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ABSTRACT

A taxonomy of psychomotor skills provides a classification of all human movement forms. The development of motor skills in this hierarchy begins with the reflexive physical responses of the infant. The stages of growth include basic interactive movement forms, skilled movement forms, and functional and creative movement forms. This taxonomy offers a way of viewing motor behavior based on a developmental rationale. A model is presented that offers a framework for the identification of all instances of human movement, whether they be dance, work, or sport related. This model focuses on what a movement does developmentally for the body. In developing a physical education curriculum, the model and taxonomy can be used in making decisions about: (1) the overall goals of the program; (2) the scope and sequence of the content; (3) the development of specific learning activities and materials; and (4) the selection of assessment objectives and techniques. (JD)

Occasional Paper No. 35

A TAXONOMY OF PSYCHOMOTOR FORMS

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Abstract

This paper outlines a taxonomic structure [illegible]ying educational objectives in the psychomotor domain. This taxon[illegible]based on human motor development and is linked to Mosston's model of the universal structure of human movement content from which it evolved. It may be used to help organize and execute instruciton, to write and assess curriculum, and to structure and communicate the results of research on teaching in the psychomotor domain.

A TAXONOMY OF PSYCHOMOTOR FORMS

Michael Goldberger[1]

School programs are designed to help people develop the variety of diverse abilities necessary for membership in adult society. For instructional purposes these abilities are categorized into areas or domains, and then translated into goals. The cognitive domain is composed of goals dealing with knowing and thinking abilities. The development of positive feelings, attitudes, and values forms the basis of the affective domain. Goals dealing with motor performance compose the psychomotor domain.

An individual human being thinks, feels, and moves as an integrated whole, and thus within an individual the abilities to do these things are inextricably linked. Educators must always appreciate the organismic nature of an individual's abilities and performance. Keeping this concept foremost in mind, it has proven helpful for instructional purposes to separate and classify abilities into these three domains.

A taxonomy is a structure which classifies things according to some natural order. An educational taxonomy classifies a domain of knowledge about instruction into some hierarchical order based on a dimension underlying that body of knowledge. Taxonomies of instructional objectives have been prepared for the three domains mentioned above. In the most well-known cognitive taxonomy of objectives, the hierarchy is based on the level of intellectual involvement (Bloom, 1954). The levels within this structure range from memorization of

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[1] Michael Goldberger was a visiting scholar with the IRT during the 1980 spring term. He was on leave from Temple University in Philadelphia, Pennsylvania.

facts to more heuristic cognitive operations such as analysis and synthesis. Underlying the most well-known affective taxonomy (Krathwhol, Bloom, & Masia, 1964) is an attention to the "inner growth that takes place as a person becomes aware of and then adopts (internalizes) the attitudes, beliefs, etc., that support his value structure and guide his behavior" (Gage & Berliner, 1975).

There are also a number of taxonomies in the psychomotor domain (Harrow, 1972; Simpson, 1966; Jewett, 1974; Kibler, Barker, & Miles, 1970). For the most part these taxonomic structures do not offer conflicting models, but rather represent alternative views of human movement.

The taxonomy presented here is not completely new. Neither does it conflict with the models already available. It is, perhaps, unique in its explicit connection to the human movement knowledge from which it evolved. This connection is the fact that the process of human motor development is central to all the taxonomies.

Human Motor Development

The motor behaviors of newborn infants are reflexive responses to internal and environmental stimuli. These movements are initially random and unrefined, demonstrating the lack of association between the infant, his/her body and movement, and the environment. Apparently, even during the first few weeks of life, rudimentary connections between movements and their consequences are being formed, and, in a sense, being practiced. Primitive pathways between thinking and moving are slowly being etched into memory.

Insatiable curiosity spurs rapid motor development in early life. Within six months of birth, infants begin to explore their immediate environment, enriching their experience, stimulating their senses, developing a crude sense of space and time, and learning how to control their motor equipment. Within the next six months they develop a primitive capacity to move around and become

able to explore a more extended world. As a consequence of this [illegible], they increase their motor repertoire. Soon they are better able to control their behavior and can approach exploring things more systematically.

