TRACK AND FIELD SKILLS: ENHANCEMENT THROUGH MEDIA SYMBOL SYSTEMS

William R. MORGAN and Gladys E. Garrett

University of Connecticut
Storrs CT 06268

In the world of technology, creativity has often been associated with the non-verbal. Through objects, pictures, or visual images, a new language developed with its fundamentals originating in art rather than science. Efforts by Marc Isambard Brunel to express his ideas in drawings were part of the intellectual history of technological development. He considered drawing techniques to be the 'alphabet of the engineer'. Similarly, Christopher Polhem, an eighteenth century Swedish technologist, constructed a 'mechanical alphabet' of machine elements: each element representing a functional unit in the total working machine. Such research had merit in attempting to identify structural differences of single entities in the visual perspective.

Would it be possible to derive an '*alphabet for human movement*' in a similar fashion? This question may be beyond the scope of this paper, however, it intrigues the mind to search for a system of fundamental elements and their respective relationships during movement. We would want to take the next step in analyzing the machine, making it necessary to look at, not only the physical parts of the human system, but the forces created by such parts.

Initially, it may seem a simple matter to portray movement by a visual organization. However, forces which determine movement are invisible, and a system must be derived to visibly express them. The task then, will be to develop a process for conceptual development in human movement which adheres to sound theoretical tenets. Such guidelines will make it possible to derive a common ground for perspectives associated with both art and science.

PERCEPTUAL AND BIOMECHANICAL PARAMETERS

In relation to sport, a coach should be able to develop a strategy by which a group of athletes are able to more fully comprehend motor performance in respect to their present level of performance. Through the integration of perceptual and biomechanical parameters it becomes possible. To initiate this process, the

principles and concepts of kinesiology and biomechanics, where the structure and function of the human body is examined and the internal and external forces acting on the body, are explored. This information can enhance performance technique by providing the athlete with information by which to make a response. However, the significant issue remains to be the means and rationale by which the coach introduces this information.

To develop the instructional strategy responsive to this problem, it becomes necessary to recognize visual, verbal, auditory, and kinesthetic stimuli as being invaluable components in learning motor skills and their logical composites, namely, techniques in sport. These modes of learning are well researched. (Singer, 1980)

For our purpose, visual and verbal components require a significant concern. The meaningful use of the verbal mode of learning enables the athlete to become engaged in the acquisition, assimilation, and manipulation of words and symbols for words. However, only when utilization of pertinent, well-developed media for the portrayal of visual forces are developed, will full integration be achieved amongst all modes. Such an aptitude has been shown to increase both cognitive and motor performance. (Ho, 1978) A concern then arises in determining the manner by which we isolate or combine such perceptual modes. This must be undertaken carefully with respect to specific task requirements. Any intentional organization will result in the focus of the athlete's efforts in a particular manner. This, of course, can work to the advantage of the coach if systematically planned. How then, do we proceed in the development of a systematic rationale conducive to sport training?

As an initial investigation into an organization, a methodology by which young age-group athletes could integrate these individual entitites into a common whole was developed. (Morgan, 1984) Using track and field skills, as refined extensions of running, jumping and throwing, a basic foundation for 'freezing' motion and visualizing its dynamics was approached. It was obvious that just as our language usage had to be altered to communicate verbally to the young athlete, the visual representation of movement had to parallel the change.

In the field of biomechanics, a great deal of effort goes into the charting of human motion, be it through the lens of a high speed camera or 35 mm camera. As a tool, such instrumentation and videography provide means by which the coach may capture a moment in time. As a preliminary or complementary data base, it has allowed the coach a perspective in communicating biomechanical parameters unique to a given technique. However, is there a more creative or appropriate value to its use, and to what extent must traditional visual media be altered to meet the demands of this system? The sensitivity to utilize visual information will provide the necessary imaginative tools to answer such questions. Our goal will be to portray the true essence of any sport skill: the underlying signature of the skill along with its inherent interplay of forces.

For our purposes, the visual aspects, relative to perceptual development and cognitive undertakings, receive the greatest part of our attention. To adequately communicate such information, the utilization of instructional media will provide the vehicle by which we may bridge the gap between the traditional 'generalized visual experience' and a more analytical 'intimate visual happening'. Specifically, graphic line configurations, in an instructional media approach, present a mode for analysis conducive to the symbolic representation of movement. Whether it be by means of the free hand approach or by computer graphics, an appropriate scheme well correlated with a specific movement may be achieved.

