Movement Cognition and Dance Notation

János FÜGEDI

Institute for Musicology of the Hungarian Academy of Sciences
Budapest

Abstract: It can be stated that dance notation was proved to be an established tool for dance research and dance education in understanding and analyzing movement. This theorem is especially valid in cases where, the structure of dance is amorphous, the units of movement sequences differ from that of the accompanying music, the tempo of the dance is high. Dance notation is used rather isolated in the field of traditional dance in Hungary, mainly in dance research. In the light of the research introduced above it is highly recommended to introduce dance notation in research, education, aesthetics and criticism in the other genres of dance.

Keywords: dance notation, education, movement cognition

Introduction

The vast majority of our movements is acquired by learning, especially great effort is spent on movement skills such as dancing – still these movements are performed without consciousness. Because of this automated unconsciousness one meets great difficulties in verbally formulating the characters, structure, the manner of exact performance of movements, that is including them in cognitive process. In spite of the fact that consciousness is a base of both science and education dealing with movement, unfortunately a conceptual frame is generally missing even from the expert thinking which would be able to define movement adequately on the level of consciousness. The intention of this study is to prove that in case of dance this deficiency can be helped by the means of dance notation and its supporting movement analytical tools.

The dance notation which the central feature of the present investigation is a young science, hardly looking back a hundred years of past. The dancer's movement is identified by symbols, in an abstract way in this system. Because of its abstract nature and its resemblance of a language its use is not so general in the dance world (among teachers, researchers and artists) such as the notation in music. Our experience is that many dance experts regard dance nota-

Studia Musicologica Academiae Scientiarum Hungaricae 44/3–4, 2003, pp. 393–410
0039-3266/2003/$ 20.00

tion with reservations, especially because of its complicated syntax and its strict – conceptualizing movement at conscious level. The consequences are expected to prove that movement consciousness is the main advantage of a dance notation by which cognitive procedure can be performed on dance.

To prove the importance of movement consciousness, great attention is paid to the theories and experimental results in cognitive psychology, and that of motor learning are surveyed as well. After sketching the movement cognitive background the notion, history and forms of application of dance notation are shortly introduced. It is followed by the discussion of an experiment and the analysis of results.

Human movement as a procedural knowledge

One of the most basic and frequently used human skills, the motor or psychomotor skill is regarded by Gardner (1983) a significant form of human intelligence. The cognitive psychology divides knowledge to procedural and declarative types (Anderson 1980). Annett (1996) thinks that the motor skill is a typical procedural knowledge, which Ferrari (1996) believes to be acquired by imitative-observational ways. The procedural knowledge is usually out of the domain of the consciousness, verbally cannot be expressed or with great difficulties while the declarative knowledge behaves quite the contrary: verbally can be expressed easily and is the field of consciousness.

In connection with movement performance under the line of consciousness 19th century researcher William James (1890) stated that "habit diminishes the conscious attention" with which the discreet motor sequences are performed. James called attention that when the sequence is in the early stages of learning there is a strong cognitive influence. But late in the practice, when the action becomes "habitual", once started, the well-integrated motor chain is run off without conscious awareness or intervention; the movement is automatic, as is common to say.[1]

The most widespread cognitive psychological approach to human movement is Schmidt's (1975) schema theory. Schmidt (1975) 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. 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

[1] A diverse set of psychologists have endorsed a version of the hypothesis in recent times: cognitive psychologists (Miller, Galanter and Pribam 1960), behaviorist (Kimble and Perlmuter 1970), developmental psychologists (McCabe 1979), differential psychologists (Fleishman and Hempel 1955), and motor learning theorists (Adams 1971; Fitts and Posner 1967; Schmidt 1975).

structure that causes movement to occur. It can be thought of as a program that governs a given class of movements requiring a common movement pattern. In order to achieve a desired outcome, an independent memory state, the recall schema selects the parameters for executing the generalized motor program properly. And at last, another independent memory state, the recognition schema is responsible for the response evaluation.

Movement cognition and the conscious knowledge about human movement

Research on knowledge representation stated that the knowledge structure (such as plans, descriptions, definitions, schemas, prototypes) represent generic conceptions in different levels of abstraction.[2] Applying the theories of knowledge representation stemming from the fields of cognitive sciences to motor skill, many researchers (Bandura 1969; Adams 1971; Schmidt 1975; Newell and Barclay 1982) came to the conclusion that memory stores the information on movement in terms of generic concepts as well. According to the experiments of Georgieff and Jeannerod (1998) the information on acts may have a double coding system in mind because the movement consciousness is independent from the information on movement control.

Motor skill and metacognition. The experimental investigation of knowledge on knowledge allowed a further insight into the character of consciousness. Koriat (2000) stated that metacognitive processes were integrated parts of the work controlled by mind. He made difference between two metacognitive components: the observations and control. The subjective observation of knowledge, the knowledge on knowledge seems to be a determinant part of consciousness, because it indicates not only our knowledge but also our being aware of this knowledge. Control is connected firmly to the idea of consciousness. Posner and Snyder (1975) contrasted the controlled processes with the automated ones in a conceptional structure as a sign of conscious action. Flavell (1981) placed the motor metacognitive experience in an affective dimension which returns a conscious inner feedback on the execution and effectiveness of an action therefore influencing its result positively or negatively.