Before the end of their second year, children have gained [illegible] array of things they can do. They are mobile, can manipulate [illegible] objects in purposeful ways, and can use their bodies effectively to meet certain personal needs. These motor patterns have a sense of universality about them in that they appear to be true for all people, happen in [illegible] order, and appear to be prerequisite to other stages of development.

Through play, an extension of curiosity, developing children build on these universal forms of movement to build complex motor patterns more germane to their culture. They incorporate imitations of adult behavior into their play and begin to be amenable to structured learning experiences. At first, children focus on the idea of the movement. They might not be able to catch a ball, but they can get their arms out in front of their bodies. Through practice and reinforcement, and in the presence of other important conditions for learning, motor patterns for a variety of skills are indelibly etched into motor memory. Even in old age, when the psychomotor attributes necessary to support performance have diminished, these motor patterns persist in memory.

For the next several years, the psychomotor "job" of the child is to expand the lexicon of skilled movements needed for work and play and to develop competency in the ones deemed most important by personal and social values. In this sense, competency is defined in terms of such things as the efficiency, accuracy, adequacy, and beauty of performance. An extension of developing competency is increasing its applicability. These motor skills become instruments to be used for an ever increasing complex of purposes.

An eight-year-old child, for example, might show interest in learning to

play the piano may be interested by his friends with his new talent, but he must learn certain body part relationships ("keep those fingers curved") and some fundamental skilled movements associated with this new activity (that certain fingers do certain things). Of course, initial movements are clumsy and sporadic, error rate is high, frustration is evident, and it takes a great deal of effort and concentration just to continue. After considerable practice, motor patterns become integrated, and additional practice "fine tunes" smooth, efficient movement. The child can now use his skill as a tool to make music.

Throughout life, people use skilled movements in this functional sense to accomplish a myriad of everyday tasks and meet the complex challenges which define the human condition. Although known skills may help in learning new skills, like skipping stones across a stream, for the most part, each time people are faced with adding to their movement repertoires, they must go through the same basic steps of skill acquisition and refinement.

There is another stage of motor development that should be mentioned that many people never approach. As a prerequisite to this stage, an individual must have great competence in an area, particularly in the functional sense, and must be highly motivated. Given these conditions, an individual may, for some elusive reasons, be inspired to search for and invent an expanded view of that movement. In other words, the individual goes beyond that which was known to a new level of richness. The piano-playing child may perhaps become a professional musician, and, in a passion one day, invent a new finger technique on the piano.

The Taxonomy of Psychomotor Terms

A broad definition of the psychomotor domain would include "all observable voluntary human motion" (Harrow, 1972). Herein, specific patterns of human movement are referred to as "psychomotor forms," as distinguished from psychomotor attributes (such as strength, flexibility, balance, and so on), which

underlie these forms. It [illegible] extricably linked to certain [illegible] (forms, attributes, and body parts) will be discussed.

The Taxonomy of Psychomotor Forms [illegible] of forms within each [illegible] to connote mutually exclusive meanings for each [illegible].

Level 1--Reflexive Movement Forms

These first movements [illegible] the exception of [illegible] to educators.

Level 1.1--Inherited reflexive forms. These are [illegible] internal and external stimuli are "on-board" at birth. The knee-jerk reflex is an example of this category of psychomotor form.

Level 1.2--Conditioned reflexive forms. Reflexive movements can, apparently, be learned. Conditioned reflexive forms are automatic motor responses (i.e., there is no thinking involved) to external stimuli and, like inherited reflexive forms, have little relevance to instruction, although they are learned (in the classical conditioning sense). Some say a sprinter reacts to the sound of the starting pistol with a conditioned reflexive form.

Level 1.3--Exploratory forms. At first the infant has little, if any, personal control over his/her motor behavior. There is no association between the infant, his/her body, and its movement potential. Rudimentary connections, or schemas, are formed through experience. Neural pathways are etched through random movement followed by trial and error exploration.

The crib-bound infant becomes aware of his/her arm, for example, and experiments with its movement potential. These movements are unrefined and lack purpose but they help to construct neural schemas prerequisite for other movements. These prerequisite movements are defined here as exploratory forms.