Such an approach to productive thinking adds another dimension beyond mere mechanical responses often associated with the areas of motor development and biomechanics. With visual figures, concepts related to body management are developed, creating an interaction between the athlete and their perception of 'what they see' and 'stored experiences of 'how they perform'. By providing a strategized manner by which to organize understanding, the athlete is also able to observe motion and internalize it for future reference. The importance of such a learning tool is in its inherent appropriateness to the athletes actual performance. They are able to see the unseen in fundamental, uncluttered certainty.

MEDIA SYMBOL SYSTEMS

If, in fact, such a format is legitimate in the formulation of cognitive skills for motor development, how do we distinguish any visuals that are developed, as being appropriate? To answer this question we look to the organization in regard to the rules required for symbolic representation. Only when these requirements are met will it be possible to have a legitimate system.

It must be mentioned that certain assumptions are made due to the lack of research into how communicational symbol systems affect thought processes. There have been recent claims that argue the point that symbolic forms used in communication evolve first in thought processes. The impression of symbol systems as a contributor to thought and not merely a result of thought processes is advocated here and supported by others. (Salomon, 1981; Goodman, 1977)

The authors' approach is based on an interaction of media with the thought processes. Through the shared commonality of symbolism in media, cognition, and learning, understanding of their integrative potential may be expanded. In the athletes acquisition of knowledge, information is represented in a symbolized manner: whether it be through labeling, cues, coding, or mental imagery. This organization is complementary to media's most essential mode of presentation: symbolic systems. The hope is to transcribe these mental arrays into a visual model, personalized to the athlete's event.

Incorporation of this theoretical approach of media into skill development is accomplished by relating graphic media symbol systems to processes of mental

interpretations of movement in selected track and field events. The approach varies from the traditional role of media due to essential differences by which graphic display structures and conveys contents of knowledge. Therefore, media as a conveyor of content will play a secondary role to the skill-cultivating potential of media's symbol system.

The need for such a symbol system is derived from a desire to identify the unseen forces of the body during athletic performance and visibly portray them. Through such a system, motion is defined in terms of a simplistic system, meaningful to the athlete, yet encompassing of the intuitive senses derived from previous experiences. To best express and represent the communicable qualities of movement through the medium of symbols, Nelson Goodman (1968) proposes a logically consisten and clear theory. His establishment of rules which qualify aspects of media as symbols or symbol systems, provide the framework by which to develop the notion of track and field skills with a visually-kinesthetic appeal.

The Symbolic Element

First, let us visualize several derived symbols: Figures 1 through 5.

Figure 1 - Sprint Stride

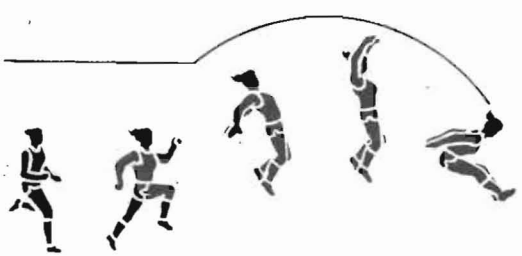

Figure 2 - Long Jump

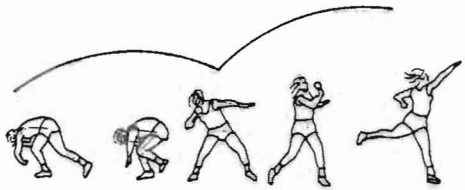

Figure 3 - Shot Put

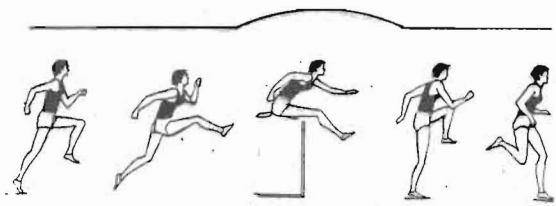

Figure 4 - Hurdling

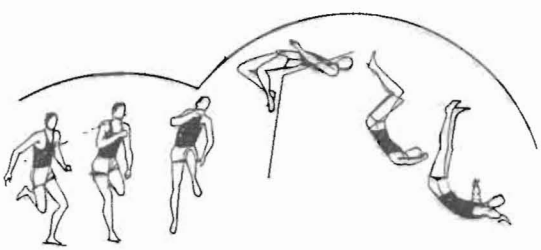

Figure 5 - High Jump

Each represents movement in a symbolic capacity by conveying information about the general requirements of specified track and field skills. As an initial encounter with the event, a structural skeleton is defined initializing each. The line configurations act in a symbolic capacity by representing something beyond themselves - as visual information, physically expressive of the unseen and respective of the event, start to finish.

It is possible to derive a simple configuration of lines which expreses the total summation of bodily forces in performing a specific skill. Figure 6 shows such a representation - the event of shot putting. The abstraction is fundamental to the total sequence of movements invovled in the event and is most valuable in

isolating the primary movement from compound movements which may cause confusion to the beginning athlete.