Motor learning and cognition

In connection with the acquisition of motor skill Fitts (1964) established three determinant phases. The first is the cognitive phase, during which the subject

[2] Knoweldge representation was defined by Miller, Galanter and Pribam (1960) as plans, by Schank and Abelson (1977) as descriptions, by Norman et al. (1975) as definitions, by Rumelhart and Ortony (1977) as schemas, by Rosche (1975) as prototypes.

learns the basic skills and verbal aid is often used. The second is the associative phase, which represents a transition between the verbally conscious phase into the more automated one. Here the components supporting the successful performance are stored and the ones with failure are rejected. In the third, the autonomic or automated phase, consciousness plays a very minor role, the movement is performed fast and attention can be directed to other tasks during performance. Adams (1971) also pointed out the importance of the cognitive processes in the early practice of motor skills. He evaluated his results that the motor performance becomes automated after a fixation achieved by multiply practice, therefore cognitive factors need little attention. Adams (1971) called the beginning phase of movement performance verbal–motor phase, and the fixated section motor phase.

Following Fitts' and Adams' theories a number of motor researchers came to the conclusion that the introductory part of motor skill acquisition contains cognitive structures such as cognitive maps, plans, models, patterns. The learning of new motor patterns include the building on the old structures. The elements of a task can be understood and organized on the base of the cognitive declaration (Kleinman 1983), and selecting the proper motor program and its parameters. As a summary of the above theories Carroll and Bandura (1987) stated that the motor information can be gained by the selective perception of critical characteristics, and by the symbolic coding and cognitive attempts to be transformed into cognitive representations of motor tasks. *The movement is controlled by cognitive representation*. Beyond the attention and memory processes which defines the acquisition of cognitive representation, a conception-comparison governs the transformation of representation into acts. The reproduction of a modeled action patter is helped by the observation simultaneous with performance, but only then, when the adequate representation of action patter has already been formed. After the exact cognitive representation a demonstrated movement sequence can be reproduced from memory just as exactly as if it was presented simultaneous with the performed action.

Cognitive determinants of motor skill

Piaget (1974) stated that if movement is intended to be made conscious, a new conceptual knowledge must be created about the executed movement. A form of conceptualization can be the *verbalization*. The importance of verbalization as the cognitive determinant of discrete motor sequences a number of other researchers stressed also, because the individual striving to understand the movement can get to the independent formulation of idea on movement (Cantor 1965; Goss 1955; McAllister 1953; Sage 1984). But the cognition of a motor task can have a non-verbal aspect, and *imagery* is the candidate for it (Paivio 1971; Piaget 1974; Engelkamp 1991).

Minas (1980) separated the continuous or interactive motor skills into two main components: the first is the sequence of the movements, the second is the nature of that. The mental practice – the imagery of large muscle movements without actual performance (Minas 1978) – can influence both mentioned aspects of the skill.[3] On the measured bases of the effect of mental practice Minas (1980) declared that the mental practitioners could achieve a better result in the acquisition of motor tasks compared to a control group, because only they had the possibility to structure and organize their action plan prior performance.

Minas (1980) believes that the success of mental practice validated by experiments supports the notion that the movement information is represented in high level cognitive units. These units can be manipulated by clear psychological processes, and not necessarily include the simultaneous performance of motor task. Beyond this fact the mental practice supported the formulation of new motor schema with the selection and planning of old movement experience as well as *this support was manifested in the quality of the movement* too.

Dance education and movement consciousness

The overall applied method of dance education is the imitation – as Beck (1988) put it the "movement-mimicri" – a generally accepted way of teaching dance based on the authority of history. The traditionally imitative way of dance education was criticized by Locke (1970). Since during education the teacher requires imitation and on correcting the mistakes s/he does not give the possibility to the student to follow the origination of correction, the student becomes dependent from the teacher's movement patterns. The process can be called rather taming – says Locke – and it could be called education only if the student gets a creative insight into the structure of the movement.

Many authors stress the importance of movement observation and analysis in the territory of movement education. Sweeney (1970) thinks that if the student can conceptualize and verbalize the movement, s/he also understands it. By the means of understanding the acquisition of the movement needs less rehearsal and the movement stays in memory for a longer time. Therefore Sweeney regards the understanding and the ability of analysis among advantages of the mental rehearsals. Hannah (1999) believes that the knowledge on how the parts of the body can move in the threefold unity of space–time–force and how

3 Sackett (1934) argues that mental practice is primarily for determining the symbolic or cognitive aspect of a movement task.

the meaning is embodied through style or content can shape the learning and understanding of different dances.

The advantage of conceptualization was pointed out by Foley (1991) in comparing the performance of simple and complex movement tasks by dancers and non dancers. The dancers were able to code the unknown movement sequences not only in movement but also verbally, therefore they achieved significantly better results in the memory tests compared to non dancers, who could call up the dance only in movement.