Figure 1

The Taxonomy of Psychomotor Forms

1. Reflexive Movement Forms

   1.1--Inherited Reflexive Forms

   1.2--Conditioned Reflexive Forms

   1.3--Exploratory Forms

2. Universal Movement Forms

   2.1--Basic Movement Forms

      2.11--Non-locomotor Forms
      2.12--Locomotor Forms
      2.13--Environment Interaction Forms

   2.2--Conceptual Movement Forms

3. Skilled Movement Forms

   3.1--Discrete-Closed Skill Forms

   3.2--Continuous-Closed Skill Forms

   3.3--Discrete-Open Skill Forms

   3.4--Continuous-Open Skill Forms

4. Functional Movement Forms

   4.1--Algorithmic Forms

   4.2--Low Organization Forms

   4.3--Complex Forms

5. Expansive Movement Forms

   5.1--Interpretive Forms

   5.2--Creative Forms

Their development proceeds [illegible] to move various body parts at will, although without [illegible] ability to orient and use sense receiving organs, and [illegible] ositive and motivation to explore. With these [illegible] proceeds from gross to specific [illegible] cephalo-caudal pattern (Wickstrom, [illegible]).

Level 2.--Universal Movement Forms

These movements are universally observed in early human [illegible]. They are naturally occurring motor responses [illegible] and appear to be prerequisite to the [illegible]. They are gained through a process of exploration, as [illegible] petence, and are etched indelibly into motor [illegible]. Discrete bits of motor behavior are shaped and combined to form patterns which [illegible] function.

Level 2.1--Basic movement forms. These specific forms, which are the fundamentals of human functioning, also serve as the building blocks for more advanced patterns. This category includes the following subtopics:

2.11--Non-locomotor forms. Controlled movements which (1) stretch, curl, and/or twist various body parts, individually or in combination and (2) transform the body into a variety of shapes (e.g., round, long, curved).

2.12--Locomotor forms. Movements which transport the body from one place to another (e.g., walking, running, hopping, sliding).

2.13--Environment interaction forms. (An environment could be an object, a person, a surface, a temperature, and so on.) Movements in which the environment (1) is unobstrusive, (2) is an obstacle, (3) is manipulated, (4) manipulates, or (5) is synergistic (e.g., hurdling, climbing, dodging, jumping, leaping, hooking, grabbing, throwing, catching, kicking, floating, coasting).

Development of these specific forms proceeds from simple to complex, from [illegible]rt to whole, from one body part to many, from slow to fast, and from gross

to specific. Armed with a continually growing repertoire of basic movement forms, the individual begins to gain control over these movements (Laban, 1974):

Control of force: from light to strong output.
Control of flow: from jerky to smooth output.
Control of time: from slow to fast output.
Control of space: including general and personal space, level, direction, pattern, distance, and more.

Level 2.2--Conceptual forms. In the cognitive domain, the content thought about is information in the form of facts, concepts and/or principles. Concepts and principles are particularly powerful tools for they permit one to generalize known ideas to similar, but previously unknown, information.

There are concepts in the psychomotor domain as well. For example, if one visualizes an individual chopping down a tree, moving a part from a stack to an assembly line, or hitting a forehand stroke in tennis, and one focuses on the individual's hip movement, as the object (e.g., tennis racket) is moved from one point to another, one can see a similar movement pattern of this body part. In each case, hip rotation precedes movement of the object. These examples demonstrate the principle of summation of forces; they also demonstrate a movement concept, or actually part of a concept, that underlies a variety of similar activities and that can be taught and transferred.

Level 3.--Skilled Movement Forms

With maturity and experience the normally developing child gradually builds an impressive repertoire of skilled-movement forms. These are specific, purposeful activities which vary somewhat from culture to culture. They may be examined from two perspectives: from the movement itself and from the movement's outcome. In observing a golfer, for instance, one may focus on aspects of the movement itself (Was the head down? Did the hips come through before the arms?) or on the consequences of the movement (Where did the ball go?). The focus at this level of the taxonomy is on the movement itself and not its consequences. In this view, called the "assigned" view (Mosston, 1965), specific

movement patterns are assigned agreed-upon values of "goodness" by experts, judges, employers, others, or the performers themselves. These ideal patterns of movement are based on mechanical/kinesiological principles and/or empirical/asethetic pronouncements.

