



Biomechanics in Dance (Part 1)

Why do some dancers perform such a perfect and effortless looking Feather step? Why is the Latin- American style more suitable for some people than Ballroom or vice versa? What makes for a good hip action? What creates a better swing in Waltz? How about a powerful and quick movement?

The answers may be rooted in physiological, psychological, or other areas but, the problems identified are biomechanical.

What is Biomechanics?

The term biomechanics combines the prefix bio; meaning "life", with the field of mechanics; which is the study of forces' actions.

Bio-mechanists use the tools of mechanics to study the anatomical and functional aspects of living organisms. (For example; how does a bird fly or a dancer leap across the floor?)

There are two main branches of Biomechanics; Kinematics that deals with the geometry of the motion of objects, including displacement, velocity and acceleration without taking into account the forces that produce the motion and; Kinetics, which is the study of the relationships between the force system acting on a body and the changes it produces in body motion.



In terms of this, there are skeletal, muscular and neurological considerations we also need to consider when describing biomechanics.

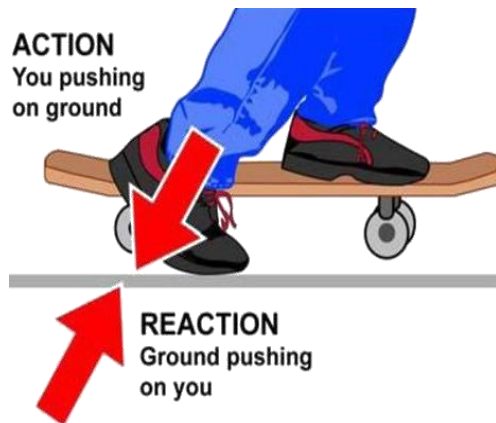
In dance, some of the areas where biomechanics is applied to either support the performance of or solve issues may be in the:

- Identification of optimal technique for enhancing performance in terms of linear and angular movement
- Analysis of body loading to determine the safest method for performing a particular movement
- Assessment of muscular recruitment and joint loading
- Analysis of dance and exercise equipment e.g., shoes, surfaces and costumes.

Newton's Laws of Motion

There are three laws that describe, in a nutshell, how an object that has mass or weight can move around in space as a result of the forces applied to it.

In our case; a dancer has a mass/weight and therefore moves; and, the only way we can move in dance is through internal or external forces; internal being our muscles and external being gravity, the floor, or our partner.



1st Law - Inertia

Isaac Newton's first law of inertia explains that; for the dancer to move we need some force to act on the dancer's body for it to move and; objects tend to resist changes in their state of motion; while an object in motion will tend to stay in motion and; an object at rest will tend to stay at rest...unless acted upon by a force.

For example; the body of a dancer who dances scatter chases around the floor will tend to want to retain that motion unless muscular forces can overcome this inertia and either transition to another step, change direction or stop.

2nd Law - Acceleration

Newton's second law explains how much motion a force creates, i.e.; the acceleration an object experiences is proportional to the force's size and, inversely proportional to the object's mass.

For example; when a ball is thrown, kicked, or struck, it tends to travel in the direction of the applied force's line of action; similarly, the greater the amount of force applied, the greater the speed the ball has.

Suppose a dancer improves leg strength through training while maintaining the same body mass...in that case, they will have an increased ability to accelerate the body using the legs, resulting in better agility and speed (this also relates to the ability to rotate segments of the body).

3rd Law - Action and Reaction

The Third Law tells us that for every action (force), there is an equal and opposite reaction (force).

For example; the force created by the legs "pushing" against the ground results in ground reaction forces in which the ground "pushes back" and allows the dancer to move across the floor (as the Earth is much larger than the dancer, the dancer accelerates and moves rapidly, while the Earth does not accelerate or move at all).

This action-reaction also occurs when we try to stand on our toes.

By pushing through the calf muscles to the floor, the ground reacts on our bodies with equal and opposite force causing us to get up on the toes much like a ballerina on point.

Friction is another important force for dancers and the friction between a dancer's feet and the floor is an example of a horizontal ground reaction force...providing that there is enough friction between the dancer's foot and the floor, the horizontal ground reaction force of friction then pushes the dancer's mass forward.

Similarly, when we need to stop moving or change direction, the friction from the floor is needed. The dancer pushes forward to stop moving forward and the reaction force from the friction pushes backward, stopping the dancer.

The (COG) Center of Gravity is an imaginary point around which the dancers' body weight is evenly distributed and the center of gravity (of the human body) can change greatly, since the segments of the body can move their masses with joint rotations...this concept is important to understanding balance, stability and how gravity can affect dance techniques.

