

Affective Relationships in Dance Teaching Mediated by Hula Hoops¹

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In the field of dance studies, a well-known thinker who focused on the study of space was Rudolf von Laban (1879 - 1958), who named this study Corêutica. The study of the disposition of the body and movement in space underlies the present work, which was developed as a course conclusion work by the three first authors under the guidance of the fourth author, at University of Campinas. In the following year, the authors revisited the manuscript and wrote together this article. Laban is a common reference to the various disciplines of the course and the basis of research for several professors. In this work, the focus was the use of the hula hoop as a scenic object in dance and as a mediating object of the affective relationships and teaching. We understood this object as a potent enabler of the

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¹ This article was based on a Dance degree monograph developed by the first three authors under the guidance of the fourth author at Universidade Estadual de Campinas in 2019.

integration between body and mind of the dancer and between teacher and student within the school. We are interested in investigating this object from different points of view, in an interdisciplinary perspective, starting from geometry and, equally, from studies in the symbolic field of psychology, particularly Jungian.

This work focuses on the study of the possible affective² relationships that can be established in dance teaching mediated by hula hoops. It was inspired, initially, in *Bambodança*³ techniques, which we will discuss forward, as well as in Choreology Studies (LABAN, 1978). Our methodology is of a practical-theoretical nature. The first three authors developed, under the guidance of the fourth author, a workshop for sharing with people interested in the experience of dancing with hula hoops. Although this workshop was not configured as data collection, but as a free experiment in which we shared our perceptions during the process, we considered that it would be interesting to first expose our impressions about the lived experience.

The premise of working with hula hoops led us to a study, in literature, about the circle as a symbol present in the dances of different cultures, whether in the disposition of the dancers or in the forms composed by the body parts of the dancer, for example. We also present the study of the bibliography, which pointed to possibilities of thinking about an interdisciplinary dance teaching project, in dialogue particularly with the field of mathematics, for elementary school students.

To think about the relationship between dance and mathematics through teaching dance with hula hoops, in an interdisciplinary perspective, we use the concept of flow: instead of looking at the circle as we usually do in geometry - concerned with measuring it, analyzing its angles, area, perimeter, radius, diameter - we paid attention to its ability to help our minds and bodies to flow, dance in cyclical space-time, beautifully and timeless, which allows us to leap out of our tendency to rationalize the world and human existence. And, for that, an important reference for this work was Carl G. Jung and his writings on the role of the symbol in human culture:

What we call a symbol is a term, a name or even an image that may be familiar to us in everyday life, although it has special connotations beyond its obvious and conventional meaning. It implies something vague, unknown or hidden to us. [...] a word or an image is symbolic when it implies something beyond its manifest and immediate meaning. This word or image has a broader "unconscious" aspect, which is never precisely defined or fully explained. Nor can we hope to define or explain it. When the mind explores a symbol, it is led to ideas that

² Translation note: In Portuguese the authors used the expression "relações de afeto" instead of "relações afetivas", to highlight that the work is about the quality of the teacher-student relationship (based on affectivity) and not in affective relationships.

³ *Bambodança* or *Hooping* became popular in England between the years 1400 and 1500. It's a dance performed with hula hoops.

are beyond the reach of our reason (JUNG, 2016, p. 19, free translation).



Fig. 1: Photo of the conclusion of the work presentation, 2019 (Personal Collection).

Dance with scenic objects, and specifically with the hula hoop: a choreological perspective

When studying the movement of the hula hoop, it is noted that many basic premises for the study of movement are present. This observation led us to think about proposing a dance experiment using hula hoops under the light of Choreology. In his master's degree and later in his doctorate, Andraus (2004; 2012) studied Choreology, a field of studies developed by followers of Rudolf Laban based on principles he designed for the study / analysis of dance. Citing Valerie Preston-Dunlop, choreology allows those who analyze not only to look at movement, but at other elements that constitute dance, such as music, costumes, scenic objects, among others.

As her research was focused on Chinese Martial Arts, the scenic objects he looked at were wushu training weapons, such as sticks, sabers, spears, swords, san-tien-quan (three-section stick) and daggers. In this work, we turn our attention to the hula hoop as a scenic object that can be used in dance, paying special attention to the possibilities that this object, with the symbolic character implied in it (circle), provided for the people who participated in the workshops.

