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CHAPTER 7

RELATED TOPICS: SOMATICS AND PILATES IN DANCE

Adriano Bittar / Aline Haas / Janine Bryant

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INTRODUCTION

The quotation “Dancers are the athletes of God”, is often used in the dance community to describe the mix of athleticism and spirituality with which professional dancers dance. This saying is attributed to Albert Einstein and, although no one seems to be able to pinpoint when, where and in what context Einstein said it, this citation withstands and aptly applies to dancers everywhere.

Silvia Davini (2007, 2002), in her research about the training of performing artists, shed some light on the understanding of this seemingly beautiful, yet “unknown state”, in which dancers’ bodies create an art form totally based on physical qualities, skills and a highly developed kinesthetic awareness, dependent on: “[...] a body production capable of creating complex senses, controllable on stage. From this perspective, voice and movement are body productions of the same category, able to

organize complex speeches and to establish performance control parameters.” (Davini, 2002, p. 60).

Thus, for the body to become a danced poetry and dancers, “athletes of God”, it is necessary that they develop an awareness that each body is capable and producer of its own syntax, so that transformations based “[...] on how each dancer deals with his/her own body can determine the boundaries and extensions of the artwork itself.” (Tourinho & Silva, 2006, p. 127). Ferreira & Silva (2012) and Ferreira (2013) have also delved into defining what it means to be poetic in dance: to put oneself in *poiein* (a Greek word, meaning “to create or make”); to hatch or break through a place in which body structures and paths are transformed into materiality, which can be triggered by the artist’s needs. Bittar (2015) tries to synthesize it, stating: “[...] to dance is to learn principles of movement and to expand them in one’s own ways; [...] movements should be both inward and outwardly focused; [...] the organisation of the perceptive sphere determines the dance that is made.” (p. 169-171).

In recent years this body construction has been overstretched, because increases in the physical and poetic demands of dance have required that dancers perform powerful and faster moves, in extreme ranges of motion (ROMs) and with varied movement qualities, often resulting in debilitating injuries, that suggest dance technique classes alone are insufficient for this contemporary phenomenon (Bittar, 2004, 2015; Pizarro, Cunha & Vellozo, 2019). Moreover, as explained by Batson (2007, p. 70): “To convey meaningful and nuanced beauty through an expanded movement range, dancers must spend supranormal numbers of hours practicing in class and rehearsal, with additional hours devoted to personal physical cultivation”.

Therefore, the training of dancers has come to be a complex combination of dance technique classes, somatic practices and conditioning (Chmelar & Fitt, 1990), with the two latter often not available and not included in the dancers' working hours, even in major dance companies. The introduction of regimes based on such an assumption is becoming more and more necessary, as vocational and professional dancers are challenged to keep up with the technical and poetic demands of artistic directors and choreographers alike (Bittar, 2004; Batson, 2007; Bittar, Melo, Noieto, & Lemos, 2017).

In this chapter, Somatics⁷⁹ and Pilates are presented as tools often used by dancers for injury prevention and performance enhancement. The following are some reasons why it is time to rethink dance training, including biomechanical, physiological and motor control principles within the context of overall dance training.

1. SOMATICS AND DANCE

The combination of complex qualities found in the dance technique class may be one of the main reasons for Somatics⁸⁰ to be

⁷⁹ Throughout the whole chapter you will find Somatics spelled with a capital "S", as advised by Diego Pizarro, one of the authors. According to Pizarro: "*Somatics with a capital "S" refers to a neologism created by Hanna to describe a specific field of knowledge. We use it in lowercase whenever it is functioning as an adjective.*" When quoting other authors' original works, such as books and articles, and parts of what they wrote, we kept the word Somatics/somatics as used by these authors.

⁸⁰ Somatics is the term used nowadays to substitute a variety of other words used to describe this field of study. For example, in Brazil the terms "body awareness" and "body expression" were present for decades before they were replaced by "somatic education", especially inspired by the Vianna family's proposals (Angel, Klauss and Rainer Vianna). In the United States of America (USA), prior to the popularization of Somatics, the most common terms were body therapy, bodywork, body awareness, or mind-body practices. Fortin (2002) remarks that in France, Somatics was something unheard of not so long ago, and there is hardly any use of the term, since institutionalization as an official formation of dance-education teaching policy established it as the *L'Analyse Fonctionnelle du Corps no Mouvement Dansé - AFCMD* (Functional Analysis of the Body in the Dance Movement).

used in the training of dancers (Batson, 2007; Bittar, 2015). Body therapies, guided imagery, neural patterning, proprioception and constructive rest are but a few of the possibilities available. The general idea is to give the dancer's body some quality time to let things "sink in" and find its inner potency, achieved by a deeper listening to the body. Somatic interventions are normally performed in a slow manner⁸¹, so that integration and sensibility can be fostered for artistry and emotion to be expressed. Even though medical research has not provided clear scientific evidence that these practices are effective, social science research, anecdotal information and more than one century of lived experiences within somatic research suggest they play a striking role in dance.