Certain representatives of dance education have already paid attention to the great advantages of movement consciousness dance teaching. Dimondstein (1971) regards an important part of the school dance education programs the development of kinesthetic consciousness. Acquiring the kinesthetic consciousness the learner can achieve a consciousness beyond the pure performance of the movement, that how and why the movement is formulated. The connection between body and possibility of expression can be understood only this way. A goal of Tillotson (1967) was to increase the students' movement consciousness and understanding, so she included in the main areas of her education program the development of consciousness on spatial and bodily movement possibility.

Moomaw (1967) believed that the dance notation education greatly increases the children's ability of understanding and analyzing movement. In her view dance notation improves the teaching and peforming ability, the structure and parts of a notated choreography can be analyzed, and the flow, dynamics of the individual movement units can be studied. Beck et al. (1987a, 1987b) made dance notation playing a central role in their textbook on dance for young ballet students in favour of replacing the already mentioned movement–mimicri with integrated body–mind approach. Moses (1990) and Warburton (2000) examined in experimental conditions the validity of their hypothesis, whether students learn a notation system, they get better results in recognizing and performing movement. According their results the application of dance notation really helps the child's movement cognitive–symbolic development and the understanding dance.

Dance notation

Dance notation is the literature of dance, a symbol system for notating dance, just as in music the musical score. During the history of dance in Europe the notation of dance[4] appeared first in the 15th century, and in this age it belonged

[4] The earliest forms of dance notation in the European tradition date back to the late Middle Ages, the Renaissance. The development and announcement of different dance notation systems last until these days. (Hutchinson 1984; Fügedi 1993).

to the court culture of higher classes. From the point of dance literature two outstanding period must be mentioned: the 18th and the 20th century. The 18th century Feuillet–Beauchamp system[5] (Feuillet 1700) was in use for about 150 years. In the 20th century the symbolic notation system of the Hungarian origin Rudolf Laban[6] spread all over the world under the name of Labanotation or Kinetography Laban.[7] Beck (1988) states that Labanotation now influences the dancer's training, the dance history research, dance criticism, dance analysis, the creative process of choreography making and dance education. Further on under the title "dance notation" Labanotation is understood.[8]

The kinetographic notation of dance is not only a set of graphic symbols corresponding to movement phenomena, but a system of movement analytical theories and rules taking into account the syntax and meaning of dance.[9] Following Hutchinson (1977, 1983) it could be regarded the written language of dance.

A verbalization-like tool of movement, but for its perspicuity and integrated movement information character Laban (1956) takes the system far more effective than verbal description. While investigating the theories of artistic symbolism Goodman (1976) thinks Labanotation an impressive scheme of analysis and description which refutes the common belief that continuous complex motion is too recalcitrant a subject matter for notational articulation.

In the view of Briston (1991) dance notation lifts the art of dance out of the illiterate age; beyond preserving dance it makes possible studying in depth, helps emerging the real dance history and dance tradition, because all these cannot exist today without notation archives containing large amount of notated material.[10]

5 For the education of this system only indirect data could be found but the system was a part of the culture in the royal courts (Hutchinson 1984). It is a question why its use was abandoned. Some researchers reason that the system could not follow the development of dance technique, others believe that dance culture got into the hands of tradesman where literature and reading stood out of interest (Horwitz 1988).

6 Rudolf Laban was a determinant personality of the 20th century modern dance (Laban 1975; Maletic 1987; Hodgson and Preston-Dunlop 1990).

7 Hutchinson 1977; Knust 1979; Szentpál (no year/a).

8 Dance notation describes the spatial three dimensionality, the time and dynamic values of dance. All these factors must be determined for the whole body and for all the independently moveable body parts. An important part of the system is also the indication of relations to objects, partners, groups, and other imaginative shapes such as the circular paths, etc. With a musical comparison the notation of one person's movement resembles rather a score of an orchestra than a single instrument.

9 On the development and application of the system a large number of study have been published. For a full list of sources see Warner (1984, 1988, 1995).

10 The most significant dance archives are: the Conservatoire de Paris; the Dance Notation Bureau in New York; the Institute for Musicology of the Hungarian Academy of Sciences in Budapest, Hungary; the Language of Dance Centre in London; the National Resource Centre for Dance in Guilford, UK; the Ohio State University in Columbus, USA; the Folkwang Hochschule in Essen, Germany.

The hypothesis of research

From the point of the present investigation the cognitive psychology showed important results. The theories proved that in spite of the fact that the movement becomes automated while learnt, its performance is controlled by cognitive schemas. The observation and conscious control of movement is the domain of metacognition. Our knowledge on movement is procedural; to make this knowledge conscious the knowledge must be transformed into the category of declaration. It is believed here that in case of dance the procedural knowledge can be effectively transformed into a declarative one by the means of dance notation. Since dance notation is a symbolic and an analytic system, it naturally provides the high level cognitive units of movement information, the classes of conceptualization beyond even verbalization, and it also demands the use of movement imagery and mental practice of movement. The knowledge on movement becomes conscious in structured categories, therefore the reconstructor acts in the higher sphere of movement metacognition.