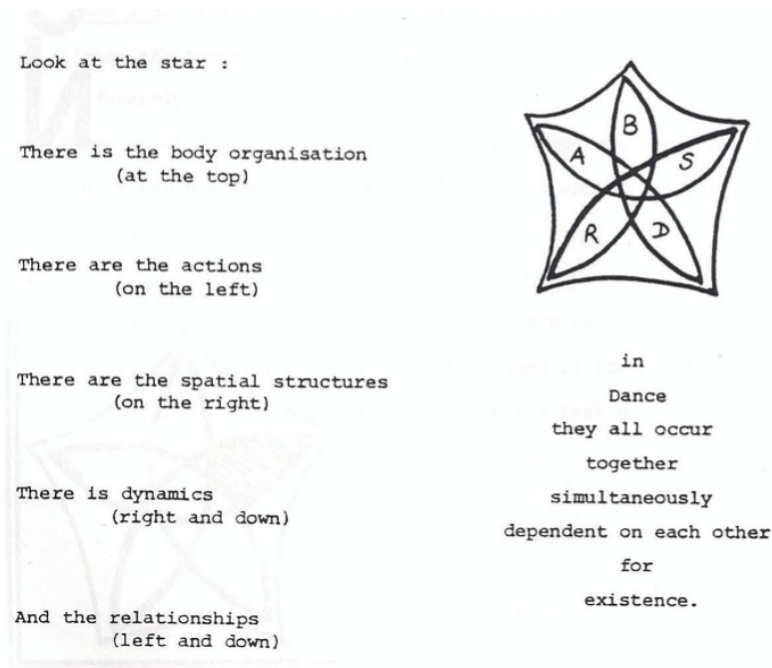


Fig. 2: Choreological star (Preston-Dunlop, 1987, p. 41).

We start by presenting our object of mediation: in 1958, a Brazilian toy factory called “Estrela” launched the hula hoop here in Brazil. At that time the object became a fever among children and adults, turning to a very popular object in Brazilian houses. The most common materials for making professional hula hoops are polypropylene (“polypro”) and high-density polyethylene (HDPE). The difference between them is the weight and air resistance, associated with the speed of the hula hoop. The lighter the tube, the faster the movement. In this case, the “polypro” is more recommended, as this way it is possible to make faster and more accentuated movements that stop abruptly and change direction. HDPE, on the other hand, is heavier and creep occurs due to greater inertia. Other materials can also be used, such as polipex (PEX), nylon, carbon fiber, low density polyethylene (LDPE) and even bamboo. In the case of low-density polyethylene, there is a lower quality of the material, but it is more used for beginners and children because it is more malleable and does not break so easily.

There are several types of hula hoops for different types of purpose: for example, a more rigid and heavy HDPE tube is ideal for developing cardiovascular conditioning and reducing body measures, while “polypro” would be more suitable for manipulation tricks, and for people who already have more experience, as it is a material that is difficult to control. The contact of

the hula hoop with the body is also influenced, from the point of view of physics and the kinematic analysis of movement, by its size and thickness: the larger the hula hoop is, slower it turns.

When studying the relations between this scenic object and the body, a first point to pay attention to is the relation with gravity. There are two possible relations with gravity: resistance of the body acting against the ground and surrender of this acting in favor of the ground. This resistance and delivery can be observed all the time when performing the movements with the hula hoop. In order to keep it rotating around the body, we establish a constant relationship with gravity, in which tension and resistance become present at all times when the body moves to maintain the rotation of the object and to make movements of upward characteristics. Delivery is also present in moments when the hula hoop moves downward, creating a constant game of fall and recovery.

A second important aspect observed throughout the process was how much work with hula hoops helped people to relax and better understand their body in space. To transform the flow of energy into a healthy one and get rid of bodily tensions perceived in everyday life, it is common to use various body techniques and strategies in dance classes, such as massages and stretches. In this work we propose that the circular movement of the hula hoop through all parts of the body is an active factor to relieve body stiffness, transforming this flow, as well as expanding body possibilities and skills.

A third aspect to highlight is the work with breathing promoted by the hula hoop: this vital function is our first movement and with it we can naturally open internal spaces of the joints and produce more elasticity and projection in the muscles, as well as blocking or unblocking certain parts. It is common that when rotating the hula hoop in a certain part of the body, tensions are evident, but that, through the synchronicity of the circular movement with the circularity of the breathing movement, it is possible to oxygenate these parts and establish a continuous flow. This is easily noticed when the hula hoop's movement becomes constant and fluid.

A fourth aspect would be the points of Support, Strength and Compensation: in order to move we are constantly driven to an eternal transfer of points of support over the ground. Likewise, to move the hula hoop constantly and make the object move through the body and space, there is an intense study of exchanges of different supports, from the simplest to the most complex, in an eternal search for balance.