The term somatic education became popularized by Thomas Hanna (1928-1990) around 1980. He defined it as an experience of bringing awareness to the inner body in synergy with the World. This awareness is related to the processes in the body, breath, voice, circulation, emotions, habitual movement patterns, postures and tensions, as opposed to the idea of the body as an object (Hanna, 1993). The result from engaging in somatic activities is that a deeper attention is given to the body in space and to the interpretation of body sensations. Such a heightened state of being enables dancers to consciously search for better mechanics and for a mindful state, in which, by staying more connected to the present time while moving or not, they can turn pain free and perform with greater vitality and expressiveness (Eddy, 2009).

In Somatics, self-empowerment and critical thinking through experience are key, and the body is considered as a

⁸¹ Minimization of effort and speed of movement is only one strategy utilized specially during initial stages of somatic learning (Batson & Schwartz, 2007).

self-regulatory mechanism. As such, it is capable of refining its perceptual, kinesthetic, proprioceptive and interoceptive sensitivity in order to recognize habitual patterns of postural and movement interactions with the environment. The ultimate goal is to improve movement coordination and overall body integration, which can lead to a transformation of one's self.

The inaugural techniques in Somatics include Alexander Technique, Laban-Bartenieff Fundamentals of Movement, Eutony, Feldenkrais, Ideokinesis, and Rolfing. As time passed, other second and third generation methods, like Body-Mind Centering*, Continuum and Experiential Anatomy, to name a few, appeared. Even now it is possible to have a Somatics-based ballet class, meaning that some of the somatic principles are in use in that class. Although, there are rules that keep Somatics unique and different from the majority of dance technique classes, such as a shift from outside authority to a self-responsibility and autonomy, decentralization of decision-making and cultural pluralism (Batson & Schwartz, 2007).

Since Thomas Hanna announced Somatics as a field of study and practice in the 1970s, bringing together various Euro-American techniques, methods, and systems, developed since the late 19th century, it has developed itself consistently in various corners of the Western world. Moreover, rather than focusing on specific methods, the field of Somatics is widening as a breeding ground for first-person experience research and its inclusion within the collective in relation to the environment (Pizarro, 2016).

In this sense, it is even observed that the ritualistic, cultural and social practices of native people in various countries share an extended somatic coexistence. Thus, holism, communion, subjectivity, integration with nature, and belief, based on

practice and doing, forge intrinsic aspects of a field that has been named by the global north in its tendency to capture and delimit movements and practices. Such movements have existed for millennia as characteristics of worldwide traditional cultures. Hence, the field of Somatics today is as broad as the existence of living expression approaches, according either to the actuality of structured methods or the simple gathering of people together in order to promote integration through the experience of their physical, mental, energetic, emotional, and spiritual bodies (Pizarro, 2016). The way each culture relates to this “international movement” is peculiar and differentiated in relation to social, political and economical contexts. Therefore, according to Fortin (2002), Somatics is neither homogeneous nor a unified international field, especially when we delve into the somatic manifestations carried out in each country.

When expanding the notion of Somatics as a way of being in the world – a process that encompasses the lived experience from the perspective of the first person with the collective in the environment without necessarily setting immutable rules for its existence – new processes arise to think about Somatics in dance and its integration with Dance Science, remarking its differences and expanding possible points of contact and integration (Pizarro, 2016). Indeed, it would be reductive to talk about Somatics without commenting on the breadth of development that the somatic field has taken over the last decades.

Academia’s embrace of Somatics, driven by the efforts of Hanna (1970, 1976, 1980) and Don Hanlon Johnson (1992, 1995) and their somatic theories, for instance, has grown dramatically since the 1970s. Thus, Somatics has also become a methodological approach to research, following the international movement of artistic Practice as Research (Barret & Bolt, 2007).

Understanding the place of Somatics, as a new paradigm in academic research, then gained additional outlines. Somatics as Research (Fernandes, 2014) brings forth Somatics as a way of exploring, structuring and organizing research processes:

The point is that somatics reverses a fundamental principle of scientific research, namely, that one must distance oneself from the research object in order to analyze it. The somatic researcher is an immersive performer, i.e., he/she integrates experience and real-time analysis, deconstructing the study subject as a passive and tractable object, and instead dancing with(in) it. [...] The somatic researcher/performer is not only immersed in research as an imminent field of discovery, but is him/herself part of this field, starting from the experience lived in space time. (Fernandes, 2014, p. 122)

For instance, the Somatic-Performative Research proposed by Fernandes (2014) is a methodological approach that proposes new pathways for the wide scope of Performing Arts research. It involves several principles embedded with its foundational, thematic and contextual characteristics. As an approach, it includes several possibilities, being based in the concept of “Art to the Art” as a fundamental element of its procedures. Subject and object are utterly integrated into their roles within this research. By affirming the unique ability of the artist researcher on “transforming secular dichotomies into somatic and ecological modes of contemporary life” (Fernandes, 2014, p. 77), the author quoted affirms another type of privileged intelligence in this approach, a somatic intelligence.

