more efficient and pleasant would the learning process be if we could merely halve learned errors.

Once the correct image or template has been established, the learner then begins to eliminate errors that occur in the movement sequence. Fitts and Posner referred to this phase of learning as the associative phase and would seem to be an ideal time to use MP as an aid to link together the skill sequences in the correct form and order, and to refine the timing of execution. In addition MP can be used to provide understanding of skilled performance. Continuing to use golf as an illustration, it is

recommended that attention during MP be focused first on the initial movement sequence: then, in a progressive fashion, adding succeeding links in the sequential movement chain. In this manner an understanding of each part of the movement sequence can be put in memory and visual, tactile, and kinesthetic images become clarified and refined. It also may be assumed that the image of performance becomes internal rather than external; that is, the learner has developed images of himself or herself performing the skill rather than images of another person executing the skill. As such, the learner has access to each component sequence within the complex act, and is developing concomitant images. This interpretation is consistent with MacKay's proposition that physical nodes are important to the formation of their mental node counterparts (which are then available for imaginary rehearsal).

Let us also illustrate using the musician as an example. As noted for the cognitive stage, the auditory performance model was established and remains available, as auditory images, for comparison against actual physical attempts to produce the same sounds. In the course of such practice, visual (performance plus the relationship between notation and sound production), kinesthetic, and tactile images are added to the auditory images which are already in place. Refinement of performance and execution is aided by comparison between the ideal image and actual output—and internal images (MacKay's mental nodes) become further refined and elaborated.

There are a number of speculations which might be made about recommended procedures and resulting processes during the associative stage. Many of these have been provided in a lengthy list by Suiin (1984). It is worth noting that if images of ideal performance are available to the learner, then those models can provide a ready source for feedback, since comparison or discrepancy between actual performance and the model would be immediately available. The

image can thus allow the learner to make good progress without such extensive need for a teacher or coach. Such self-generated feedback can also allow self-reinforcement (Cautela, 1970).

Another speculation concerns the development and rehearsal of sequences. In our example of the golf swing, we described a direct forward-chaining procedure. But, as Suiin has noted, use of part or whole learning is a matter of choice; the superiority of one over the other has not been established. It is only necessary to focus attention on the next part of the sequence that is not being performed correctly. If the grip, stance, backswing and power phase are all being performed correctly but, the follow-through is not correct, then attention is focused upon the follow through. In the case of music, a helpful admonition is to insist on slow performance to ensure perfect execution; then raise speed (overall rate of performance) at a sufficiently gradual rate so that no errors are produced (Wilson, 1982). This procedure ensures that the images of performance are accurate, which also ensures that any MP using such nodes will be beneficial. Nideffer (1985), makes a similar recommendation when suggesting that skills might be rehearsed in slow motion. One must be careful not to change an invariant characteristic of the skill and thereby alter the skill itself. We suggest also, that the use of MP during the associative stage can serve a diagnostic function—pointing out where performance is flawed or where memory for certain components is deficient or missing.

Implementation of MP during the associative stage may be a typical application imaginary rehearsal. It also resembles the typical laboratory test, where the learner is struggling with the acquisition of a novel skill and is forming images of performance which are of limited value, since MP will lead to rehearsal of deficient information. In MacKay's system, physical nodes that are less-than-ideal establish equally limited mental nodes; rehearsing the

latter will strengthen the former. We contend however, that by introducing ideal or "correct" images at the very outset of acquisition during the cognitive stage, the quality and utility of images available for MP during the associative stage is greatly improved.

Finally, the autonomous stage, according to Fitts and Posner, is when the skill has become fully automated. It can also be viewed as the stage in which use of limited attentional resources is not required for the successful execution of the task. In the case of our golfer, little attention is focused on the act of gripping the club, getting the proper stance, etc. The golfer can then attend to the direction the ball is being sent and overall force of the swing. Golf is also an example of pre-performance tuning or control of arousal level, and imagery of the correct shot being hit down the middle of the fairway. If the proper arousal level is not attained or attention is being directed toward an irrelevant cue, then initiation of the skill can be delayed—ideally until attentional control is regained. A great deal has been written describing applied practices for attention control

and pre-performance "psyching". So there is little need for repeating or describing those various practices. However, It may seem ironic that these tactics constitute an additional layer of skills which, for optimal performance, must be rehearsed and superimposed upon the skill they are intended to enhance; essentially a "meta-skill", requiring extended mental practice of mental preparation (Nideffer, 1985, Unestahl, 1986). While this commentary has not introduced new facts, it is hoped that the variety and potential scope of what is termed "mental practice" can be expanded, with the result that researchers and practitioners can perceive a greater role for mental practice in tasks requiring learning and performance. It is our contention that MP can have a substantial role and make a major contribution from the very onset of skill acquisition. Further, that careful and thorough adoption of well structured MP regimens can go a long way toward creating conditions which allow for error-free skill acquisition as well as optimal terminal performance.

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