Regarding the relationship between the dancer's internal and external space, we observed that, with the hula hoop, it is interesting to focus the movement on the internal space first, starting to rotate it along the central axis. The movement of turning the hula hoop induces the notion of counterpoint and resistance necessary to conquer this space. For example, in the movement of turning the hula hoop on the leg, the tailbone is opposed to other parts of the body; thus, the musculature reacts like an elastic band, which gains space and projects itself on its sky-earth axis. After studying the movements on that axis, it is possible to include the external movements, outside the body - so that, in this way, the external space is conquered, and

a balance of movement occurs. In *Bambodança* — nomenclature used to refer to dance with hula hoops - these movements are called “On Body” and “Off Body”⁴.

When the interpreter conquers internal space, he creates an elasticity and a tone in the musculature that is thrown (or launched) towards the outer space. Purposely when an actor-dancer wishes to communicate an intention of a movement, it is driven by the interior space. This projection can occur in a more or less intense way, occupying greater or lesser distances and in any direction. The combination of space in the joints, greater or lesser elasticity in the muscles and the quality of the flow (controlled or released) will give variations in the projection of a given movement. (LOBO; NAVAS, 2003, p.68, free translation).

Gradually, with continuous and daily work with the hula hoop, these internal spaces increase and, to maintain the continuous flow of movement, the muscles create a differentiated tonus, especially when the size of the object is changed to greater or lesser, changing thus its speed and, consequently, creating a tonus that can vary from the highest to the lowest. This work thus directly influences the projection of the artist's body in space.

Due to social and emotional conditions, over the years, our movements and expressions tend to become less and less responsive. There is a limitation of education and society, which wants a body adapted to standards; the latter, repressed, suffers a loss of identity, and develops muscle rigidity harmful to physical and emotional health. In dance, there are many rigid and coded techniques that can further distance bodies from their identity to make room for a technical model. These are techniques which keep dance teaching focused on the execution of the movement, they are not very flexible when it comes to an individual space of sensation and creation. The same happens with *Bambodança*, which, as it is a highly codified technique, ends up creating a standardization of movements in which the technical value and the difficulty of execution are much more appreciated than the individuality and expression of the individual. There are several forms, however, of possible thoughts about dance with hula hoops, and in this work, we propose a different approach, which prioritizes sensitive and liberating work for those who experience it.

Working with the student, be it a child or an adult - since they both carry pre-established social, behavioral and movement patterns - becomes a difficult task for the teacher, as he often needs to perform an almost therapeutic function and requires of the student who is open to dismantle these standards, being a self-observer and a questioner of himself; so that a work of self-knowledge can take place and expand his possibilities as an interpreter-creator.

⁴ On Body movements are those that happen with the hula hoop in contact with the body and Off Body movements are those in which the practitioner explores the object's relationship with space.

Hula hoop dance work is no different from other dance works that involve sensitivity and perceptive care for one's own body, such as contemporary dance and somatic education, and that is why we started with raising awareness to prepare that body for new possibilities that we aim for.

At the workshop, based on the thinking of Klauss Vianna⁵ (1928 - 1992) on teaching and on somatic education, we started with the work of “chegança”⁶. We call attention to the feet, the support base of the body that will reflect the entire functioning of the spine, while verbally reporting our bodily experiences, personal trajectories and questioning about what is sought with work. Firstly, we started preparing this body while still in pause, bringing our look to ourselves, feeling the body's temperature, supports, weight, position, and the environment through awareness of its location, sounds and noises around and field of vision. From that we put it in motion, bringing simple everyday situations like stretching, bending, heating joints, all without the object (hula hoop), so that the body is available for the relationship with it and reveals how we use and transfer our supports, as well as what are our limitations of body and creative vocabulary.

We were attentive to make the individual aware of the concrete study of his body before starting a coded hula hoop training. As in other dance techniques, it is common for the artist to have an expectation of movements they want to learn, and this phase is as if we took them out of that dream and brought them into a universe of questions. We verified that this is a necessary phase for the artist to build body work safely.

In dance, we start with anatomy, whose first approach must be to become aware of the skeleton. We use as a base an artificial skeleton external to us, to visualize its structures, and then study them in our own bodies. In the case of hula hoops, this knowledge occurs simultaneously. We chose to start by raising awareness of the pelvis movement, taking the hula hoop to the waist, studying this part of the body first, as it is its center, which needs to be strengthened before the other parts, which will only be able to move because of that first. Then we studied the movement of the hula hoop in the rib cage, shoulder girdle, neck, and head.

When traveling the central axis separately, we try to make the movement upward from the waist to the neck, and downward, from the neck to the waist, passing through all parts, making the entire central axis available in a sinuous movement, like snake's one. The challenge in the descending movements is, by means of the turns, to prevent gravity from acting on the hula hoop making it fall and using the gravitational movement to its advantage, while, in the case of the ascending movements, the challenge is, through the movement and changing supports on the body, overcoming gravity in an antigravity movement (which is more difficult). After becoming

⁵ Klauss Vianna is an important dance philosopher that has influenced generations of dancers and choreographers in Brazil (<https://enciclopedia.itaucultural.org.br/pessoa349623/klauss-vianna>).