However, this type of intelligence, which is usually part of the cellular consciousness, long before it is processed by the

nervous system, has another time, quite different from the actual time – the one that attends the productive and “reproductive” demands of the academic universe –. Somatic-Performative Research products also include multisensory data records such as drawings, texts, testimonials, moving images, still images and sounds, among others. This should not be confused with lack of rigor, as the research rigor in Somatics aligns itself with other paradigms, which may be fallible, because they are at the same time exploring possibilities within the internal logic of each and every research. Ultimately, any research is then considered a pulsating soma, as living organisms that claim for their space and for their issues to be experientially considered.

Notwithstanding, the subjective aspect of such research paradigm, somatic narratives and data are a complex product borne out of a high level of critical reflection. For instance, in thinking about somatic epistemologies, Isabelle Ginot (2010) analyzed the written discourse of some pioneers of somatic practices, such as Matthias Alexander, Moshé Feldenkrais, Elsa Gindler and Bonnie Bainbridge Cohen. She argues that these authors draw on science and experience reports as a way of feeding belief in their methods, producing endogenous discourses that are unrelated to each other. Despite the relevance of this study, one must first consider that in somatic practices written discourse does not stand apart from its practice and its oral tradition. However, Ginot (2010) affirms positively that, when leaving the comfort zone of the founding discourse contexts, several practitioners have experimented Somatics in diverse contexts of precariousness, interculturality and underprivileged groups. As a result, these practices have developed innovative discourses by themselves, moving away from the domain of the belief in science evidenced by the founding discourses. For instance, both

Hanna and the pioneers of Somatics would, thus, have created a functional fiction among various discursive strategies (De Giorgi, 2015).

Considering that this criticism makes sense, especially in the breadth of Somatics academic development as a field of study and practice, it seems also important to accept that paradoxes are inevitable:

As a feminist post-structuralist researcher, I see somatic practices as a site of “normal conflict” produced through a whole range of discourses, always under co-construction, and full of grey zones. As practitioners or researchers, we constitute ourselves as hybrid subjects with contradictions in our lives. (Fortin, 2017, p. 150)

Although Hanna (1973) advocated Somatics as a science, Batson, Quin, & Wilson (2012) claim that it took decades for Dance Science and Somatics to find a common basis for conversation towards their integration. As in a vicious cycle of exclusions, each has developed apart from the other with its specific paradigms. While Somatics remained tied to the individual narratives and subjectivity characteristic of their processes, the objectivist pragmatism of Dance Science remained true to analytic empiricism. But Batson (2007; Batson & Wilson, 2014), for instance, has been looking for ways to integrate Somatics and Dance Science in academic research for at least three decades. By doing so, the author utilizes narratives and first-person somatic research as well as scientific integration of both fields.

On the other hand, Jill Green (2015) deeply questions the issues concerned with the location of Somatics under the “umbrella” of Dance Sciences, as she notes it is happening in

several higher education dance programs in the United States of America (USA). However, she states that, when invited to take part in a research initiated in the sciences, she began to think more complexly about the issue. Looking at research carried out by Batson and Green, such integration seems to be possible. Just as Batson uses participant narratives as well as evidence-based data, Green uses both the phenomenological experience and the critical rigor of postmodernism in her research. As professors, practitioners and researchers of Somatics, both of them are well aware of the importance of integrating the subjectivity of Somatics with the objectivity of science, each of the fields teaching the other how to emancipate and coexist in a fruitful dialogue.

While recognizing the limits of first-person experience, Green refuses to relinquish experience to the detriment of a theoretical framework, and vice versa. Batson dives deeper into the quest for the integration of Somatics with Dance Science, highlighting the specifics of each of these fields in research, and recognizing their different paradigms, without submitting one to another:

Both somatics and dance practices create an embodied consciousness and turn us towards cognition and self-knowledge. Somatics opens us up to the world of actuality (an opening to the possible) and dance training opens us to the possibility of expanding our notion of being in the world. Dance science tends towards a different lens – looking at the mechanics of movement, physiology and psychology as a means of optimizing our dance training and performative goals. Combining somatics and dance science provides a more comprehensive understanding for dance training that could feed and progress our dance practices. (Batson et al., 2012, p. 187)

