THE APPLICATION OF BIOMECHANICAL PRINCIPLES TO DANCE

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INTRODUCTION

The problems are a lot in the present dance teaching. In particular, we employ too many hours to make a pupil one good dancer and we waste as many others potential dancers to create a very good dancer. These two problems are linked: the teacher structures his own teaching method, based on experience matured with the most gifted and best pupils of the course, while he neglects the rest of the pupils that, on contrary, by a not empirical but scientific (biomechanical) method could be recovered to the motory and professional activity.

We have addressed our studies about the qualitative analysis of dance techniques (balances, jumps, turns and pas de deux), in order to give, at the end, scientific dignity to a teaching method based on biomechanical principles.

Particularly, biomechanics of dance, defined as the science examining internal and external forces acting on a dancer, points out mechanical and physiological effects produced by these.

We explains it by two examples, the turns and the illusion starting to turn in fly.

THE TURNS

The turns over one supporting foot on the parquet are common movements in every forms of dance and in many artistic sports. During the phase of rotation of these turns is difficult to recover an unbalanced condition, especially with esthetically pleasing movements. The difficulty is to attribute principally to the redoubt supporting basis that makes mostly limited the possible movements of the centre of mass on it.

Therefore, the pupil has to learn to acquire right kinetic energy before of the phase of rotation. On one hand we have to consider, during this last, such energy reduces for effect of the friction between foot and parquet. On the other hand, on the contrary, it needs to avoid the lacks of balance deriving from excessive or with wrong direction of the pushes.

The dancer, motionless on the feet, who intends to perform such turns, attains the necessary energy to turn and to shift his own body to the balance position on one foot pushing against the parquet, exploiting the Newton's third law (see figures 1 and 2). In first side he flings out one's arm on the almost horizontal plane passing for its shoulder (this movement is useful only to turn). In second side, he pushes the push-off leg (to turn and to shift his own body on the pivot foot). This last push is the most difficult action to manage for the pupil and is the cause of consequent loss of balance or of anaesthetic and not wanted hops.

To learn easy the turns, we have made our pupils to begin the study from positions with the center of gravity not above the center of the supporting basis, but more above pivot foot (for example taking the pivot bend leg and the other tended). In such way we avoid excessive horizontal pushes, but we reduce the friction. Then the torque applied to the parquet diminishes and the times of turns learning, motory uncertainties, is from position with the push-off foot. The torque on the parquet of the push leads annul the angular remains is that towards a faster turn.

The advanced dancer turns with an null angular variation, during the plane of the body towards the push-off foot. The angular momentum remains is that towards a faster turn.

The application of three weeks has reduced...
Technical expedient, utilised in our teaching methodology, has reduced the times of turns learning, particularly in those pupils who lives intense proceritas and then motory uncertainties. In a second didactic moment the pupils have studied the turns starting from position with the center of gravity above the center of the supporting basis, so as to faster turn.

The advanced dancers succeed in to arrive in the position of the rotatory phase of the turns with an null angular momentum towards the supporting foot, changing the speed of variation, during the passing from the double at the single support, of the moment of inertia of the body towards supporting foot, in way directly proportional to the force exerted by the push-off foot. The torque of the weight force towards the pivot foot, helped by the push on the parquet of the pivot leg that origins the lengthening of the body and increases the friction, leads annul the angular momentum towards the pivot foot. The only angular momentum which remains is that towards the vertical axis passing for the pivot foot.

The application of this methodology of biomechanical teaching to twenty pupils for three weeks has reduced of the 50% the times of learning.

**THE ILLUSION STARTING TO TURN IN FLY**

In the traditional methods the pupil is stimulated to turn the most possible. But in the dance is very effective not to turn only the most possible, but also to give the illusion starting to turn during the fly, for example in the grand assemblé en tournant (see figure 3).

In order to do that, it needs utilise expedients of biomechanical nature, so as to give the impression determining the rotation during the phase of fly.

In the traditional methods these expedients are not taught.

The angular momenturn can be determined until the take--off and it can not be increased during the phase of fly.

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**Figure 1** - The reaction of the parquet is useful only to turn the body.

**Figure 2** - The R force is the reaction of the parquet useful to turn and to shift the body on the pivot foot.
What is to be done to give the impression beginning to turn during the fly?
That is possible setting the moment of inertia of body, so as to increase and to drop
the angular velocity.

Practically, in the biomechanical method pupils are taught to jump up with the opened
legs, so as to have a big moment of inertia, and to close the legs, lessening the moment of
inertia at the peak, so as to increase the angular velocity.

Therefore the body, which until that moment turned little, performs quickly the wished
turns.

The adjustment of the moment of inertia through the arms and legs opening can be
applied to every turn and turned jump.

The training founded on these expedients has determined in our pupils the capacity,
besides turning, giving the illusion starting the rotation in fly, with the consequent and es-
thetic gains.

Figure 3 – Grand assemblé en tournant.

CONCLUSIONS

Finally, the biomechanical teaching method, we are structuring, was demonstrated more
efficient than traditional methods.

Palmisciano G., is the author of the part about the illusion starting to turn in fly; Palmis-
ciano V., is the author of the rest of the parts.

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