⁶ “Chegança” is a neologism, even in Portuguese, meaning the action of arrive and make yourself available for work

aware of the central axis, we can include the turning in the legs and encourage the upward and downward movements, now including this part of the body, bringing a total and complete movement of the entire axis.

During these movements the hula hoop produces a massage in each of these parts; so, we started working with what we call *On Body* movements. Over time and with a greater experience of the participants, we are making the movements on this axis more difficult.

Following the knowledge of the body structure, we move on to the other joints that are the hands and feet and then, finally, we explore the movements that are outside the body - or as we call it, the *Off Body* movements.

In these movements (*Off Body*), we use Laban (1978) as a reference, working on the table, door and wheel planes (RENGEL, 2001). We can see that all hula hoop movements outside the body are related to these planes.

After learning several techniques, we then propose an expressive relationship with the object. This relationship creates what we call a structured movement, which is when the scenic body is organized in a context to give meaning to the contents and images of the dance in order to structure a scenic discourse.

The hula hoops can be considered scenic objects, as they are objects to dance with, that is, they complement the movement of the dancer. We chose work with hula hoops because of the relationship between the object and the symbols present in its circular shape. By considering them, we saw power in connecting dance work with hula hoops and the meanings present in this form, as well as the study of this, present in analytical psychology. The circle as a harmonious and representative object of the totality of being (conscious and unconscious) would enable us to improve the unity between the body and the mind, with the hula hoop as mediator of this process. The hula hoop, for us, synthesized as a symbol what each one sought and felt in relation to dance, which was the feeling of integration.

The circle as a symbol of integration emerging from the experience of dancing with hula hoops

The circle is a symbol found in different fields of study, including psychology, as we see in the book "Man and his symbols" (JUNG, 2008), in which Jung reserves a part just to speak of the circle as a symbol.

The circle, or sphere, symbolizing our being, represents the totality of the psyche, that is, the relationship of being with its conscious and unconscious, and its relationship with the external environment that surrounds it. This symbol has always been present in various civilizations and in different peoples. Jung calls our attention to this fact, revealing the presence of an inner archetype. In this way, all human beings would carry and live the experience of contact with this image someday. As a symbol of integrity and totality, it stands to reason that it is within us and that it manifests itself in some way during our lives. The human being looks for an integration (body / mind, conscious / unconscious) and for harmony.

Circular mandalas, often used as a focus of attention for meditation (yantras), are symmetrical and harmonic figures and often take us to another body state - a calmer and more relaxed one. They provide this state of serenity, precisely because they represent the unity and totality of the psyche (conscious and unconscious). Thus, when we look and focus our attention on this symbol representing totality and harmony, through contagion and identification, we are resembling it and thus achieving a state of inner peace.

Geometric figures or shapes can bring about changes in our internal state, as in the case of mandalas. But these figures can also, from another angle, reveal our internal states and the contents present in our unconscious. Artistic productions involving harmonic circular shapes, for example, reveal a more organized state of a certain person's unconscious, as well as drawings that bring a connection of circular and square shapes represents the connection between the mind and the body (the latter associated with the symbol of the square).

Thus, we believe that the work with the hula hoop, being a circular object, can provide for the practitioner a state of wholeness, integration, harmony and tranquility, both for those who do and those who assist. In addition, movements *On Body* and *Off Body* can provide even greater work in relation to the totality of the psyche, since it also concerns the relationship of the being with the external environment (relationship worked on in these movements). And, in a secondary way, working with hula hoops focusing the body in relationship with space can provide an internal work of connecting the conscious with the unconscious. If the body is understood in an integrated way, if we work and modify it in relation to the external environment, it can also reverberate in the internal and vice-versa.

In some way, too, we consider that working with the hula hoop can be an important and significant means of contact and diving with our own internal and external contents, conscious and unconscious, seeking in some way to integrate them.

In addition to the hula hoop being a circular shape, its practice also requires a flow, an immersion of the body in the flow of circular movements. In this way, the body of those who practice hula hoop dancing enters a state of flow. Flow is an ecstatic experience, something that escapes your everyday life, that brings focus, on which you focus. When you focus on something, your brain is totally immersed in this task, it forgets about other things, problems or your own physical sensations.