Our research hypothesis is, that on reconstructing dance from notation the result is more authentic than imitative reconstruction because the reconstructor
– gets independent from the space and time difficulties during the identification of the movement sample
– is disengaged from the effects of movement stereotypes, the danger of changing the pattern to imitate with expected cognitive patterns already learnt
– recognizes the coherent units of movement and gets free from the influence possibly differently structured music accompanying dance
– recognizes and gets deeper in understanding the structure of movement sequences and gets deeper in understanding.

The description of the experiment – comparing dance reconstruction from Labanotation and from video

In the experiment the interpretive performance of an 18 member Notation Group (NG) from Labanotation and an imitative performance of the same dance material from video by an 18 member Video Group (VG) was compared. The task for both groups was to reconstruct 11 authentic movement sequence[11] – motives or motive sequence – and in the case of a motive sequence to state its structure.[12] The Notation Group got the movement sequences in notation and could not see the original performance. The Video Group could

[11] The movement sequences were selected from the Folk Dance Archive of the Institute for Musicology of the Hungarian Academy of Sciences.

[12] On the structure of folk dance and the idea of dance motive see: Martin – Pesovár 1960; Szentpál 1961; Martin 1964.

watch the same on video but were not helped by any cognitive means, therefore they could learn the dances purely by imitating them. The original, 1–8 measures long movement sequences were performed by male dancers.

Both groups consisted of 18 persons, between age of 20 and 40, six professionals and twelve amateur dancers.[13] NG members were trained in Labanotation for two or three years (at corresponding courses), and all graduated at the Hungarian Dance Academy as dance teachers. VG members were selected not being educated in the analytical approach of Labanotation, or at very low level, not being able to use it in the case of the introduced tasks requiring high level analytical capabilities. The movement sequences (MS) were deemed to reflect the most important and generally known movement features of Central European folk dances.[14] From the point of the threefold space–time–force unity of movement, the reconstruction were judged by the following general movement genres.[15]

Space	direction, level, movement category, distribution of weight and partial weight, contact, rotation
Time	rhythm, relation to the main beat of the music

The MS were ordered in an increasing difficulty of technique, rhythm, structure and tempo from Nos. 1–11, the task defining the structure was identified as No. 12. There was no time limit for reconstruction, members of both groups could spend as much time as they needed to achieve a result satisfying for themselves. All solutions were recorded on video on the bases of which the evaluation was carried out. All movement sequences were evaluated according to different sets of criteria suiting their movement characters the best ways and selected from the points given above. The right solution was given a value 1, a wrong solution value 0. Samples for the movement criteria and for the evaluations can be seen in *Figures 1–4.*

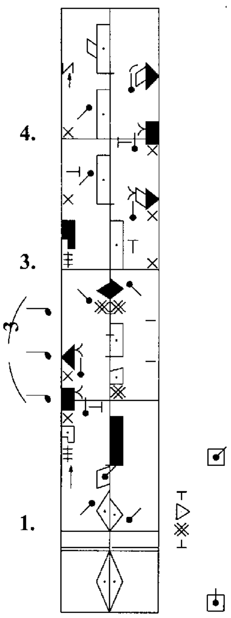
The results of reconstruction

Investigating the space–time appropriateness of reconstruction it could be stated that the Notation Group achieved a significantly better result compared to that of Video Group. A summarized general movement appropriateness

13 All participants started dancing before age 10, therefore even the amateurs could be regarded qualified performers. This education is believed important from the point required movement understanding.

14 Szentpál (no year/b); Fügedi 1997.

15 From the point of the threefold space–time–force unity of movement the force category has not been thoroughly investigated in folk dance yet. During the experiment only one genre, the “bouncing spring” was taken into consideration as a criteria – see Szentpál no year/b.



Notation Group					
	3.1	3.2	3.3	3.4	3.5
1.	0	1	1	1	A
2.	1	1	1	1	A
3.	1	1	1	1	A
4.	1	0	1	1	A
5.	1	1	1	1	A
6.	1	1	1	1	A
7.	1	1	1	1	A
8.	1	1	1	1	B
9.	1	1	1	1	A
10.	1	1	1	1	B
11.	1	1	1	1	B
12.	1	1	1	1	C
13.	1	1	1	1	A
14.	1	1	1	1	B
15.	1	1	1	1	A
16.	1	1	1	1	B
17.	1	1	1	1	B
18.	1	1	1	1	C

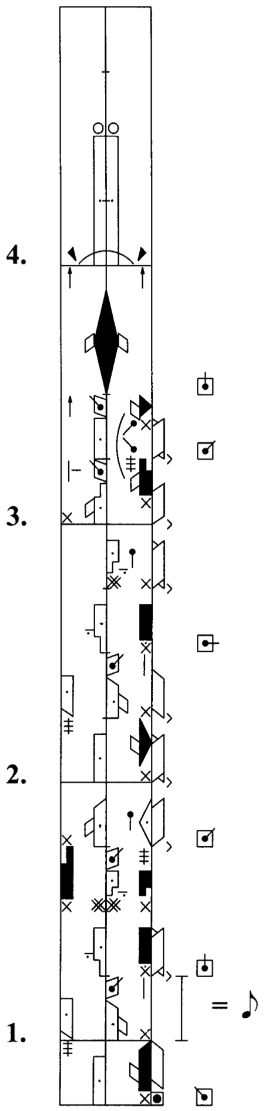
Video Group					
	3.1	3.2	3.3	3.5	3.5
19.	0	0	1	0	A
20.	0	0	1	0	B
21.	0	0	0	1	A
22.	0	1	1	1	A
23.	0	0	1	1	A
24.	0	0	0	0	A
25.	0	0	1	0	B
26.	0	0	0	0	A
27.	0	0	1	0	B
28.	0	0	0	0	B
29.	0	0	0	0	B
30.	0	0	0	0	A
31.	0	0	0	0	B
32.	0	0	1	0	A
33.	0	0	0	0	D
34.	0	1	1	0	A
35.	0	0	1	0	A
36.	0	0	0	0	B