For the authors, “[...] scientific constructs of embodied cognition and phenomenological constructs of embodiment [...]” (Batson et al., 2012, 184) present themselves as emerging paradigms that readily may link Somatics and science. Indeed, said authors reaffirm the richness and emergence of such integration, with theories and practices coming together as a reality today. Forty years ago, when differences between both science and Somatics were thought to be unbridgeable, the connection between these fields was not possible, existing only as a desire and a need within dance training (Eddy, 1991; Myers, 1991). Despite the fact that there is still a lack of scientific research showing outcomes of Somatics in dance training, denying the affinities between both fields means to erase innovative theories coming from sciences itself, as Neurophenomenology, for example. In addition, beyond claiming for scientific research on Somatics, researchers might perceive and recognize the paradigmatic instances concerning both fields, highlighting their affinities⁸², as well as their differences.

The creation of the Brazil-United Kingdom Dance Medicine & Science Network (BRUK DMS NET) is a great opportunity to carry out research for the integration of Somatics and Dance Science. In this realm, many kinds of projects may be developed, including, but not limited to, at least three different themes: 1 – scientific research about Somatics in dance; 2 – somatics research concerning dance training and dance creative processes; 3 – Somatics and Dance Science in conversation for the enhancement of both fields.

82 “Etymologically, an affine is one who is situated *ad finis*, one whose domain borders mine. The affines are those who communicate by the edges, who have “in common” only what separates them.” (De Castro, 2018, p. 67).

2 PILATES FOR DANCERS

Dancers need sufficient strength, flexibility and neural integration to meet the ever-increasing demands of differing roles. The artists-athletes who can expertly perform demanding roles understand that the artistry of the role cannot be compromised because their activities have been solely focused on one aspect of training over another. The best dancers seek balance. The issue raises legitimate questions regarding what activities are most effective for building strength as well as flexibility (Koutedakis & Jamurtas, 2004).

It is thought that a great activity that offers a balance between strengthening, stretching, core functional activation, alignment and coordination is Pilates (Bittar, 2004, 2015; Ahearn, Greene, & Lasner, 2018), but medical scientific research is still to prove it. Pilates seems to work with sophisticated and integrated movement patterns that train both types of muscle fibers at the same time. It could be thought of as whole-body re-education system, implementing corrective exercises that might prove to be necessary for dancers.

Pilates is a system of movement that uses a varied set of body conditioning, corrective and therapeutic exercises developed over a span of 60 years by German-born athlete and pioneer, Joseph Hubertus Pilates (1883-1967) and his “wife” Clara Zeuner (1883-1976). Initially known as “the art and science of Contrology”, Pilates was defined by Joseph Pilates as the complete coordination of body, mind and spirit (Pilates & Miller, 1998).

It is believed that Pilates originally created his method by linking oriental techniques and philosophies, such as Yoga and Martial Arts, to western body education methods, such as Ling Medical Gymnastics and dance techniques developed by Rudolph von Laban. Pilates follows six basic principles: concentration,

centering, flow, breath, precision and control (Friedman & Eisen, 2005). This set of principles functions in an integrated manner in all of the more than 500 exercises created by the German masters (Panelli & De Marco, 2017).

Used by many dancers and non-dancers, Pilates incorporates matwork exercises and also machines, such as the Reformer, Cadillac/Trapeze Table, Chairs, Barrels, etc. Anecdotal data shows Pilates can increase core conditioning, overall body awareness and stability (Kloubec, 2011; Barbosa, Guedes, Bonifácio, Silva, Martins, & Barbosa, 2015; Bernardo, 2007), improving posture and alignment, leading to an economy of energy during movements and an increased ROM (Emery, De Serres, McMillan, & Côté, 2010; Phrompaet, Paungmali, Pirunsan, & Sitalertpisan, 2011). It is also speculated that Pilates stimulates circulation and promotes new neuromuscular patterns and more precise coordination (Parrott, 1993; Segal, Hein, & Basford, 2004). All these things combine to possibly prevent injury, and may aid in alleviating chronic pain (Amorim et al., 2011; Amorim et al., 2011a; Bittar, 2004). Unfortunately, these are not well-designed evidence-based studies (Bergeron et al., 2017).

In the United Kingdom (UK), Pilates instructors can work in several different environments including private Pilates or fitness studios, in conjunction with rehabilitative specialists such as physical therapists, athletic trainers, and occupational therapists, as independent contractors, in dance companies and schools. In Brazil (BR), Pilates is normally another tool used by Physiotherapy, Physical Education and Dance graduates, in studios, gyms, hospitals, universities, dance companies and schools.