The sport skill of high jumping, for example, actually has a number of different skill forms associated with it (e.g., the western roll, the belly roll, the "flop"). Actually, any skill may be broken down and will be found to consist of a combination of lower-order movement forms. If a movement form is specialized (i.e., it has a unique function and is specific in a behavioral sense), it most probably fits at this level of the taxonomy.

The concepts of closed and open skills (Gentile, 1972) and discrete and continuous skills prove helpful in classifying skilled-movement forms. No matter what category a skill fits into, it has a specific motor pattern associated with it that is it's focus at the skilled movement level of the taxonomy.

3.1--Discrete-closed skill forms. These are short, sequenced, self-paced skills performed under fixed environmental conditions. Hammering a nail, doing a swan dive, and shooting an arrow are examples of discrete-closed skills.

3.2--Continuous-closed skill forms. These are also self-paced skills performed under fixed environmental conditions, but they involve a continuous pattern of movement. Dealing cards, typing a letter, and figure skating on a open lake are some examples of these skill forms.

3.3--Discrete-open skill forms. These are short sequenced skills performed under changing environmental conditions which require performers to adjust their responses during the activity. Swatting a fly, trap shooting, and batting a baseball are some examples of this category of skilled movement forms.

3.4--Continuous-open skill forms. Continuous-open skills involve a continuous pattern of movement and require the performer to constantly be making

adjustments to changing environmental demands. Examples of this category include skating in a crowd, flying a plane, and riding a bicycle in Philadelphia.

Level 4--Functional Movement Forms

After an individual has gained the rudiments of a skilled movement form or more accurately, during the learning process, a keen desire is born to apply this skill under realistic circumstances. As this is done, the focus literally shifts from the skill itself to it's consequences. Of course, prerequisite to this shift is the attainment of enough control to keep performance on track and to avoid disorientation as the focus shifts. The learner must shift attention away from the movement itself and to the relevant environmental factors. In terms of motor performance, the learner must be able to perform the skill and make the necessary adjustments to account for environmental influences. In many cases this shift is allowed to occur too quickly. If if occurs before the skilled movement form is firmly etched into motor memory, it may lead to failure and frustration. Think of the beginning tennis player or individual trying to make bread being rushed too quickly to total immersion in the activity. Self-doubt, frustration, and failure often result, leading, perhaps, to abandonment of the activity.

It appears that functional movement forms are best developed under conditions in which environmental factors are allowed to gradually influence performance. In general, the more environmental factors involved and/or the greater their intensity, the greater the need for skill moderation/adjustment and the more difficult it is to gain competence.

The categories within this level are related to the categories within the previous level. That is, for example, the functional movement form analog for a discrete-closed skill form is the "algorithmic movement form." Tossing a dart is a discrete-closed skill. Tossing a dart at a dartboard for score is its functional-level equivalent. The number of environmental factors

affecting dart-tossing performance are few in number and low in intensity compared with either a rugby player running in a broken field or a construction worker 15 floors up trying to connect a fitting.

In this sense, the categories within this level of the taxonomy are based on the amount of environmental influence associated with the application of skilled forms. The three categories suggested below range from minimum environmental influence (algorithmic forms) to maximum environmental influence (complex forms). To repeat, it is the environmental conditions under which the skill is performed that dictate the category. As mentioned above, dart throwing to hit a target is classified as an algorithmic form. However, if this same task was performed with a swinging target, it would be in a different category (4.2--low organization form).

4.1--Algorithmic forms. An algorithm is a precise prescription for carrying out a specific sequence of basic functional operations, and this concept has application to both intellectual and physical activities (Landa, 1974). The term implies little or no need for adjustments. In this context, algorithmic forms are defined as the functional analog of discrete-closed skill movement forms. Cracking an egg into a bowl without either shattering the yolk or getting shell into the bowl, doing indoor archery, and bowling are examples of forms in this category.

4.2--Low organization forms. In terms of quantity, if not in time spent, this category includes the bulk of the psychomotor forms most humans employ on a daily basis. It forms the bridge between those skills which require little adjustment in application to those which demand a lot of skill and concentration. Psychomotor forms in this category are characterized by controls imposed either by the movement form itself (i.e., it is either a continuous-closed or discrete-open skill) or by extrinsic conditions (i.e., restrictive parameters or rules).