3.1	Measure 2: performing the triplet
3.2	Measure 3, beat 2: touching gesture
3.3	Measure 4, beat 1: direction and rotation of leg gesture
3.4	Measure 4, beat 2: direction and rotation of leg gesture

Figure 1: Movement sequence 3

showed a 90.45 % result in the case of NG while VG achieved 35.81 % good solutions.

Applying dance notation showed an even more outstanding advantage in case of certain tasks. Such tasks were as 3, 10 and 11. Task No. 3 illustrated in *Figure 1* deviates from a stereotypic performance in its amorphous structure and the appearance of a triplet in the second measure. The right reconstruction solution could be witnessed in NG = 96% versus VG = 22% proportion. In the case of task No. 10 (*Figure 2*) the shift of the movement sequence unit compared to the musical main beat (as a result of the uneven, 5/8 inner structure of the



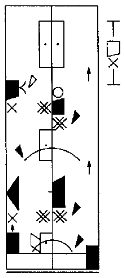
Notation Group			
	10.1	10.2	10.3
1.	1	1	A
2.	1	1	A
3.	1	1	A
4.	1	1	A
5.	1	1	A
6.	1	1	B
7.	1	1	A
8.	1	1	A
9.	1	1	A
10.	1	1	B
11.	1	1	A
12.	1	1	C
13.	1	1	B
14.	1	1	B
15.	1	1	A
16.	1	1	B
17.	1	1	B
18.	1	1	C

Video Group			
	10.1	10.2	10.3
19.	0	1	A
20.	1	1	A
21.	0	0	C
22.	0	1	A
23.	0	0	C
24.	1	0	A
25.	1	0	A
26.	1	1	A
27.	0	0	D
28.	0	0	C
29.	1	0	A
30.	1	0	A
31.	0	0	A
32.	0	1	A
33.	0	0	C
34.	1	1	A
35.	0	0	C
36.	0	0	C

10.1	Recognizing the uneven, 5/8 motive structure
10.2	Performing the shift in relation to the music

Figure 2: Movement sequence 10

motive) caused difficulty. Reconstruction resulted NG = 100% versus VG = 36%, where the 100% solution by the NG is really remarkable. In the case of the most difficult task of the experiment, task 11, the very high tempo (♩= cca. 200) caused a special reconstruction difficulty for the VG both in spatial and temporal perception, while the NG had no difficulties in this respect, since the



11.1	**Recognizing the rhythm**
11.2	**The accuracy of movement 1**
⋮	
11.7	**The accuracy of movement 6**
11.8	**Performance in the original tempo**

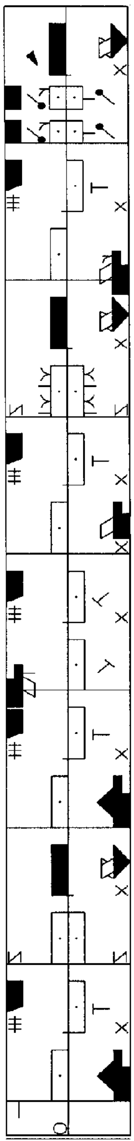
Notation Group									
	1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	1	1	1	1	1	1	1	0	B
2.	1	1	1	1	1	1	1	1	A
3.	1	1	1	1	1	1	1	1	A
4.	1	0	1	1	1	1	1	1	A
5.	1	1	1	1	1	1	1	1	B
6.	1	1	1	1	1	1	1	1	A
7.	1	1	1	1	1	1	1	1	A
8.	1	1	1	1	1	1	1	0	B
9.	1	1	1	1	1	1	1	1	B
10.	1	1	1	1	1	1	1	1	B
11.	1	1	1	1	1	1	1	0	B
12.	1	1	1	1	1	1	1	0	C
13.	1	1	1	1	1	1	1	0	B
14.	1	1	1	1	1	1	1	0	B
15.	1	1	1	1	1	1	1	0	B
16.	1	1	1	1	1	1	1	0	B
17.	1	1	1	1	1	1	1	0	B
18.	1	1	1	1	1	1	1	0	C