Why is it that, as far as supplemental training is concerned, so many dancers seem to gravitate toward Pilates in the first

instance? It might be because since 1926, after arriving in New York city from Germany, Pilates established his studio in 8th Avenue, beside the School of American Ballet and New York City Ballet. By word of mouth, many injured dancers got to know that a certain “German master” applied a conditioning technique that resembled lots of gestures practiced in dance. Joseph also mingled with dancers and created a collection of exercises using them as guinea pigs. From early 1940s onwards, Joseph was also a frequent teacher at the Jacob’s Pillow Festival, contributing with his teachings for the body conditioning of many dancers (Pérez & Aparicio, 2013). Some of those dance students became the first followers of the Pilates method, turning to be masters and true disseminators of this work. They became responsible for keeping this method alive (Siler, 2008).

Ever since, Pilates has been linked to dance training, gradually evolving to integrate current biomechanics, physiology, motor control, and DMS concepts. The roots of Pilates are derived from Joseph’s philosophy and movement patterns, with dance and gymnastics being at the core of its development. It is important for all dancers to know the lineage that each Pilates teacher belongs to. It may seem complicated at first, but it is required of teachers that they keep learning with the elders, as Pilates has always been taught in a master-apprentice manner, the same as in classical ballet.

2.1 Powerhouse or whole-body training?

According to Siler (2008), in Pilates the trunk is the main place for understanding movements. This is where the “powerhouse” is located, and from this “center”⁸³, movement initiates and radiates throughout the entire body. Therefore,

83 To know more about the “powerhouse”, please refer to “Core Training” on Chapter 6.

muscles of the abdomen, lower back and gluteus are the ones that act constantly in all Pilates exercises. They are trained so that right body positioning is attained and endurance is increased, collaborating for the maintenance of posture and of the physiological curvatures (Loss et al., 2006). Trunk stability and organized overall body mobility in all planes of movement are key, and quality of movement brings about a sense of self and moving from within that are important characteristics in the method.

Pilates exercises are divided into four levels: basic, intermediate, advanced and super advanced. All of them, regardless of their levels, have as main goal; full body development through proper activation of the “powerhouse” (Panelli et al., 2017). Even with the “powerhouse” being considered the most important region of the body, Pilates is also intended to work the upper and lower limbs, requiring simultaneous participation of the whole body (Albuquerque, 2006; Panelli et al., 2017).

In Pilates, different types of breathing patterns are used for core training and whole-body organisation. Deep exhalation is key to a full inhale (Pilates et al., 1998). Some say inhalation should not expand the abdomen, but this might be more restrictive than beneficial. Thus, an overall distribution of the inhale through the abdomen and thorax seems a better strategy (Anderson et al., 2000; Bittar, 2015). When exhaling, a gentle tridimensional drawing-in of the abdomen is required. Too much contraction of the Transverse Abdominis (TrA) is seen as not such a good strategy. Ron Fletcher, a Pilates elder, created the Percussive Breath[®], done with air being blown out through the back of the teeth. The difference from other breathing techniques used by related lineages is that they exhale through an open mouth, or through the nose. Research about Ron’s breath has suggested

it is useful for a better activation of the respiratory systems of adolescent ballet dancers (Bittar et al., 2017; Melo, Noletto, Bittar, & Lemos, 2018).

Different pre-Pilates exercises were created by most Pilates schools. They normally start in neutral spine, but not all are performed in supine. Pilates mat favors spine flexion and a balance between spine available motions is advisable. Mat exercises work in chains and the right execution of movements is key to take the dancer beyond. Exercises on the machines constantly mimic mat exercises, and the springs used facilitate or make the exercises even harder. Repetitions of each posture/exercise do not go above 8 times in general. Then, for endurance, different postures are used to activate the same muscle group in more sets and repetitions. Super advanced Pilates is geared towards more gymnastics movements, requiring full body activation and a lot of control.

2.2 Scientific data

Unfortunately, until this day, there is a scarce number of well-designed studies about Pilates and dance, showing there is a lack of medical scientific information in the area, and a weak support to account for the effectiveness of Pilates in dance (Bergeron et al., 2017). Bernardo et al. (2006), for instance, published a literature review about Pilates training in dancers and found that just five clinical trials were scientifically sound. The weakness on the scientific data was related to research methodology: small sample size, no determined statistical power and lack of true experimental designs. The authors suggested more studies should be developed with control groups and randomized subjects, calculation of statistical power and use of valid and reliable methods to measure outcomes.

Bergeron et al. (2017) published another systematic review about Pilates and dance, and 11 years after Bernardo and Nagle's first review, only nine well-designed clinical trials were found. Again, the majority of the studies in the area were considered poor in quality, according to PEDro scale's rules, presenting lacked blinding protocol, insufficient statistical data, and using assessment methods that are not specific for dancers. These authors concluded that Pilates in dance is effective in improving muscular conditioning and flexibility, but appears to be ineffective to increase vertical jump and balance.

