THE EFFECT OF COGNITIVE FACTORS TO HUMAN MOVEMENT

by

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Introduction

It hardly has to be proved in this forum that dance notation is a multipurpose and invaluably useful tool in both dance education and dance research. Therefore I am always deeply astonished when I face the negative attitudes of my colleagues at the Hungarian Dance Academy – especially that of the ballet masters – that notation is not needed, it is difficult, circumstantial, superfluous and only engrosses time from practice. It is regarded rather a tolerated subject than a base of dance education. And in spite of the fact that Labanotation is used in Hungary mainly in the field of traditional dance, even the bulk of the folk dance teacher colleagues agrees that the experiments of my advanced students introducing dance notation in the primary school dance curriculum is a total absurdity, what's more, it is more harmful than useful.

This vehement opposition and my contradictory conviction inspired me to make my Ph.D. thesis in the field of education sciences researching certain aspects of efficiency of Labanotation in dance education and as a conclusion to risk a proposal for a change of education paradigm. The change would shift the stress of dance education from the present mainly imitative teaching to a more conscious, a more interpretive one.

An inherent feature – and also a great difficulty – of Labanotation stemming from its symbolic character is the very detailed analysis of movement. Analysis however is a cognitive process, that is at reconstruction conscious cortical mental activities send coordination commands to the limbic system and to the spinal cord which are responsible for the great muscle movements. In the thesis the effect of dance notation to movement cognitivity is planned to be investigated in the frame of an experiment.

It is apparent for the first sight even for those who are only marginally versed in the subject, that there is a serious gap in the referential literature. That is why as a start I turned to a young branch of science, to the cognitive psychology of human movement. In the present lecture I would like to present in short the result of my research and the possible consequences from the point of dance notation.

The consciousness of human movement

Adams[1] in his study about the cognitive factors of motor performance refers to a hypothesis of last century researcher William James[2] according to which „habit diminishes the conscious attention with which our acts are performed". These „acts" were discrete motor sequences with a number of steps and James said that each step had its „sensation".

> „... each of these sensations becomes the object of a separate perception of the mind. By it we test each movement, to see if it be right before advancing to the next. We hesitate, compare, choose, revoke, reject, etc., by intellectual means; and the order by which the next movement is discharged is an express order from the ideational centers after this deliberation has been gone through."[3]

James stated that *when the movement sequence is in the early stages of learning there is a strong cognitive influence*. But late in the practice, when the action is „habitual", „the only impulse which the centers of the idea or perception need send down is the initial impulse, the command to start." The explanation of serial action late in the practice was the response chaining hypothesis, where the response-produced feedback from one segment of the movement was the stimulus for the next. James emphasized proprioception as the source of feedback that regulated movement, although he acknowledged that other sources of feedback, like vision and audition, might play a role as well. Once started, the well-integrated motor chain, held together by response-produced feedback stimuli „... are all supposed to have their seat below the ideational lines"[4]. When the sequence is finished, the end result will be consciously appraised, as the start received conscious attention, but otherwise it is run off without conscious awareness or invention; the movement is automatic, as is common to say.

Adams[5] pointed out that a diverse set of psychologists have endorsed a version of the hypothesis in recent times: cognitive psychologists, behaviorist, developmental psychologists, motor learning theorists and differential psychologists.

The schema theory of human movement

The presently most widespread cognitive psychological approach to human movement is Schmidt's schema theory. In 1975 Schmidt[6] proposed that a fundamental aspect of the learning of motor skills involved the acquisition of schemata that define the relationships among the information involved in the production and evaluation of motor responses. As Shapiro and Schmidt[7] summarizes, the schema theory has three major components: the *generalized motor program*, the *recall schema* and the *recognition schema*.

The generalized motor program is an abstract memory structure that causes movement to occur. It can be executed in several ways to yield various movement outcomes. To attain the various outcomes certain parameters of the program must be determined (e.g. speed or force). Thus a generalized motor program can be thought of as a program that governs a given class of movements that requires a common movement pattern.

The idea of the generalized motor program emerged from the observation that movements which were slightly different from each other in some way seemed to be identical in certain other ways. Armstrong[8] found that when a movement sequence was speeded up accidentally, the entire movement sequence was speeded up as a unit, that is 'relative timing' or *phasing* as it is usually called, appeared to remain constant in the faces of overall movement time. It led to discovering another invariant feature of the generalized motor program, the *relative force*, or the relations among the forces called up in the muscles participating in the action.

