

Physics of dance

[Science](#), [Physics](#)



Many people fail to realize the importance of physics in athletics. People who are untrained in the scientific field may believe that an athlete's performance level is solely based on their skill-set, such as strength and training. However, one's ability to employ physics concepts is the true determinant for success. This is imperative to dancers; most movement and technique can be improved dramatically by following Newton's laws accordingly. By utilizing key physics concepts, a dancer can improve by locating the center of balance and determining the force vectors of a Grande Jette jump. Maintaining a strong center of balance is one of the key principles of strong dance technique. Whether dancers are working to control their turns or maintaining a position while standing on their toes, they are always instructed to "hold their center" or "keep a strong core." These instructions may seem foreign to non-dancers, they both relate to the physics concept of static balance; by holding the center of gravity directly above the area of contact with the floor, a dancer will have zero net force and therefore hold their position steady. This is the only way a dancer can stay balanced in the arabesque (when the position of the body is supported on one leg as the other leg is extended behind the body). To ensure that the net force of gravity sums up to zero, a dancer must offset the weight of his/her back leg by leaning over with the upper body just enough distance. Since the leg has less mass, it must be stretched farther away from the center of gravity as the heavier torso bends forward a smaller distance so the force vectors across the x-axis are equal. If properly executed, the gravity's downward push (due to the force of gravity) and the floor's upward push (due to normal force) will be aligned straight through the dancer's body to the point of contact with the

floor. This will equate to zero net forces, and the body will remain balanced. This concept of “center of gravity” can also be used when analyzing the physics behind a grande jete jump. To perform this movement, a dancer springs off the floor with one leg as the other leg is extended in front, then is suspended through the air in a split position and lands on the front foot. It is easier to analyze this trajectory motion from one concentrated point since the parts of a dancer’s body are moving in different directions throughout the jump. Therefore, the “center of gravity” is used to determine change in distance and velocity over the x and y-axis. Once the dancer is launched into the air, the only force acting on his/her body is constant acceleration due to gravity along the y-axis. So center of gravity (noted before) will be launched into the air at a certain velocity, then slow down to 0 m/s while in the air, and fall back down at an increasing speed until it reaches the initial velocity. Since there are no forces acting on her body across the x-axis while in the air, it will be moving at constant velocity across a distance on the floor, creating a “hyperbola” path of motion. However, dancer create the illusion that they are “floating” through the air when they by raising their legs at the top point of the hyperbola... therefore changing the distance between the center of gravity. This will make his/her body seem as if it is at a higher point on the x-axis, and therefore “floating” through the air. So even though the motion of the center of gravity follows the basic laws of physics according to the forces acting upon it, a dancer can create the illusion that he/she is defying gravity in a Grande Jete jump. By understanding of how a dancer’s movements obey the laws of physics, one can form a deeper appreciation their talent and skills. Physics is vital for the utilization of many dance

numbers and pieces of choreography because it is the foundation for how a dancer moves in the way they do. Therefore, the concepts behind balance and many jumps such as a Grande Jete are dependent on physics.