The direction of the force of gravity through the body is downward towards the center of the earth and this line of gravity is important to understand and visualize when determining a person's ability

to successfully maintain balance and when the line of gravity falls outside the (BOS) Base of Support (the area supported beneath the object), a reaction is needed to stay balanced.

In Part 2 next month, we will look at how these laws directly tie in to the dancers' body movement in space, while becoming more familiar with ideas such as displacement and velocity.

Walking your way to becoming a Better Dancer

A key to better dance is your footwork.

It gives you balance, posture, power and rhythm and if your feet don't have a strong connection to the floor, then no matter what else you do, you will not be as good as you could.

If you feel that maybe your foundation in dance is not as strong as it could be, or that you're just not secure enough, then it's likely your foot work and below are some pointers to make it better.

For footwork to be better, you need to have a well-developed feeling for your feet and how they move as you dance and, one way to develop this feeling, is by simply walking but, as you do in dance, slowly and with attention.



First note the different parts of your feet:

- The heel
- The inside
- The outside
- The ball
- The toes

Choose a dance style that you are currently working on and think about the basic figure for that dance...now walk through it thinking about the following:

- Which of the parts of your foot first feels pressure as you move your weight to that foot?
- Where does the pressure travel to after this?
- How does the pressure travel through the foot until the time when you lift your foot from the ground?
- How much pressure is there; is there enough; is there too much?

You should feel that you move onto, through and out of the foot...there is a transition that you should feel.

You should also feel that the amount of pressure gives you security, balance and power by connecting you to the floor. If you think that this is not the case, then it's possible that you are not walking correctly or not fully aware of the weight distribution on your foot.

Go over your walks with your teacher/coach to determine which and if you are stepping correctly. You will then know if you need to change your walk or just need to be more aware of your feet.

Now think about the following:

- Do you close your feet (bring the heel and toe together) properly when you should?
- Do you brush your feet properly when you should?
- Do your feet turn the correct way as you step?

You might need to double check with your teacher/coach or perhaps in the mirror. With an increased awareness of your feet, you will be able to cross reference how feet look with how they feel, allowing you to then be able to practice your feet work more effectively.

After focusing on how your feet feel and aligning this with how your feet are to move, you should notice quick gains in your connection with the floor and the corresponding improvement in dancing that comes from this.

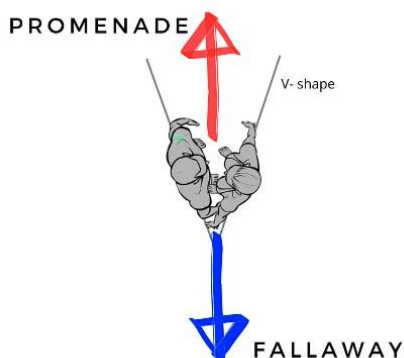
The Promenade and Fallaway Positions

Promenade and Fallaway positions are challenging if we do not have a clear goal and picture in mind of what we want to achieve so, let's dig deeper.

Creating a variety of movement patterns and beautiful shapes in the different dances is one of our art forms' fascinating features and a solid understanding of the principles that allow two bodies to move together and establishing a sound system that we can follow, to perform specific tasks like progression, rotation, rise, lowering, and change of positions is needed.

Focusing on one of the all-time problematic areas- the promenade and fallaway positions, the goal is to develop a simple method for achieving the positions from various entries and give you examples so you can start using that method on your own.

What are Promenade and Fallaway positions?



In partnered dancing, the term position describes how the lead and follow's bodies move in relation to each other.

The default position for Standard Ballroom is the Closed position with both lead and follow facing each other; when one moves forward, the other moves back and vice versa, while maintaining contact through their Right sides.

Imagine, for example, if we are limited to this one position and dance a 2-minute waltz in the same position...it might become a little boring so, let's introduce a new body position and explore how it works.

The Promenade position is the first position introduced to dancers other than the closed (*where partners maintain their body contact with their left sides*).

The bodies' new contact point will create a V shape position that will allow both partners to move in the same direction...forward.

The Fallaway position is absolutely the same as the promenade; the only difference is that this time the partners will be moving in the same configuration but backward instead of forward.

How do we achieve these positions?

The promenade or the fallaway position can be achieved in many different ways, depending on the preceding figure and it is important to note that both partners have a specific role to play while moving our bodies, to create the positions...more precisely, each partner turns a different body part depending on the type of promenade.

To achieve the promenade or fallaway positions we rarely use BOTH our hips or our ribs (shoulders) and to make things very clear and straightforward, we will separate our promenade entrances into two categories- Left and Right turns to PP.

Each of those will contain two subcategories; Forward and Backward turn into the promenade and we will look at how we go about creating the promenade from the Lead perspective and the Follow perspective.