Video Group									
	1.	2.	3.	4.	5.	6.	7.	8.	9.
19.	1	0	0	0	0	0	0	1	A
20.	1	0	0	0	0	0	0	1	A
21.	1	0	0	0	0	0	1	1	A
22.	1	0	1	0	0	0	0	1	A
23.	1	1	1	1	1	1	1	1	A
24.	0	0	0	0	0	0	0	1	A
25.	1	1	1	1	1	1	1	0	A
26.	1	0	0	0	0	0	1	1	C
27.	0	0	0	0	0	0	1	0	C
28.	0	0	0	0	0	0	1	0	C
29.	1	0	0	0	0	0	0	0	C
30.	1	1	1	0	0	0	1	0	A
31.	0	0	0	0	0	0	0	0	A
32.	1	0	1	0	1	0	1	0	A
33.	1	0	1	0	1	1	1	0	C
34.	0	0	0	0	0	0	0	0	C
35.	1	1	1	1	0	0	0	0	C
36.	1	0	1	0	1	1	1	0	C

Figure 3: Movement sequence 11

static notation provided a comfortable understanding. Though performing the motive in the original tempo was a problem especially for the amateur woman dancers. Aside from the difficulties caused by the high tempo the reconstruction comparison of the two groups showed NG = 99% versus VG = 30% results. Taking the temporal aspect into account as well, the result came nearer to the general, NG = 92 % versus VG = 33% could be noted.[16]

[16] Even the temporal aspect would be much better in the case of NG if enough time was used for practice.



Notation Group		
	12.1	12.2
1.	0	1
2.	0	1
3.	0	1
4.	0	1
5.	0	1
6.	0	1
7.	0	1
8.	0	1
9.	0	1
10.	1	0
11.	1	1
12.	0	1
13.	0	1
14.	0	1
15.	0	1
16.	1	1
17.	0	1
18.	1	1

Video Group		
	12.1	12.2
19.	0	0
20.	0	0
21.	1	0
22.	1	0
23.	1	0
24.	1	0
25.	1	0
26.	1	0
27.	1	0
28.	1	0
29.	1	0
30.	1	0
31.	1	0
32.	1	0
33.	1	0
34.	1	0
35.	1	0
36.	1	0

12.1	**Structure stated by two measures (based on music)**
12.2	**Structure stated by one measure (based on notation)**

Figure 4: Movement sequence 12

Significant differences could be experienced also in the case of task No. 12, where the structure of a short, 8 measure long movement sequence had to be defined – see Fig. 4. The NG could go deeper to one measure level in establishing the structure in a pure cognitive way. Many from the VG could analyze the sequence only after learning it. All of them identified two measure units, which corresponded primarily with the phrases of the accompanying music.

Discussion and conclusion

The results of the experiment represent a very sharp distinction between the performance of the two groups. The approximately three times better reconstruction of NG confirms very convincingly the validity of cognitive structures in research and education of movement. They point out also that the movement cognition can be developed and an outstanding tool for this development is the dance notation. Therefore *the experiment proved the hypothesis*.

The reason for the significantly better result of the NG was, that dance notation, discovering the structure, the spatial and temporal relations of the movement material, provided the information on movement structures and conceptions represented in cognitive units, this way the reconstructor became independent from the difficulties of identifying the movement patter in space and time. Members of the NG escaped the burden of memorizing and creating cognitive patters of the required movement sequences, only transforming the already memory-stored, and notationally evoked movement primitives into real movements (remember the double coding system described by Georgieff and Jeannerod 1998). Dance notation represented an especially great advantage in case of high tempo.

From the point movement research the result, that NG solved all the tasks significantly better, which required the recognition of structure, seems essential. The NG was also able to discover deeper structural correspondence in the case of the non-reconstructural task than the VG, whose members identified the structural unit by the music and not by the inner sequences of the dance itself.[17]

As a summary it can be stated that dance notation was proved to be an established tool for dance research and dance education in understanding and analyzing movement. This theorem is especially valid in cases where
– the structure of dance is amorphous
– the units of movement sequences differ from that of the accompanying music
– the tempo of the dance is high.

[17] This phenomenon needs further investigation, and may indicate that the musical ordonnance in mind is stronger than that of the visual impressions.

Dance notation is used rather isolated in the field of traditional dance in Hungary, mainly in dance research. In the light of the research introduced above it is highly recommended to introduce dance notation in research, education, aesthetics and criticism in the other genres of dance (such as ballet, modern and social dance).

References

ADAMS, J. A. (1971): A closed-loop theory of motor learning. *Journal of Motor Behavior*, 3, 111–149.

ADAMS, J. A. (1981): Do Cognitive Factors in Motor Performance Become Nonfunctional with Practice? *Journal of Motor Behavior*, 13, 262–273.

ANDERSON, J. R. (1980): *Cognitive Psychology and its Implications*. New York: W. H. Freeman

ANNETT, John (1996): On knowing how to do things: a theory of motor imagery. *Cognitive Brain Research*, 3, 65–69.

BANDURA, A. (1969): *Principles of Behavior Modification*. New York: Holt, Rinehart & Winston.

BECK, Jill with LYNN, Enid & FLEMING, Diane (1987a): *My First Ballet Workbook*. Parts I–II. Hartford: School of the Hartford Ballet.

BECK, Jill with LYNN, Enid & FLEMING, Diane (1987b): *My Second Ballet Workbook.* Parts I–II. Hartford: School of the Hartford Ballet.

BECK, Jill (1988): Labanotation: Implication for the Future of Dance. *Choreography and Dance* Vol. 1, 69–91.