Included in this category are (1) the application of continuous-closed or discrete-open skills, such as operating on most assembly lines, dealing cards, or typing a letter, and (2) drills, exercises, or leadup activities associated with the application of continuous-open skill forms (to be discussed next), such as driving a car in a secluded parking lot, catching a batted fly ball, or performing a simulated "fireman's carry."

4.3--Complex forms. Complex forms involve the application of continuous-open skill forms. For example, acquiring the complex sport skill called the "instep soccer kick" involves being able to balance on one foot, with the toe facing the target, and bringing the other foot in contact with the ball, across the instep part of the foot (level 3.1). If the same skill is performed with a moving ball, the level shifts to 3.3. If the requirement of having to kick the ball through a goal target is added, the level shifts to 4.1. Finally, if the performer must kick a moving ball during a continuous game through a target guarded by an opposing player, the level shifts again to 4.3. The playing of many team games and the performance of many complex jobs fall into this category.

5.--Expansive Movement Forms

Expansive movement is the psychomotor equivalent of the cognitive process of problem-solving. The problem is defined as something, either naturally occurring or artifically induced, that causes an individual dissonance and propels him/her into the realm of divergent thought and expansive expression of ideas.

The objective of someone in a state of dissonance is to eliminate the discomfort by solving the problem. The steps in this process include the following:

1. clearly identifying the problem,
2. collecting data about the problem and searching for solutions,
3. perhaps having to make new associations in the data or inventing other solutions, and

4. testing solutions and expressing the "good" ones.

In all forms of movement there is an inextricable link between thinking and moving, as I mentioned before. A functional movement form is the learned motor response to a specific set of stimuli. Even in reflexive movement forms, the action is in response to a stimulus. In both these examples, as with all movement forms below the expansive level, the motor outcome is in response to a specific stimulus or set of stimuli. This is not the case at the expansive movement level. Here the stimulus or set of stimuli causing the dissonance is in the form of a "problem" which, as mentioned above, does not clearly reveal the desired motor outcome.

The problem, by definition, is somewhat vague (that's why its a problem). It appears subjective and, in a sense, hides what might be good solutions from the performer. The individual is compelled to engage in those steps listed above to search for, to uncover, and to express what s/he knows, considers to be an appropriate solution. If the solution reduces the dissonance, the process ends, at least temporarily. The nature of the problem dictates the level of category.

A classic example of this is the process 1968 Olympic gold medalist Dick Fosbury went through in inventing his popular "flop" technique of high jumping. The work of a choreographer/performer in creating a new work and the trial performances of a job analyst trying to improve the work patterns of an assembly line worker would both be in this category.

It is difficult to say with assurance that an individual has performed at this level. It depends on what s/he knows, can do, and the process s/he goes through in attempting to resolve the dissonance. It should be clear, however, that at this level the initial process involves divergent thinking and the product involves movement.

It should be noted that the novice performer engages in exploratory-type

movement behavior. These movements, as defined in this taxonomy, are classified at the reflexive level and do not represent expansive movements. In other words, non-specific movement forms are not necessarily classified as expansive. In order for a movement form to be thought of as expansive, the performer must be highly skilled, in the functional sense, as a prerequisite. The performer must then go beyond his/her present perceptions and abilities to form something that is new to him/her. This is primarily the domain of the artist. Most sport and work forms, by their structure, do not expect, encourage, or, in many cases, permit expansive movement forms because of their rigid rules and scope.

5.1--Interpretive forms. These are psychomotor forms in which the performer expresses his/her own literal interpretation or translation of an existing idea. Trying to replicate a particular fencer's style or chef's technique, which goes beyond the ability to successfully perform a particular skill in the functional sense, and to include the nuances of that master's performance is the focus in this category. Also included here is the use of movement to interpret or express one's own ideas or feelings. This could be a personal, as opposed to a literal, translation of an idea.