The dance with hula hoops can provide a state similar to the flow to its practitioners, as it provides a challenge - after all, staying with the hula hoop rotating in some region of the body is something that requires study, time and practice, in addition to providing pleasure, for being related to a game, for being something different and playful. The challenge, linked to pleasure, can provide a state of deep immersion and attention in the present moment, almost a meditation that provides a state, calm, pleasant and of body / mind union.

When the hula hoop manipulation is mastered and it becomes something fluid and pleasurable, we can notice a state of trance and immersion

related to the repetition of circular movements. The manipulation of hula hoops provides, for those who are doing or seeing, a plunge into fluid, constant and repetitive dynamics, especially when the movements are made with colored hula hoops, like the ones used in the presentation of this work, once the images formed by the swirling colors of the hula hoops draw more attention than the bodies, creating a hybrid body-hula hoop figure. To dominate the object's turns through the body, it is necessary to find a continuous movement time. Thus, the manipulation of the hula hoop determined by this continuous time and by fluid movements provides a reassuring state for those who manipulate it and, mainly, for those who see it.

It was based on these initial considerations that we designed the workshop to share with people interested in reflecting on the body on the topics researched. In this way, we will share our impressions about the experience lived in the workshop, in order to further deepen the relationship we established with mathematics and elementary school.

The workshop: an analysis

In a general perspective, the workshop provided new experiences and new bodily places (internal and external) for the participants. Although many movements and dynamics are challenging, the participants reported that they did not feel discouraged at any time, due to the way the instructions were approached and the dynamics were guided. Participants also reported that at the moment of creation, during the exchange and elaboration of a third joint choreographic cell, they felt a connection, they felt it was fluid and natural.

Still on fluidity, one of the questions we asked in the final sharing wheel was whether the participants were able to feel it, if they felt their bodies gaining a flow. They reported that yes, that the contents of the workshop were progressive and that they felt the body gaining a flow of movement due to the attention we had at the time of each dynamic.

We also asked about possible memories accessed through movements made during the workshop and about possible releases of content that were blocked in the body. One of the participants shared about her body condition: the day before the workshop, her spine was stuck due to a fall, causing her a lot of pain. She reported that the proposals we made throughout the activities, since they always included stretching work, made her experience that day easier, allowing her to finish the activity better than when she started it. Still another participant reported that she remembered her childhood during the workshop and said that it is very good to be in a space where she can do this, bring the childhood to the surface.

Finally, another point of reflection that we had was about the path taken to arrive at the more codified tricks and manipulations of the hula hoop. We use other strategies to reach these places, such as heating the body's joints by means of rotations, before trying these movements with the object; build a time of affinity with the hula hoop, explore movements with it on the three

levels (high, medium and low); and explain the work with Laban's plans (table, door and wheel), to then allow other tricks and movements with the object to arise, through free explorations.

Interdisciplinarity: dance and math

Although we had as an initial purpose the idea of exploring movements with the hula hoop as a strategy to relieve body stiffness and enable the body-mind integration of the participants of our workshop, when developing the work in practice we started to notice other possible relationships and to turn our focus to the area of basic education. We were dealing with the circle, which, in addition to being a symbolic element, is also a geometric figure studied by children around the world. Sine, cosine, pi, circumscription, inscription, perimeter, area - what child in the world does not dwell on understanding this form and its nuances? Although the symbolic path to access the circle is accessible in different cultures, we began to realize that we could speak in a much more concrete and targeted way if we also paid attention to the most important character of a hula hoop: it is a circle. Thus, from a simple dance experiment, designed by dancers for people interested in dancing, we began to elaborate on themes arising from geometry that could bring a new layer of depth to the work - quoting just one example, the possibility of guiding people to make their own hula hoops, with the characteristics that they most liked: larger, smaller, with larger or smaller caliber, lighter or heavier materials. The limits of the work began, at this moment, to expand far beyond what we initially thought so specifically within the field of dance. We started looking at geometry from concepts such as the golden ratio and the Fibonacci sequence. We started another trip, along the paths of Geometry.

Geometry is a field of mathematics that studies the geometric shapes, understanding their volumes, lengths and areas, for example. This field is divided into three parts: spatial, plane and analytical geometry. Plane geometry will work with two-dimensional shapes, spatial with three-dimensional shapes and analytics will join algebra with geometry and study coordinate systems based on the concepts of point and line. For this work, we focused on flat and spatial geometry, to find out how these fields could approach the study of dance with the hula hoop.

Spatial geometry works with objects of more than one dimension that occupy space. These objects are known as "geometric solids" or "spatial geometric figures". They are the cone, the prism, the cube, the pyramid, the sphere and others. Plane geometry works with figures that have no volume, that is, they do not occupy a place in space. They are two-dimensional; have a length and a width. Some of these figures are the triangle, the square, the rectangle, the circle, the trapezoid and others.