BRISTON, Peter (1991): *Dance as Education: Towards a National Dance Culture*. New York: The Falmer Press.

CANTOR, J. H. (1965): Transfer of stimulus pretraining to motor paired-associate and discrimination learning tasks. In: L. P. Lipsitt & C. C. Spiker (Eds.) *Advances in Child Development and Behavior* (Vol. 2). New York: Academic Press.

CARROLL, W. A. & BANDURA, A. (1987): Translating Cognition Into Action: The Role of Visual Guidance in Observational Learning. *Journal of Motor Behavior*, 19, 385–398.

DIMONDSTEIN, Geraldine (1971): *Children Dance in the Classroom*. New York: Macmillan Publishing Co. Inc.

ENGELKAMP, J. (1991): Memory of Action Events: Some Implications for Memory Theory and for Imagery. In: C. Cordony & M. A. McDaniel (Eds.) *Imagery and Cognition.* New York, Berlin: Springer Verlag.

FERRARI, Michel (1996): Observing the Observer: Self-Regulation in the Observational Learning of Motor Skills. *Developmental Review* 16, 203–240.

FEUILLET, R. A. (1700): *Chorégraphie, ou l'art de décrire la danse*. Paris. Reprint. New York: George Olms, 1979.

FITTS, P. M. (1964): Perceptual motor skill learning. In: A. W. Melton (Ed.) *Categories of Human Learning*. New York: Academic Press, 244–284.

FITTS, P. M. & POSNER, M. I. (1967): *Human Performance*. Belmont: Brooks/Cole.

FLAVELL, J. H.(1981): Cognitive monitoring. In: W. P. Dickson (Ed.) *Children's Oral Communication Skills*. New York: Academic Press, 35–60.

FLEISHMAN, E. A. & HEMPEL, W. E., Jr. (1955): The relation between abilities and improvement with practice in a visual discrimination reaction task. *Journal of Experimental Psychology* 49, 301–312.
FOLEY, A. M. (1991): The effects of enactive encoding, type of movement, and imagined perspective on memory of dance. *Psychological Research* 53, 251–259.
FÜGEDI, János (1997): An Analysis and Classification of Springs. *Proceedings of the Twentieth Biennial Conference of the International Council of Kinetography Laban, August 9–14, 1997*, held at the Hong Kong Academy for Performing Arts, Hong Kong, 41–76.
FÜGEDI, János (1993): Tánclejegyző rendszerek (Dance notation systems) I–III. *Táncművészet* XVIII, 1–2, 48–49, 3–4, 49–51, 5–6, 47–49.
GARDNER, Howard (1983): *Frames of Mind: The Theory of Multiply Intelligence*. New York: Basic Books.
GEORGIEFF, Nicolas & JEANNEROD, Marc (1998): Beyond Consciousness of External Reality: A "Who" System for Consciousness of Action and Self-Consciousness. *Consciousness and Cognition* 7, 465–477.
GOODMAN, Nelson (1976): *Languages of Art*. Indianapolis: Hackett Publishing Company, Inc.
GOSS, A. E. (1955): A stimulus-response analysis of the interaction of cue-producing and instrumental responses. *Psychological Review* 62, 20–31.
HANNAH, Judith Lynn (1999): *Partnering Dance and Education; Intelligent Moves for changing Times.* Champaign, IL: Human Kinetics.
HODGSON, John & PRESTON-DUNLOP, Valerie (1990): *Rudolf Laban – An Introduction to his Works & Influence*. Plymouth: Northcote House.
HORWITZ, Dawn Lille (1988): Philosophical Issues Related to Notation and Reconstruction. *Choreography and Dance* Vol. 1, 37–53.
HUTCHINSON, Ann (1977): *Labanotation or Kinetography Laban – The system of Analyzing and Recording Movement*. Third Edition, Revised. New York: Theatre Art Books.
HUTCHINSON, Ann (1983): *Your Move: A New Approach to the Study of Movement and Dance*. New York: Gordon and Breach.
HUTCHINSON, Ann (1984): *Dance Notation: The process of recording movement on paper.* London: Dance Books.
JAMES, W. (1890): *The principles of psychology* (Vol. 1). New York: Holt.
KIMBLE, G. E. & PERLMUTER, L. D. (1970): The problem of volition. *Psychological Review* 77, 361–384.
KLEINMAN, Matthew (1983): *The Acquisition of Motor Skill*. Brooklyn College of the City University of New York: Princeton Book Company.
KNUST, A. (1979): *A Dictionary of Kinetography Laban* I–II. Plymouth: Macdonalds and Evans.
KORIAT, Asher (2000): The Feeling of Knowing: Some Metatheoretical Implications for Consciousness and Control. *Consciousness and Cognition* 9, 149–171.
LABAN, Rudolf (1956): *Laban's Principles of Dance and Movement Notation*. London: Macdonald and Evans.
LABAN, Rudolf (1975): *A Life for Dance*. London: Macdonald and Evans.

LOCKE, Lawrence (1970): A Critique of Movement Education. In: Robert T. Sweeney (Ed.) *Selected Readings in Movement Education*. Reading, Mass.: Addison–Wesley Publishing Company, 187–202.