In order to achieve a desired outcome, an independent memory state, the recall schema selects the parameters required to execute the generalized motor program properly. And at last, another independent memory state, the recognition schema is responsible for the response evaluation. The recognition schema is composed of initial conditions, past actual outcomes and past sensory consequences.

Movement skill influenced by cognitive factors

Now let's return to James' statement that cognitive factors provide prominent guidance in the early stages of movement training which diminishes in functional guidance with practice. As Adams[9] states research has established verbal factors as a cognitive determinant of motor sequences, but cognition in a movement task could have a nonverbal side as well, and imagery is the candidate for it. Engelkamp[10] thinks that images of an action can be formed in two different ways: it can be imagined how somebody else performs the action and an image of action by the performer himself exists. The latter is called by Engelkamp *motor imagery*.

Wisberg and Ragsdale[11] refer to the experiments carried out by Adams[12] and Fitts[13] whose papers expound the importance of cognitive processes early in the practice of motor skills. This initial stage is called by Adams „verbal-motor stage" and by Fitts „cognitive stage". After considerable experience with the tasks both authors characterize movement performance as being practically automatic.

Later Adams[14] proved that *in certain circumstances the effect of cognitive factors do not become nonfunctional with practice*. He came to the conclusion that cognitive factors might be used in an effort to improve performance so long as the performer made error. A

similar result was achieved by Russian researcher Sljobumov[15] who stated that the information on the result of a motor task has an importance only in the early learning state while in the stage of perfection the mental activity makes the needed correction of the performance.

Many researchers made experiments with the effects of mental practice on movement skills. Sacket[16] reasoned that *mental practice primarily served to establish the cognitive aspects of a task*. Jones[17] demonstrated that *movement learning can occur through mental practice without prior experience of the task if guidance was used*. According to Minas[18] guided mental practice given before the actual experience of a movement task improves performance. She stated that the success of mental practice supported the idea that *movement information was represented in the form of cognitive entities* and these entities can be manipulated by purely psychological means. From our point one of the most important findings is her statement *that such facilitation can be manifest in the quality of the movement as well*.

The metacognitive aspects of movement

Newell and Barclay[19] investigated primarily the metacognitive aspects of human movement. They define movement metacognition as a person's awareness of the association between movement and its consequences. They think that an awareness of one's own actions involves two major types of knowledge: sensitivity to the situations requiring skilled actions and knowledge of factors which affect the outcome of the action. Sensitivity involves two related elements: a knowledge how the characteristics of the movement task must be manipulated to meet the identified goal, and the person's awareness of the context in which the task is presented. The second major category of movement metacognition is the person's knowledge of the factors affecting movement performance which includes three related elements: the person's knowledge about his enduring physical structures, the ongoing action and the strategy, the person's approach to problem-solving.

Dance notation as cognitive mean influencing dance education

The cognitive psychological theories introduced above pointed out that verbalization has an important role at the beginning of learning movement tasks. Dance notation from cognitive point of view can be regarded as a mean of verbalization, or as Rudolf Laban stated it can even go beyond the limits of verbalization. But at the same time dance notations is a movement imagination tool as well because it is expedient to evoke the image of movement in the reader. The positive effect of movement imagination during movement acquisition was emphasized by the above introduced theories as well.

I feel especially important Minas' statement about mental practice according which not only the sequence of learning but also the quality of movement was improved. This way a separate, independent scientific branch, the cognitive psychology of movement proved that a wider introduction of dance notation into dance education can be a valid step to enhance the effectiveness of dance training. It may be regarded the first theoretical argument to a change of paradigm in dance education.

NOTES

[1] Adams 1981, 262

[2] James 1890, 114

[3] l.c., 116

[4] l.c., 117

[5] Adams 1981, 263

[6] Schmidt 1975

[7] Shapiro and Schmidt 1982, 115

[8] Armstrong 1970

[9] Adams 1981, 264 refers to Cantor 1965, Gross 1955, and McAllister 1953.

[10] Engelkamp 1991, 208

[11] Wisberg and Ragsdale 1979, 207

[12] Adams 1971

[13]Fitts 1962

[14] Adams 1981

[15] Sljobumov 1978

[16] Sacket 1934

[17] Jones 1965

[18] Minas 1980

[19] Newell and Barclay 1982

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