5.2--Creative forms. To do a creative form, an individual must express, through movement, something which is both new and unique to him/herself. The individual must be an expert in this movement form. Through insight, practice, luck, or whatever, the individual then goes beyond his/her present range of expression. This is the level of invention, which is indeed quite rare and very magical.

The Three Dimensional Model of Developmental Movement
(a universal structure of human movement content)

The taxonomy presented above offers a way of viewing motor behavior based on a developmental rationale. It should be emphasized that one level of this taxonomic structure is in no way "better" than any other level. Each level

represents a cluster of psychomotor forms which are all part of the total lexicon of human movements.

In learning a motor skill, it is assumed that these levels are more or less sequential, that development proceeds from the universal-form level through the functional-form level. A particular learning task may or may not be appropriate to a given learner's developmental level. For example, it would be [illegible] as inappropriate to have a beginning gymnast working at the "expansive" level as it would be to have a skilled gymnast working at the "universal" level.

As was mentioned earlier, a taxonomy classifies some domain of knowledge into an order based on a particular dimension. Perhaps the unique contribution of the taxonomy presented here is the way it fits into the model of human movement from which it evolved. This model, "The Three Dimensional Model of Developmental Movement", (see Figure 2), was developed by Mosston (1965) to offer a universal perspective of psychomotor content (of which psychomotor forms are a part).

The model is based on what Mosston calls the "intrinsic view" of human movement; it focuses on what a movement does (developmentally) for the body. Theoretically, the model offers a framework for the identification of all instances of human movement, whether they be dance, work, or sport related.

The model consists of three, interconnected, dimensions:

Dimension 1: Taxonomy of psychomotor forms. This dimension, which was presented in detail above, provides a classification of all human movement forms. The placement of the taxonomy into the model is an adaptation of the original structure developed by Mosston (1965).

Dimension 2: Psychomotor attributes. Underlying the learning of any psychomotor form is the required presence of certain abilities. here called attributes. For example, prerequisite to the acquisition of skill in archery