MALETIC, Vera (1987): *Body – Space – Expression*. Berlin: Mouton de Gruyter.

MARTIN, György & PESOVÁR, Ernő (1960): A magyar néptánc szerkezeti elemzése (Structural analysis of the Hungarian folk dance). *Tánctudományi Tanulmányok 1959–1960*, 211–248.

MCALLISTER, D. E. (1953): The effect of various kinds of relevant verbal pretraining on subsequent motor performance. *Journal of Experimental Psychology* 45, 329–336.

MCCABE, A. E. (1979) A paradox of self-regulation in speech-motor interaction: Semantic degradation and impulse segmentation. In: G. Zivin (Ed.) *The development of self-regulation through private speech*. New York: Wiley.

MILLER, G. A. & GALANTER, E. & PRIBAM, K. H. (1960): *Plans and the Structure of Behavior*, New York: Henry Holt.

MINAS, S. C. (1978): Mental practice of a complex perceptual motor skill. *Journal of Human Movement Studies* 4, 102–107.

MINAS, S. C. (1980): Acquisition of a motor skill following guided mental and physical practice. *Journal of Human Movement Studies* 6, 127–141.

MOOMAW, Virginia (1967): The Notated Creative Thesis. *Research in Dance: Problems and Possibilities*. *Proceeding of the Preliminary Conference on Research in Dance*. Greystone Conference Center, Riverdale, New York, 133–136.

MOSES, Nancy H. (1990): The Effects of Movement Notation on the Performance, Cognitions and Attitudes of Beginning Ballet Students at the College Level. In: Lynnette Y. Overby & James H. Humphrey (Eds.) *Dance – Current Selected Research.* Vol. 2. New York: AMS Press, 105–112.

NEWELL, K. M. & BARCLAY, C. R. (1982): Developing Knowledge About Action. In: J. A. S. Kelso & J. E. Clark (Eds.) *The Development of Movement Control and Co-ordination*. New York: John Wiley and Sons, Ltd. 175–212.

NORMAN, D. A. & RUMELHART, D. E. & LNR Research Group (1975): *Explorations in Cognition*. San Francisco: Freeman.

PAIVIO, A. (1971): *Imagery and verbal process*. New York: Holt, Rinehart and Winston.

PIAGET, J. (1974): *La prise de conscience*. Paris: Presses Universitaires de France.

POSNER, M. I. & SNYDER, C. R. R. (1975): Attention and cognitive control. In: R. Solso (Ed.) *Information processing and cognition: The Loyola symposium*. Hillsdale, New York: Erlbaum.

ROSCHE, E. (1975): Universals and cultural specifies in human categorization. In: R. Brislin, S. Bochern and W. Lonner (Eds.) *Cross-cultural Perspectives of Learning*. New York: Sage-Halsted.

RUMELHART, D. E. & ORTONY, A. (1977): The representation of knowledge in memory. In: R. C. Amderson, R. J. Spiro and W. E. Motague (Eds.) *Schooling and the Acquisition of Knowledge*. Hillsdale, NY: Lawrence Erlbaum.

SACKETT, R. S. (1934): The influences of symbolic rehearsal upon the retention of maze habit. *Journal of General Psychology* 10, 376–395.

SAGE, George H. (1984): *Motor Learning and Control: A Neuropsychological Approach*. University of Northern Colorado, Dubuque, Iowa: Wm.C. Brown Publishers.

SCHANK, R. C. & ABELSON, R. P. (1977): *Scripts, Plans, Goals and Understanding*. Hillsdale, New York: Lawrence Erlbaum.

SCHMIDT, R. A. (1975): *Motor Skills*. New York: Harper & Row.

SZENTPÁL, Olga (1961): A magyar néptánc formai elemzése (Formal analysis of the Hungarian folk dance). *Ethnográfia* LXXII, 3–55.

SZ. SZENTPÁL, Mária (no year/b): *Táncjelírás – Lábán kinetográfia* I–III (Dance notation – Laban's kinetography). Budapest: Népművelési Propaganda Iroda.

SZ. SZENTPÁL, Mária (no year/b): *A mozdulatelemzés alapfogalmai* (Basic concepts of movement analysis). Budapest: Népművelési Propaganda Iroda.

SWEENEY, Robert T. (1970): Motor Learning: Implications for Movement Education. In: Robert T. SWEENEY (Ed.) *Selected Readings in Movement Education*. Reading Mass.: Addison–Wesley Publishing Company, 203–207.

TILLOTSON, Joan (1967): A Program of Movement Education for Plattsburg Elementary Schools. *Research in Dance: Problems and Possibilities*. *Proceeding of the Preliminary Conference on Research in Dance*. Greystone Conference Center, Riverdale, New York, 114–118.

WARBURTON, Edward C. (2000): The Dance on Paper: The Effect of Notation-use on Learning and Development in Dance. *Research in Dance Education*, Vol.1, No. 2, 193–213.

WARNER, Mary Jane (1984, 1988, 1995): *Labanotation Scores: An International Bibliography.* An ICKL Publication. Chelsea, Michigan.