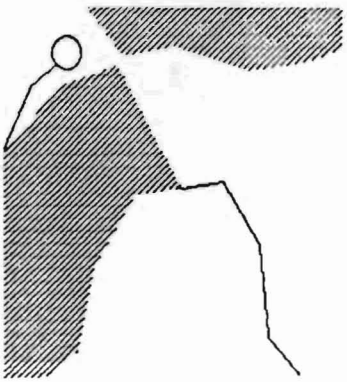

Figure 6 - Shot Put
(summation of forces)

With the fundamentals of the entire movement sequence suppressed into a single, more representative image, information is conveyed to the athlete. Such work conforms to Goodman's rules for symbols. (Goodman, 1968)

Each separate symbol must also have its own identity which is unchanged and fixed. This rationale assures unambiguous communication. By example, we explore the following two sets of lines: ' ', and ' '. The first depicts translation in the horizontal plane while the second depicts translation in the vertical plane. Any variation from one or the other influences the character of its portrayal. The obvious example would be the following set of lines, ' ', which encompasses characteristics of each of the previous sets. The simplistic formation exhibited by such line configurations is the very reason we can consider them as 'symbolic elements', adding to the strength of a theoretical rationale.

A more complex, yet logical progression in expressing quantities of force would be evident with changes in the density within each symbol area, as shown in Figure 7:

Figure 7 - Density Line

The greater the force production, the greater the density in the graphic display. Thus, line configurations become 'vector drawings', showing both direction and magnitude of force.

The Symbolic Scheme

If one symbol becomes combined or arranged with yet another symbol, a 'scheme' for this interaction evolves - the creation of a compound element from single elements. Figures 8 and 9 show such a progression. The integrity of each separate symbol is maintained as a unitary character or coding element. Also, it is interesting to note a parallel in the expressed interplay of separate body segments with the combination of words into phrases in the written language. Just as the correct combination of words convey the proper message to the learner, so do the varied combinations of elements for levels of performance.

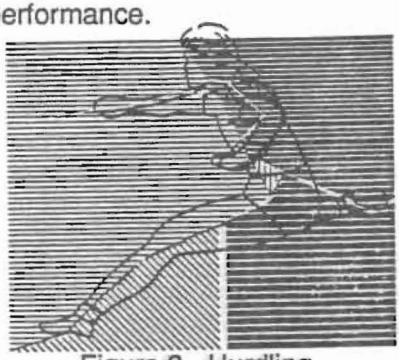

Figure 8 - Hurdling
(symbolic scheme)

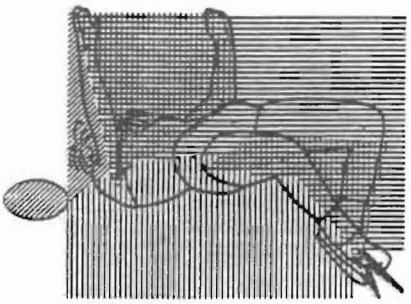

Figure 9 - High Jump
(symbolic scheme)

The value to the young athlete is in the frozen nature of segment forces, allowing for comparative judgments. Of course, the selection of pertinent, well-established visuals by the coach cannot be taken lightly, as any introduction of new material will inevitably effect the cognitive growth of the individual.

The Symbol System

The symbol scheme, as depicted by vector lines, becomes fully established as a symbol system when correlated with a 'field of reference'. We may desire to distinguish the horizontal line as the reference due to its common nature among many skills. As our combinations of symbols are developed, relationships are determined due to their correlation with the given frame of reference - 'horizontal line'. Differences in spatial relationships are,therefore, encountered. As Salomon states, " ... the understanding of the correlation between symbol systems and their field of reference is essential for the classification of symbol systems and for determining how a symbol system represents, describes, or expresses." Movement away from the frame of reference will show the action of a vertical component. The degree to which this is shown will determine the magnitude of such a component.

In essence, the symbol system will consist of the 'syntactic' component - elements of single identity - and its semantic component - the correlation of such symbols to the reference. The following symbol system, Figure 10, defines a technique used in the long jump. The field of reference is a straight line in the vertical position.
Note the change in character of each symbol as the event is undertaken. The value for such isolation of critical moments in time is a significant formulation to the budding athlete.