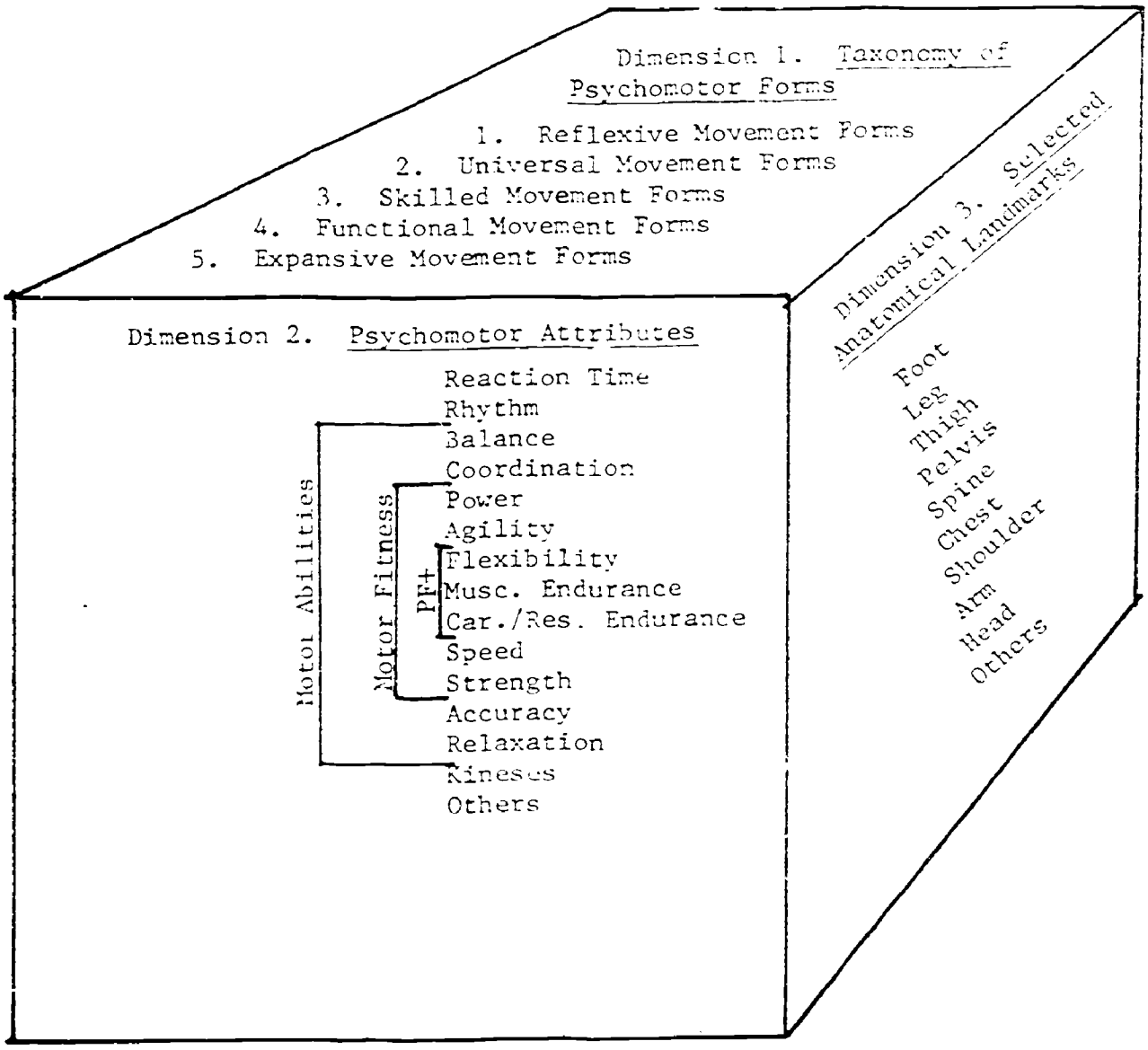

Figure 2

The three dimensional model of developmental movement[2] (Modified from Mosston, 1965).

[2] It has become popular recently to define Physical Fitness in terms of flexibility, muscular and C-R endurance.

is the presence of enough upper arm strength to draw the bowstring into the anchor position. Strength is an attribute. In addition, the individual must have enough eye-hand coordination to nock the arrow into the bowstring and aim the bow toward the target. Coordination and accuracy are attributes. One way to conceptualize the presence of an attribute is to ask the question: What underlying ability is being developed when this particular movement form is being performed? In the case of archery, upper arm strength, shoulder strength, and hand-eye coordination, among other things, are being developed. As noted in Figure 2, groups of psychomotor attributes can be combined to form certain constructs such as physical fitness, motor fitness, motor ability, and so on.

Selected anatomical landmarks. Psychomotor attributes and psychomotor forms are developed in terms of specific parts of the body. For example, strength development in the upper arms has little, if any, effect on developing strength in the legs (unless the movement to develop upper arm strength includes the use of the legs). These are developed independently or, in other words, development is generally specific to the body part or parts engaged in performance. For another example, development of the skilled form of "throwing a football" has little effect on improving kicking ability, or even throwing ability with the opposite hand. This third dimension is an integral part of the overall model.

The Applications of these Structures to Curriculum and Instruction

Both the model of developmental movement and the taxonomy of psychomotor forms can be useful for curriculum development, instruction, and assessment.

In developing a physical education curriculum, the model and taxonomy can be used in making decisions about (1) the overall goals of the program, (2) the scope and sequence of the content, (3) the development of specific learning activities and materials, and (4) the selection of assessment

objectives and techniques. The reason why these models are so potentially useful lies in their universal nature: they provide a framework through which to view the curriculum.

For example, in selecting the overall goals of a K-12 school curriculum, planners using these structures would have a point of reference of what could be included in the document. Specifically, if objectives dealing with the development of the attribute flexibility were not included, planners would at least be aware of this omission and, perhaps, might then decide to include it.

Developmental movement itself could be used as the organizing idea for a curriculum or a series of units. In this context, the focus would not be on developing specific sport or dance skills, but on learning, both cognitively and in psychomotor terms, the content of the model itself. For example, a theme might be introduced dealing with the attribute of balance and learning activities developed to teach balance on a variety of body parts. The theme could be expanded to include other attributes, environments, and purposes. A learning activity from such a unit might be the following: "On how many different body parts can you balance while maintaining contact with a partner?"