Flat geometric figures are formed by body parts, whether in static or moving postures, and are also perceived in the displacements made by the body in space, when drawing drawings on the floor. As dance - the art of movement - has the component of dynamics always present, it is not common to observe in a clipped way the proportionality of the drawings formed by

the body, since one posture quickly gives sequence to another, another and another posture. A possible study to be carried out would be to analyze the golden ratio in each captured position (in frames), to identify if there is a correlation between the harmony of the figures and the sensation of harmony that we perceive / feel when appreciating a dance work. A first step would be to study the golden ratio:

Mathematically speaking, the golden ratio is an irrational real algebraic constant obtained when dividing a line into two segments so that the longest segment of the line divided by the smallest segment is equal to the complete line divided by the longest segment, and its value consists of 1.618033987... or, rounding up, 1.6180 (Instituto de Engenharia, 2019, free translation).

The image below, extracted from the same source, helps to illustrate and better understand how this proportionality occurs:

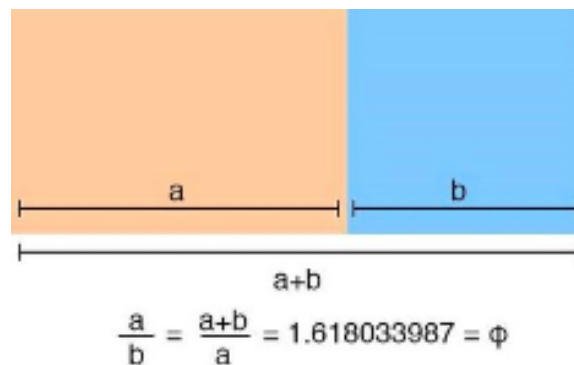


Fig. 3: Golden ratio. (Instituto de Engenharia, 2019).

A better-known image is that of the Fibonacci Spiral (fig. 4), in which the golden ratio is observed in the distribution of the rectangles according to the proportionality observed in the sequence observed by the mathematician.⁷ If we convert the Fibonacci sequence numbers into squares and organize them in a geometric way, we will be able to trace a spiral, which can be found in animals, flowers, in the human body, in buildings and in other places of nature. This proportion is a form of measurement, and it makes things more harmonious in our human eyes, most of the time and time unconsciously.

The golden ratio number is approximately 1,618. This harmonic form of measurement can be found on our bodies, faces, in old buildings like the pyramids and in some paintings, as in the case of the painting of the *Mona*

⁷ This sequence was discovered by the Italian mathematician Leonardo de Pisa or Leonardo Fibonacci (1170 - 1240), who brought important contributions of Hindu-Arabic numerals to Europe. His book "Liber Abaci" was very prominent and introduced this question.

Lisa by Da Vinci. It is widely used to analyze still images but analyzing it in the body in motion becomes a complicator, as it requires specific measuring instruments.

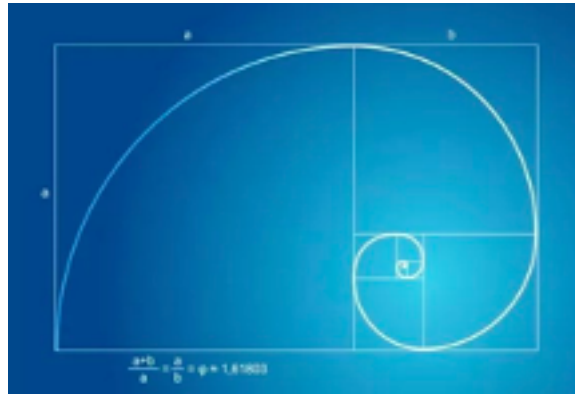


Fig. 4: Golden rectangle / Fibonacci sequence.
(Instituto de Engenharia, 2019).

When formulating a dance course project using hula hoops for elementary school children, we take into account the formation of harmonic images with these objects in interaction with the students bodies, and this has become one of the objectives of this work: to develop and apply a dance course project with hula hoops to be developed in formal education schools in an interdisciplinary perspective with mathematics, taking into account that it is during this phase of teaching that students come into contact with geometry and, thus, perform studies on circumference, connecting us to hula hoops, without losing sight of our main objective of developing affective relationships between dance teacher and students mediated by the hula hoop.