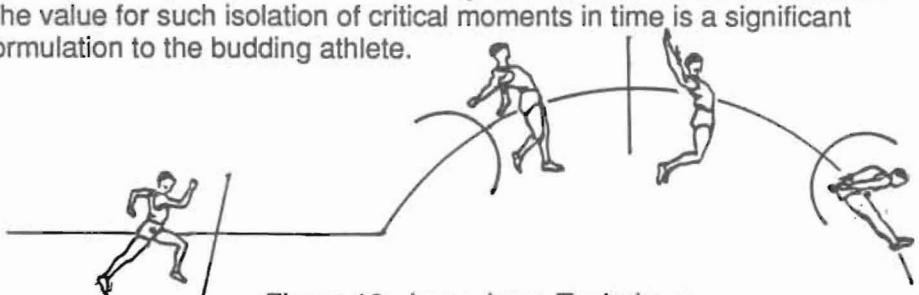

Figure 10 - Long Jump Technique
(symbol system)

It is interesting to note that systems are primarily verbal. It was recognized earlier that the verbal mode was an invaluable component in learning motor skills. To utilize the verbal mode in symbolically

representing qualities desired in movement, the long jump example is expanded using representative verbal symbols - 'punch' - 'arch' - 'stretch' - 'snap'. As a field of reference; position, force or direction, become the common ground for each symbol element. Furthermore, the verbal symbol system becomes an extension of the already developed visual symbol system and is shown in Figure 11.

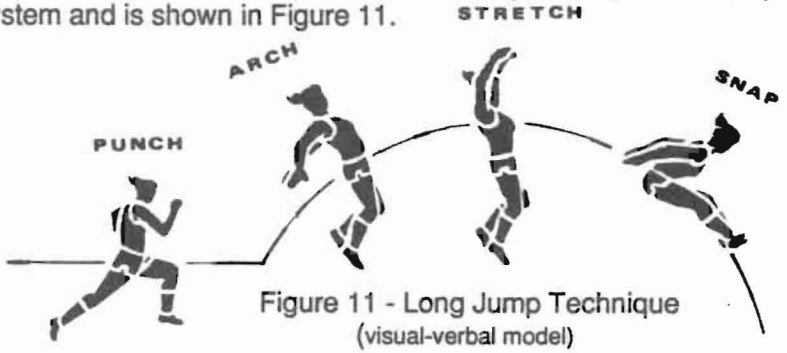

Figure 11 - Long Jump Technique
(visual-verbal model)

The use of both visual and verbal modes of representation as a strategy for instruction is most fitting to a young athlete.

CONCLUSION

Although the visuals developed in this paper are appropriate to those involved in understanding the forces which underlie human movement, instruction of young athletes will provide the unique concerns for the coach. The child sees the world in a similar yet vastly different manner; a paradox of significant meaning. To aid them toward an understanding of their own body, the attempt has been to provide a progressive and systematic rationale for using visual and verbal orientations in movement studies. The prescription for such motor development has involved the interrelationships derived from kinesiology/biomechanics and the sensory integrative processes of the individual.

To present a dualistic (visual-verbal model) approach to comprehending human movement requires an appreciation of both realms. Isolated, each mode diminishes the quality of instruction necessary for fulfilling the demands of a young athlete whose world has developed through interactions of both visual and verbal elements. As Rudolph Arnheim (1969) points out, 'the senses lose educational status', and the child is molded into the verbal world of adults and teachers who are 'generally unaware of the significance of nonverbal components of thought'. (Ferguson, 1977) The visual world - represented by elements, schemes, and systems - becomes the *alphabet for human movement*, much as words, phrases, and sentences determine our alphabet for human language.

REFERENCES

Arnheim, R. Visual Thinking, Berkely, Calif., Univ. of Calif.: 1969.

Ferguson, E.S. The Mind's Eye: Nonverbal Thought in Technology. Science, 197, N. 4306, pp. 827-836, 1977.

Goodman, N. The Languages of Art. Indianapolis: Hackett, 1968.

Goodman, N. "When Is Art?" In D. Perkins and B. Leondar (eds.), The Arts and Cognition. Baltimore: Johns Hopkins Univ. Press, 1977.

Ho, L., and J.B. Shea. Levels of Processing and the Coding of Position Cues in Motor Short-term Memory. Journal of Motor Behavior, 10, pp. 113-121, 1978.

Morgan, W.R. and G. Garrett. A Developmental Biomechanics Instructional Approach - Learning Basic Track and Field Skills (Ages 5-12). Proceedings: Second National Symposium on Teaching Kinesiology and Biomechanics in Sports, Colorado Springs, Colorado, pp. 97-104, 1984.

Salomon, G. Interaction of Media, Cognition, and Learning, Washington: Jossey-Bass Publishers, 1981.

Singer, R.N. Motor Learning and Human Performance, New York, N.Y.: Macmillan Publishing Co., Inc., 1980.