# THE APPLICATION OF BIOMECHANICAL PRINCIPLES TO DANCE

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## INTRODUCTION

The problems arc a lot in the present dancc teaching. In particular, we employ too many hours to make a pupil one good danccr and wc waste as many others potential dancers to crcatc a very good danccr. Thcsc two problems arc linked: thc teacher structures his own teaching mcthod, based on cxpcricncc matured with thc most gifted and best pupils of the course, while hc ncglccts thc rest of thc pupils that, on contrary, by a not empirical but scientific (biomechanical) mcthod could bc rccovcrcd to the motory and professional activity.

Wc have addressed our studies about thc qualitative analysis of dance techniques (balanccs, jumps, turns and pas de deux), in order to give, at the end, scientific dignity to a teaching mcthod bascd on biomechanical principles.

Particularly, biomcchanics of dance, defined as the scicncc examining internal and external forces acting on a danccr, points out mechanical and physiological effects produced by thcsc.

Wc explains it by two cxamplcs, thc turns and the illusion starting to turn in fly.

## THE TURNS

The turns over one supporting foot on thc parquet arc common movcmcnts in every forms of dancc and in many artistic sports. During thc phase of rotation of these turns is difficult to rccovcr an unbalanced condition, especially with csthctically pleasing movcmcnts. Thc difficulty is to attributc principally to the rcdoubt supporting basis that makes mostly limited thc possible movcmcnts of thc ccntrc of mass on it.

Thcrcforc, thc pupil has to learn to acquire right kinetic cncrgy before of thc phase of rotation. On one hand wc have to consider, during this last, such cnergy rcduces for effect of thc friction bctwccn foot and parquct. On thc other hand, on thc contrary, it nceds to avoid thc lacks of balancc dcriving from cxccssivc or with wrong direction of thc pushcs.

Thc danccr, motionless on the feet, who intends to perform such turns, attains the ncccssary cnergy to turn and to shift his own body to thc balancc position on one foot pushing against the parquct, exploiting thc Newton's third law (sec figures 1 and 2). In first side he flings out one's arm on thc almost horizontal plane passing for its shoulder (this movement is useful only to turn). In second side, hc pushcs thc push–off leg (to turn and to shift his own body on thc pivot foot). This last push is thc most difficult action to manage for thc pupil and is thc causc of consequent loss of balancc or of anaesthetic and not wanted hops.

To learn easy thc turns, we have madc our pupils to begin thc study from positions with thc ccntcr of gravity not abovc thc ccntcr of thc supporting basis, but morc above pivot foot (for example taking thc pivot bend Icg and the other tended). In such way we avoid excessivc horizontal pushcs, but wc rcducc thc friction. Then thc torque applied to the parquet

diminishes and the maxim velocity of turn.

This technical expedient, utilised in the 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 centcr of gravity above the centcr 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 lcngthcning 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.

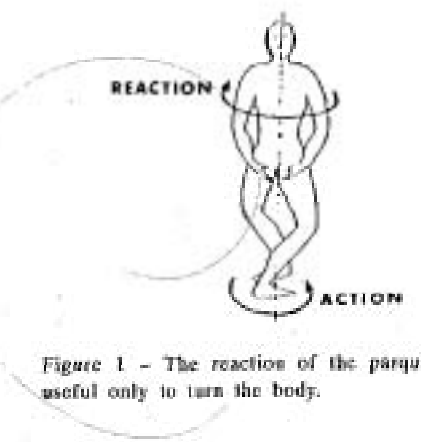


*Figure 1 – The reaction of the parquet is useful only to turn the body.*

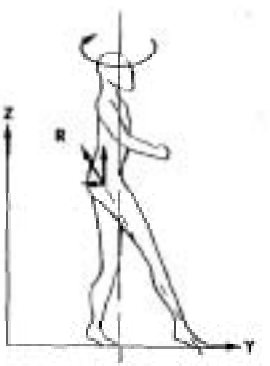


**Figure 2. The R force is the reaction of the parquet useful to turn and to shift the body on the pivot Toot.**

## 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 cn 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 teached.

The angular momcnturn can be determined until the takc–off and it can not be increased during the phase of fly.

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 esthetical gains.

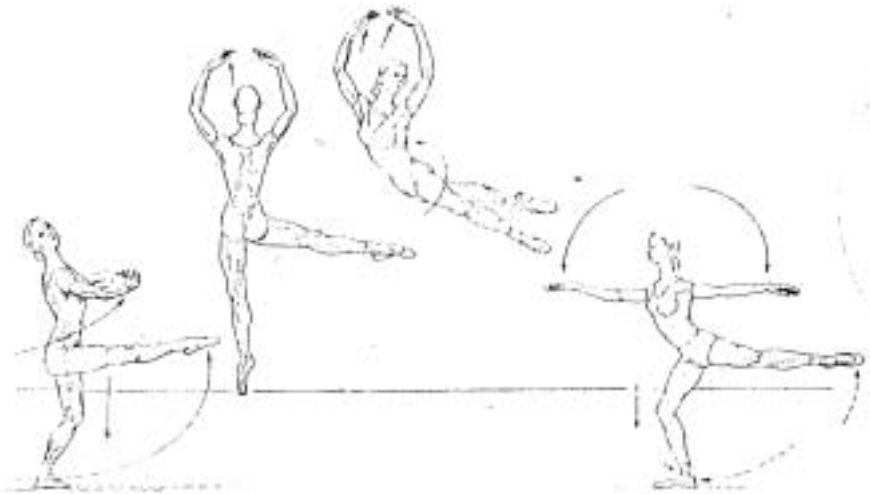

**Figure 3** – Grand assemblé en tournant.

## 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; Palmisciano V., is the author of the rest of the parts.

## REFERENCES

– Baumann **E.** (1882) Meccanica umana. Bologna, Italy.

- Bosco C.(1985) Stretch–shortering cycle in skeletal muscle function. Atleticastudi, Italy, 1, 3-57.
- Hay G. (1980) Biomécbanique des techniques sportives. Vigot, Paris, France.
- Kirstein L. (1985) Tecnica della danza classica. Di Giacomo, Roma, Italy.
- Palmisciano G. (1991) 500 escrcizi per l'equilibrio. Ed. Mediterranee, Roma, Italy.
- Palmisciano V. (1990) Biomeccanica della danza e della ginnastica ritmica. Alfredo Guida ed., Napoli, Italy.
- Pozzo T., Studeny C. (1987) Théorie et pratiquc des sports acrobatiques. Vigot, Paris, France.