Another field of mathematics involving geometric figures is that of Set Theory. The Venn Diagram, created by the mathematician John Venn⁸ (1834 - 1923), is a visual model, usually constructed with circles, but can also be elaborated with other shapes. These circles are overlaid to explain the logical connection between some set of things or some subject. This diagram helps us to understand points of similarities and points of differences between two or more things, and works with the concepts of union and intersection, the latter being the point of connection and equality between the two or more subjects covered. The Venn Diagram is used to solve questions of logical reasoning and can carry a broader and more complex structure, as in the following case:

⁸ Graduated from Cambridge College and ordained a priest two years after that, Venn was professor of logic, probability and moral philosophy, having as one of his great interests the application of theory in practice. From 1883 his career changed direction and he then became interested in the area of history (Somatemática, 2019).



Figure 5. Venn Diagram (Gradusct, 2019).

These structures can be related to shapes found in nature, like some flowers, and resemble the structures of mandalas and some yantras⁹.

The Venn Diagram can be used in different areas, such as in mathematics, to explain about sets, unions and intersections; within statistics and probability, to analyze the probability of certain occurrences; within logic, to discover the validity of certain arguments and conclusions; and within linguistics, to analyze the similarities and differences between different languages. In dance, this diagram could be used for studies of a sociological nature; in this work, however, he is mentioned only for the harmony suggested by his images, as illustrated by Figure 6, but we could also think that the hula hoop, when used as an object to “fish” colleagues for a dance in partnership, helps practitioners to organize themselves into different sets with two, three or more people dancing on the same hula hoop, as in Figure 7.

The Venn Diagram makes possible, for the field of logic, in addition to analyzing the validity of certain arguments and conclusions and being able to compare and group in similarities and differences certain subject nuclei, to do all this in a visual way. After all, when it is brought to the drawing of the circles (or another figure), this analysis becomes much easier to be visualized in its entirety, being able, from it, to understand its separate parts.

Since this study was important and brought changes to the field of logic, it can also be beneficial for the organization of the body once mind and body were never separated. In this way, it could be said that mathematics and dance come together, because while one can work in the field of organization of logical reasoning, the other can work in the field of understanding and bodily organization, and both can help each other. After all, when we organize our inner mental part, we can notice that it reverberates in our physical external part and vice-versa.

⁹ Yantras are the studies of mandalas, a Sanskrit word that means circle. In other words, it is a study through sacred geometric forms that in certain dispositions are connected, balancing the desired and specific energies.



Fig. 6 (left): Similarity between the Venn Diagram images and the hula hoops arranged one above the other. **Fig. 7**(right): “Phishing” colleagues.

We also observed that this diagram is related to plane geometry, since its geometric designs are in the bidimensional plane – that is, they have no volume. Geometry, in addition to being in the mathematical field, is also found in the philosophical and religious studies fields. For many religions, the shapes in geometry have a spiritual meaning, such as the Flower of Life, a geometric pattern found in Buddhist mandalas, for example. In philosophy, Plato and Pythagoras related geometry to a more general and sacred plane; the second philosopher believed that this mathematical field would be the language of the universe, since numbers would be present in all of nature, in all of creation. The numerical scale is ordered and harmonic, as we can see in the Fibonacci sequence; in this way, everything that follows a numerical scale in nature will be equally harmonious. For these philosophers and religious, this geometry was sacred, because it was bathed in meaning. The sacred, in different cultures, has this characteristic: it gives a path, it commands, it has a center, an essence that guides and unifies things.

In geometry we can see that the circle is an elementary shape that gives basis and life to other shapes or figures. When we take a compass and draw circles of the same dimension and with the same radii and, later, identify their points of intersection, connecting these points through lines, we will see shapes like the square, the triangle, the hexagon and others form. It is from these connections and intersections that the design of the Seed of Life and the Flower of Life emerges.

The forms, in addition to informing us about quantitative and numerical data, help us with logical problems, among other things, and are also symbolically connected with human characteristics and relational aspects. The circle is a form that can be found in nature and that brings an idea of flexibility, movement, innovation, totality. The square, on the other hand, is a form that cannot be found naturally in nature: it is a constructed form

and, therefore, it is therefore mechanical, it brings the idea of rigidity, domain of rationality, structure, stability.



Fig. 8: “Seed of Life” made with hula hoops (Personal Collection).

The psychoanalyst Carl Jung (1875 - 1961) showed great interest in the study of these forms, mainly that of the circle and the square, and what these forms bring in terms of information about our unconscious. According to the author, the circle would represent our psyche and the square our body. In this way, images that bring these two symbols together would represent an integration of the body with the mind, as we see in mandalas, and images that bring these distorted or dissociated symbols would be representing a separation of the body-mind. Images in this second sphere are widely found in our contemporary world, as well as the predominance of square shapes, demonstrating not only a dissociation of the body with the mind, but also an appreciation of and about the body.