The Promenade Position

Left Turn to PP

Forward L turn to PP

Lead: Turns the HIPS

Follow: Turns the RIBS

Example: Open Telemark

Backward L turn to PP

Lead: Turns the HIPS

Follow: Turns the RIBS

Example: Outside Change to PP

Right Turn to PP

Forward R turn to PP

Lead: Turns the RIBS

Follow: Turns the HIPS

Example: Turning Lock to R, Hover Telemark

Backward R turn to PP

Lead: Turns the RIBS

Follow: Turns the HIPS

Example: Open Impetus



If you carefully review the descriptions above, you will notice that for all Left turns to PP, the LEAD is turning the HIPS and the Follow is turning the RIBS and, for all the Right turns to PP the lead is turning the RIBS and the follow is turning the HIPS.

The Fallaway Position

Achieving the Fallaway position can be done generally in two ways; a forward left turn and a backward right turn and while there can be variations to the entrance depending on how elaborate the step is, those are the two most common scenarios for dancing the fallaway position.

Left Turn to Fallaway

Forward L turn to Fallaway

Lead: Turns the HIPS

Follow: Turns the RIBS

Example: Fallaway Reverse Slip Pivot

Right Turn to Fallaway

Backward R turn to PP

Lead: Turns the RIBS

Follow: Turns the HIPS

Example: Fallaway Ronde (American Smooth), Natural Fallaway

How can you use this information?

1. Analyse the type of position and take the appropriate steps.
2. Determine the direction of the turn to PP or Fallaway- right or left.
3. Determine your job as a lead or a follow. (Should you turn the hip or the ribs?)
4. Enjoy dancing.

Always keep in mind that in partnered dancing (and specifically in the Ballroom styles), it is not about doing a lot...it is about doing the right thing at the right time...while turning one body part at a time will help you 'fit' with your partner better.

Back-Leading

Back-leading is likely the single biggest challenge leaders can expect from their partners on the dance floor, simply because it's so difficult for followers to give up control over where (and sometimes when) they move.

Back-leading is basically when a follower either "pushes" or "pulls" the leader into a move, rather than letting him "push" or "pull" her into it. This can be done a number of ways...



Sometimes the follower will anticipate a step back and will take it before it is really lead, resulting in the leader then having to take the step as well, whether they had planned to lead the step or not.

Sometimes the follower will raise both theirs and their partner's arm prematurely to do an underarm turn.

Sometimes a follower will simply "resist" a lead and do something else because they think it is "wrong" or "off-time", resulting in the leader then having to compromise.

Often a follower can't quite pick up on a weak lead and will interpret it as they see fit.

As you can see, the definition of back-leading is rather vague...the best thing I can think of to further define it is "any time when the follower stops being passive/responsive and starts being aggressive/guiding" and while it might be tempting to engage in a tug-of-war with your partner for control of the dance, there are other (much more productive) ways a leader can respond.

Consider going with it!

In some dances, like Argentine tango and West Coast Swing, a follower can make 'suggestions' or even outright 'hijack' the movement. This is fine, as long as they don't lead the majority of steps and, you can actually make the dance more fun by going along with it.

Avoid the step.

Your partner may be trying to steer you away from moves they don't know, or might aggravate a past injury. If they seem to back-lead more on certain types of moves - dips for example, or multi-spins, you might want to just avoid those steps entirely.

Make sure you've balanced your partner properly.

Your partner might be back-leading - or they might be trying to keep their balance. When you dance, shift your weight 100% from one foot to another on every step and make sure your partner is doing the same.

Increase the assertiveness of your lead.

Many followers fall into back-leading if they aren't feeling enough lead themselves so; tighten up that frame; increase the pressure slightly; and make sure you never 'leave your arms behind' on any movement. They should move with your body - as one unit.

Gently let your partner know.

If your partner is still not getting the message, you might need to tell them, delicately, that they need to wait for you. This can range from a simple 'would you mind waiting a bit longer for my lead?' to the more risky but humorous 'tell you what, you can lead the next one, what do you say?'



Have them close their eyes. (Practice)

If your partner is someone you practice with regularly, and the floor is not crowded, suggest they close their eyes while you dance.

This forces them to rely completely on the pressure through your frame, instead of guessing the movement from what they see.

Stick with the patterns you know best while trying this - no dips!

Be creative! (For advanced dancers only!)

This doesn't work for everybody, but in my lessons, I've found it to be a good way to teach your partner not to anticipate if all else fails.

Look for places where they tend to back-lead, like a spot turn; then throw in a variation the next time you try it! Make sure it still meshes with the movement and don't sacrifice your technique.

Will they be surprised? Very likely.

Will they be more patient next time in case you try it again? Definitely!