The model and taxonomy can also be used in curriculum assessment. If, for example, a curriculum document claims, among other things, to "develop creativity in learners," a review of the learning activities should produce some experiences which would fit into the creative movement forms category (Level 5.2). If no experiences are found which invoke this level of psychomotor form in learners, chances are that this claim is more a hope than a promise.

The model and taxonomy can also be used during each of the three phases of the instructional process: pre-impact (planning), impact (execution), and post-impact (assessment). Their use in general curriculum planning was discussed above. They can also be used by teachers to structure specific

learning activities. An analysis of the skill "[illegible]," for example, reveals it to [illegible] (vertical direction), the attribute power," and the [illegible] may design several tasks to develop the abilities underlying this part of the skill (e.g., doing knee bends with weights as well as [illegible] activities.

The following three examples further illustrate the [illegible] taxonomy in assuming or modifying learning activities. [illegible] may decide, based on his observations of his players during a game, that they appear weak in the attribute agility (the ability to control the body in space). He may, based on this knowledge, decide to include agility drills in all his practice sessions. Or, before attempting to apply rhythmical breathing to the crawl stroke in the water, the swimming teacher would provide land drills based on the movements which compose the overall skill (i.e., rotating the head, keeping the lips pursed, and so on). This is an application of the popular "part-whole" method of teaching. Or, for a third example, if a new skill to be learned relies heavily on a particular attribute, say strength, the knowledgable teacher would not have developmental activities for strength preceding introduction of the new skill or learners would be too tired to perform adequately.

During impact, when the learners are engaged in performing a task and the teacher is usually monitoring their performance, the model and taxonomy could prove useful, both in helping the teacher decide what to focus on and in deciding what feedback to provide. For example, during the initial stages of learning a new skill, feedback about the learners' form (Level 3) would be most helpful. The teacher should also try to help the learner focus on his/her form. Often learners shift their focus too quickly to skill application (level 4). This is a natural desire, but it may result in failure and

frustration.

Sometimes lack of success is due to the fact that the learner has not only inadequately learned the skill, but the psychomotor concept underlying the skill (Level 2.2). A classic example of this concerns skills dealing with overhand throwing. Some adults never learned, probably because they were never taught, to step forward with the opposite leg of the arm they use in throwing. They violate a mechanical principle, which is an aspect of the conceptual movement form "throwing an object with an overhand motion," which underlies all such throwing activities. The individual who has not mastered this conceptual movement form will also have problems learning the serve in tennis and other similar activities based on the same form.

In helping learners master complex forms (Level 4.3), which are the functional analogs of continuous-open skill forms (Level 3.4), it is helpful for the teacher to provide developmental tasks at Levels 4.1 and 4.2 before moving to Level 4.3. For example, if the activity is playing soccer, which is a complex form, it would be appropriate for the teacher to provide algorithmic tasks (Level 4.1) to develop specific skills, like kicking a stationary ball through the goal, and low organization tasks (Level 4.2), like dribbling around a series of cones, before playing an actual game of soccer.

The teacher may decide, when the learner is ready to move on to a higher order form, to have the learner work on either some underlying psychomotor attribute or on a variety of lower-order forms which compose the new skill. For example, if a teacher was preparing a gymnast to perform an advanced vault over the horse, s/he might try to answer the following questions: What attributes underlie this new skill? Does this student have adequate development of these attributes? What lower-order psychomotor forms underlie this skill? Would it be helpful to design some developmental tasks in helping this learner with this new skill? Based on such an analysis, s/he may decide to have the student

spend some time working on the trampoline developing some special movements before attempting the actual vault.

It has been shown how these models could be used in the context of curriculum and instruction. Recently they have also proven helpful in structuring and communicating the results of research on teaching in the psychomotor domain. It now appears clear that teaching behavior interacts with psychomotor content differentially. That, for example, direct teaching is more appropriate for certain kinds of psychomotor forms, whereas learner-centered teaching is more appropriate in providing those conditions necessary for the development of other levels of forms.

In summary, this taxonomy, and the model of human movement content to which it is linked, were designed to help individuals interested in human movement content to more productively study and apply information in the psychomotor domain. The goal was to provide a clear model, based on universal ideas, which would be of practical value.

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