Symbolically and in general, the circle represents integrity, unity and harmony. Thinking from Jung's perspective, it would represent our emotions, sensations, feelings and thoughts and, in the educational sphere, he would represent a more fluid methodology, involving dialogue and horizontality. The square is associated with firmness, order, among other words of similar characteristics. For Jung, it is our side of matter and rationality, and for the educational sphere it is a way that holds and limits the possibilities of students and provides a distance from the figure of the teacher towards students.

Conclusion

The research reported in this article exemplifies an unorthodox possibility in the sense that it was dance that led the authors to an interest in mathematics, and not the other way, as usually happens. In the pedagogical structure of most formal education institutions worldwide, the presence of mathematics in curricula is mandatory, while dance appears or not, depending

on the country. The status of these disciplines also varies widely depending on the local culture. In Brazil we can say that the arts, in general, unfortunately continue to be considered as extracurricular, “accessory”, less important than other disciplines and even expendable, in a significant number of educational establishments.

Mathematics brings us the concept of golden ratio, and so we are able to calculate the golden spiral and golden circles from it. These forms are characterized by their harmony, proportion and consistency, which increase pleasure to human eyes, that seek a visual harmonic balance found in nature, but the experience of dancing with hula hoops reveals, in practice, this same harmony, which can awake in children and teenagers the interest in geometry’s studies as well.

It is possible to notice the existence and predominance of spiral and circular shapes in nature, such as, for example, in shells, flowers and even hurricanes, which makes the circle an image that, in different cultures, represents integration and the cyclical and continued character of life in its perennial dynamic. However, spirals have been dances since immemorial time. Frances (2004) characterizes the importance of some circular elements of nature as her reference for sacred circular dances (which emerged with the German / Polish choreographer Bernhard Wosien, in 1976):

[...] the sun, the source of light and heat, revered as the primary source of life. Thus, the Sun was worshiped. The moon was also seen as round, meaning the compensating force of delicacy and beauty. Today, we know that the Earth is also almost spherical. Thus, the circle imitates these essential aspects of life (Frances, 2004, p. 75, free translation).

Besides that, the author emphasizes the presence of the circle in several thoughts directed to the connection with nature:

The circle has been used to exhibit this cyclical nature in many ways: the signs of the zodiac are drawn in a circle and the Earth symbol is a cross within a circle. Jung's circle of life is a circular design divided into four quadrants representing birth / childhood, adolescence / youth, maturity and old age / death. The same symbol of the cross within the circle can be used to illustrate the cycle of the seasons (Frances, 2004, p.76, free translation).

With these examples, we can realize why the circle is an image often used in symbolic elaborations of different cultures. When it appears in circular dances, carries a connotation of sacred, since ancestral rituals and dances, when performed in a circle, had for their first objective communication with the divine, in the intention of thanking and asking for food, blessing to the lands and healing, so that they believed that the union of people in the circular shape, facing the center, concentrated the intentions of all towards the center of the circle, so that everything that was put or generated there would be sacred and blessed. Thus, these dances were often performed before hunting and to attract a good harvest.

In contemporary pedagogy, on the other hand, the disposition of people in a circle is a strategy to improve the quality of communication, removing the hierarchy of relationships, since everyone speaks equally, looking into the eyes, including the teacher. In the courses of Bachelor and Degree in Dance of the University of Campinas, for example, since the decade of 1980 (time of the creation of the course) the so-called “conversation circles” prevail, methodology that the students graduated in the Degree in Dance take for their later experiences as dance teachers.

In dances in which we find overlapping circles, when viewed from above, it is possible to return to mathematics once again, when viewing one or more Venn diagrams, which, therefore, become mandala designs, which can be created intentionally, as it occurs in sacred circular dances, or just as an aesthetic form, working the harmonious look that the circles create, for the appreciation of human eyes in the search for this balance of the curves of nature, generated by human movement while dancing.

We started the work by examining the establishment of affective relationships in dance teaching mediated by hula hoops, and the process has revealed itself, along the way, a powerful stimulator of affective relationships towards mathematics, such a controversial school subject that still raises so many insecurities in elementary school students, from children to teenagers. Could dance, without being instrumentalized by mathematics, become a means of access to knowledge about the circle, in itself? Could the study of the circle not be the property of a single discipline - mathematics - but be the subject of several disciplines, including dance? Could dance teaching mediated by hula hoops consolidate its potential for opening minds, integrating what has never been disintegrated - body and mind -, establishing affects between people, between school subjects? Between Mathematics and its own fields, like Set Theory, Geometry and others?

We let some images of the presentation of the conclusion work, in 2019, and conclude this article with questions that we hope will guide future research giving rise to interdisciplinarity through an affective perspective in dance teaching.





Figs. 9-12: Pictures of the conclusion work presentation, 2019 (Personal Collection).



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