Studies that could contribute for the understanding of what Pilates effects in dance are, from 1996 to 2018, added in a chronological order, include Self, Bagley, Triplett, & Paulos (1996), that analysed knees ranges of motion (ROMs) (flexion and extension) and forces in play during *demi-pliés* in *fifth* and *first positions* in standing, and on the Pilates Reformer with two and with four springs engaged. The subjects were 5 males and 5 females, 16-31 years of age, of a professional ballet company in the USA. The results showed that the subjects had greater ROMs in the *first position*; and female dancers had more extension than males. The highest force in the knee was obtained on *demi-plié* in standing and the largest knee flexion angles were on the Pilates Reformer with four springs added.

McLain, Carter, & Abel (1997) developed another study using Pilates exercises on the Reformer as a training protocol. They analysed 24 dance students from California State University/USA; 14 in the experimental group, exercised for 8 weeks on the Reformer, and 10 in the control group, received no Reformer classes. The jump height from a supine position on the Reformer and the pelvic alignment in jumps in standing (parallel and *first position*) were evaluated. No significant difference was

found between the groups in jump high in the supine position after 8 weeks of intervention; nonetheless, each group showed significant improvements. The alignment of the pelvis did not improve after the Reformer training protocol, showing Pilates has no significant impact on this variable while executing jumps from standing.

McMillan and colleagues (1998) also designed a study to examine the effects of a Pilates-based training on ballet dancers' dynamic postures during *grand plié*. Participants were 10 young dancers from the École Supérieure de Danse du Québec, divided into control and experimental groups. The experimental group trained individually twice a week, for three months (23 classes), with a Pilates teacher in matwork and Reformer routines; and did some mat exercises as homework. The control group continued its normal routine. The vertical alignments of the head, shoulder, and pelvis on the anterior-posterior axis during *grand plié* were measured before and after the Pilates-based training. The experimental group was more stable in the upper body than the control group. These results indicate Pilates on the Reformer could improve dynamic alignment of the torso in ballet dancers.

In a study conducted by Albuquerque (2006), it was verified that contemporary dancers who practiced Pilates had improved technique, proprioception and concentration, which led to more fluid movements. Amorim et al. (2011), Amorim, Sousa, & Santos (2011a) and Leitão, Silva, & Rasia (2013) also found that Pilates can significantly improve muscular strength and flexibility of classical dancers; being a promising tool to be used as supplementary training to ballet dancers.

Wang, Lin, Huang, Liang, & Lee (2012) examined the effects of an 8-week Pilates training program on the ability to maintain dynamic bilateral and unilateral postural stability

on static or unstable surfaces, and abdominal muscle strength in young dancers. The participants were 25 female dancers, randomly assigned as experimental or control groups. All subjects received the same dance lessons but the experimental group underwent extra Pilates mat classes for 40 minutes, three times a week, for 8 weeks. The results showed that an 8-week Pilates training program could improve the limits of stability and abdominal strength in young dancers.

Amorim et al. (2011a) developed another comprehensive research in which they verified whether Pilates could be used as a tool to improve ballet dancers' performances. In their study, 15 ballet dance students were tested on how long they could sustain their legs raised while performing a *developpé* at the barre. They also verified the dancers' active flexibility (*developpé* height front, side and back) for both legs. Results showed that all dancers who participated in the Pilates sessions increased strength and flexibility, adding between 4-10° to their *developpé* height. These authors state Pilates was effective because the dancers learned to continuously engage the abdominals, hip flexors and gluteus muscles, which caused muscular adaptation, thus contributing to a stronger core, leading to an increased ability to hold their *developpés* for a longer period of time (nine seconds longer, on average).

Additionally, Amorim et al. (2011a) suggest that teachers should be aware of the importance of conditioning outside the dance classes, not only to improve performance but also to protect dancers from injuries. Pilates is recommended because it develops capacities crucial for dance performance, without neglecting the artistic component. They state that Pilates has principles very close to dance technique and uses movements very similar to certain dance technical skills. By emphasizing

breathing, alignment, positioning and abdominal work, Pilates can support dancers in the development of optimum dance technique. Pilates approaches the needs of dance technique, making it possible to develop dancers' physical capacities in a specific way.

Recently, Ahearn, Greene, & Lasner (2018) designed a study to examine the effects of Pilates training on pelvic alignment, strength and flexibility in dancers. The participants were 20 female dancers, from 17-22 years old, from two post-secondary dance programs and one performing arts high school in the USA. They participated in a three-stage screening: Screening I – in the beginning of the study; Screening II – after 14 weeks of normal dance and exercise classes; Screening III - after a 2-hour pelvic alignment workshop followed by two weekly Pilates training (Mat and Apparatus) for 14 weeks. The Screening tests consisted of an AlignaBod posture assessment, double leg lower test (DLL), upper abdominal manual muscle test, modified Thomas test, and hamstring flexibility test. After Pilates intervention, the number of postural misalignments (prevalence of forward head posture, knee hyperextension, and foot-ankle pronation or supination) decreased significantly; the prevalence of iliotibial band and hamstring lack of flexibility had a significant decrease; and lower abdominal muscle strength improved significantly. All participants reported they felt that Pilates improved their core stability, pelvic alignment, strength, and body awareness.

CONCLUSIONS: IS IT TIME TO RETHINK DANCE TRAINING?

In BR and UK pre-professional and professional dance, the common dance training scenario fosters the emergence of athleticism and aesthetics from the dance technique classes,

which focus basically on skill acquisition, working with general strength/endurance, flexibility, balance, timing, rhythm and orientation in space (Bittar, 2015). Conditioning seems to be included when overload and pain starts kicking in, and may develop muscle strength and power, flexibility, anaerobic and aerobic capacities, core stability and agility (Koutedakis & Sharp, 1999; Rafferty, 2010; Wyon, 2018). Somatics and Pilates are additions that normally follow through when dancers become injured, as well as adding constructive rest, neural integration, stability and alignment to dancers' daily routines (Bittar, 2004, 2015, 2017).

While regular dance class is essential to excel in a specific dance technique, it bypasses certain muscle groups and it does not raise the heart rate sufficiently (Hamilton, 2015). According to Krasnow and Chatfield (1996), dance classes exist primarily to: “[...] broaden one’s movement vocabulary and skills, to develop one’s musicality and phrasing, and to enhance one’s unique creativity and expressiveness through a particular voice or style.” (p. 162). In this case, an individualized cross-training program can help improve areas of weakness and increase fitness levels such as strength, flexibility or cardiorespiratory endurance, therefore decreasing risk for injury (Wyon, 2018). Koutedakis et al. (2007) and Angioi (2012) reported that contemporary/modern dancers who participated in just two-three hours of supplemental fitness training per week, adding a circuit-like training with weights and functional exercises, and exercises on a vibration machine, not only improved their physical fitness, but also their aesthetic competence.

Pilates claims to work with principles very close to dance, while also introducing a mind-body conditioning training that uses corrective exercises, verbal cues, imagery and touch inputs,

not usually found in dance technique classes. This method targets a more precise use of the whole body, its inner and outer musculature, through the application of integrated eastern/western exercise and therapeutic philosophies and principles (Bittar, 2004, 2015, 2017; Komerowski, Dallagnol, & Haas, 2018). According to Wyon, et al. (2007) some professional ballet dancers that do supplementary training, including cardiovascular, weights and Pilates, have self-reported higher aerobic power and power capacity (jump height).

At the same time, Somatics relies largely on augmented sensory processes (in stillness and movement) (Batson, 2007), that triggers a better understanding, dialogue and use of the body through listening deeply to it (Eddy, 2009). The use of Somatics may help dancers manage pain, move more easily, and perform with greater vitality and expressiveness (International Somatic Movement Education and Therapy Association [ISMETA], 2019). Somatics techniques support homeostasis, co-regulation and neuroplasticity, adding postural and movement evaluation; experiential anatomy; and movement patterning that increases efficiency, while refining perceptual, kinesthetic and proprioceptive sensitivity (ISMETA, 2019).

In programming the utmost complete dance training, awareness of supplemental training techniques is only the beginning. It is also key to understand that professional dancers develop, via technique-specific modalities, strategies that are often based on multimodal and sensory-motor integrations. These strategies elicit somatic motor (equilibrium, postural control and energy expenditure), and cognitive (memory, learning and attentional) processes, making them accessible for higher cognitive functioning (Bläsing et al., 2012). Moreover, dancers can adapt those strategies to external acoustic or visual cues and touch:

Therefore, even though dancers' movement expertise can be examined and described via biomechanical measures (see Krasnow, Wilmerding, Stecyk, Wyon, & Koutedakis, 2011), physical skills in dance can hardly be regarded separately from the cognitive functions and strategies that enable dancers to make use of them in a way that makes dance an art form (Bläsing et al., 2012, p. 302).

One specific strategy developed by dancers is the use of proprioception, and not vision, in order to enhance postural control and dynamic equilibrium maintenance (Golomer, Dupui, Sereni, & Monod, 1999; Jola, Davis, & Haggard, 2011; Ramsay & Riddoch, 2001). However, this is not true for static equilibrium tasks, in which dancers still depend heavily on vision (Golomer et al., 1999; Hugel, Cadopi, Kohler, & Perrin, 1999; Perrin, Deviterne, Hugel, & Perrot, 2002). Furthermore, dancers apparently achieve control of complex movements by optimizing motor synergies and consequently reducing energy costs in terms of force and muscle tension (Wilson, Lim, & Kwon, 2004; Lepelley, Thullier, Koral, & Lestienne, 2006).

In the motor learning realm, different theories in the last few years have been questioning the paradigm that skilled performance is only acquired through strenuous repetition (Karni et al., 1998; Korman, Raz, Flash, & Karni, 2003). A tapered practice, involving reduction of the training load, and a balance between volume and intensity of work (Batson, 2007; Wyon et al., 2007), promotes efficiency in motor performance and fitness parameters. Equilibrium of the rest-to-activity ratio in dance practice needs to be fostered urgently. Repetitive dance practice may induce alterations in the muscle chemistry and sensitivity of the muscle spindle, leading to rapid modulation in the primary motor cortex. Byl and colleagues (Byl & Melnick, 1997; Byl,

Nagarajan, Merzenich, Roberts, & McKenzie, 2002) presented an “aberrant learning hypothesis for repetitive strain injury,” in which repetitive motion could result not only in a peripheral injury, but in the creation of a brain “strain” or “engram” that might activate degraded patterns of movement.

Gentry and Feron (2004) also discovered that dancers use attention to maintain synchronicity in performance in different ways. In this case, physical contact between dancers facilitates synchronicity between them in an even more distinct manner than musical cues. Learning and memory have also been found to be different in dancers (Bläsing et al., 2012). Jean, Cadopi and Ille (2001) discovered that sequences of dance movement are better recalled if they are structured (e.g.: ballet sequences with determined steps and rhythm) and not unstructured, such as in some modern dance.

How could one re-think dance training based upon all of the above? Would it be possible to consider that dancers need special attention and guidance when lifting weights, so that proprioception, alignment and breath are further addressed? Pilates and Somatics’ instructors, on the other hand, could be aware of the different strategies used to build strength or flexibility, applying those to their classes? Therefore, the question posed is: would it be possible to use all necessary conditioning, Somatics and Pilates and mix paradigms from science and dance to create a state-of-the-art manner of training dancers, or, better yet, a so called poetic preparation (Bittar, 2004; 2015; Bittar et al., 2017), from which dancers would benefit the most (Table 1)?

Within dance training, it is extremely difficult to adjust all the activities required for the programming of an adequate training regimen that could address the entirety of the needs of the well-rounded dancer. The reasons for this range from a lack

of full somatic awareness by professionals, a lack of provisions and time in order to organize those needs, and cultural beliefs that prohibit changes or modifications from occurring (e.g.: supplemental training hours are not added to dancer’s contracts in professional companies; dance companies often struggle to put these changes in place, etc.).

Table 1 – *Training and Educating Dancers to Better Develop Multimodal Integration and Motor Control Strategies*

Strategies	Training
Improved postural control and balance maintenance (proprioceptive system)	Emphasize breathing, alignment, positioning, exercise sequencing and use of verbal, images and tactile cues in classes, rehearsals and conditioning; balance rest-activity ratio; add constructive rest; Pilates matwork or in equipments; or Somatics; 30-45 mins; 1-2 times/week
Enhanced static balance (visual system)	
Motor synergy optimization and lower energy expenditure (adapted muscle tension and strength)	
Use attention following a leader, music tracks, physical contact and movement dynamics to maintain synchronicity	

Nevertheless, the incorporation of supplemental training, such as conditioning, Pilates and Somatics into dancers’ schedules, must take into account their present workloads, which can already involve six to eight hours a day of exercise at varying intensities. Timing here is key. Conditioning training sessions need to be scheduled preferably at the end of the day to prevent fatigue from interfering with the high-skill elements of dance. If this is not possible, at least a 2-hour recovery period is needed after strength training, and an hour after cardiorespiratory training, before dancers can return to

their routines (Wyon, 2018). The selection of exercises can be tailored to the choreographic demands, if these are known in advance (Amorim, Sousa, Machado, & Santos, 2011; Angioi, Metsios, Twitchett, Koutedakis, & Wyon, 2009). A fitter dancer is more able to concentrate, suffers less often from fatigue and is therefore potentially less at risk of injury, presenting better movement efficiency and performance excellence (Laws, 2005; Rafferty, 2010; Angioi et al., 2009).

Considering Somatics and Pilates, these could also be added to the dancer's schedule and should be largely dependent upon each dancer's individual training necessities, in order to improve fine control of movements through the development of a finely tuned kinesthetic awareness (Batson, 2007; Eddy, 2009; McMillan, Proteau, & Lebe, 1998; Amorim, Sousa, & Santos, 2011a; Albuquerque, 2006). Separate and distinctly different from traditional conditioning, these activities could be scheduled either before or after the dancer's daily work activities, with at least an hour recovery period should they be done before those (Bittar, 2015).

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