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## A Movement Möbius: Intersecting Dance and Exercise Science

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Abstract

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## I . Introduction

Named after its discoverer, the German mathematician August Ferdinand Möbius (1790-1868), a Möbius strip is, *"a surface with only one side, formed by giving a half twist to a narrow, rectangular strip of paper and then pasting its two ends together"* (Guralnik, 1978; p. 912). For our purposes, let's label the rectangular strip in its entirety "movement." We will further label its twisted sides "art" and "science." When configured as a Möbius strip, the "art" and "science" of movement are forever intertwined with one another and the number of possibilities is limited only by one's imagination.

Now let's try a small experiment (Teplitskiy, 2007). Begin with a strip of paper. Down the middle of one side draw a red line (representing art). Down the middle of the other side draw a blue line (representing science). Now circle the two sides together forming a loop, but add a twist so that the red side of one connects to the blue side of the other. The two sides need to be securely taped together. This configures a Möbius strip. If we then cut along the red and blue line, we double the diameter of the Möbius strip! In effect, we have doubled that of what we originally had. If we continue to cut down the center of the Möbius strip we will begin to get a series of interlocking loops. They are inseparable. By using both sides of the same object, the Möbius strip doubles the life of belts used in manufacturing and automobiles, among other movement-related uses.

Though perhaps an oversimplification, in many ways the Möbius strip is symbolic of the relationship between dance and exercise science as academic disciplines in higher education in the United States – both evolved as part of physical education (Kraus, Hilsendager, & Dixon, 1991) or, more precisely, physical culture (Bucher, 1960). Actually, physical education birthed many higher education academic disciplines (e.g., dance education, dance science, health education, physical education, recreation) and sub-disciplines (e.g., biomechanics, exercise physiology, sport and exercise psychology, sport sociology, sports medicine) over the years (Henry, 1964, 1978; Hoffman, 1985). Sports evolved as part of physical education too. But, our focus today is on dance and exercise science, though this rich history certainly is important for informing our discussion.

Returning to our Möbius strip, let's retain the overall rectangular strip's title as "movement," but re-label the two sides of the strip as "dance" and "exercise science" (vs. "art" and "science" as was previously done). Again, we acknowledge this is an over-

simplification, but the labels are less important than the symbolism that this arrangement represents. Furthermore, in this new configuration, imagine that the loop was never twisted. Instead the two sides were treated as separate sides of the same strip. That is, rather than forging a Möbius strip they simply formed a loop. As A.F. Möbius mathematically demonstrated, a loop is not as robust as is a Möbius strip. Moreover, when cut down the centerline, rather than expanding the diameter of the loop, two distinct and separate loops of equal size are created. In many ways this is quite symbolic of what has occurred between “dance” and “exercise science” within the higher education community. As this occurred, the two academic disciplines – dance and exercise science – grew in their own distinctive ways. Dance tended to grow as an “art,” and exercise science tended to grow as a “science.” Sometimes additional labels were attached to each. While both disciplines have thrived in this arrangement, we contend that each has also suffered (i.e., something has been lost). Moreover, the chasm between the two seems to have widened over time, with each becoming increasingly distinctive and less interconnected (Table 1).

Table 1. Partial List of Potentially False Dichotomies Between Dance and Exercise Science<sup>1)</sup>

Dance	Exercise Science
Aesthetic	Secular
Affective	Measured, observed
Art	Science
Cooperative	Competitive
Entertainment (emotive, expressive, communicative, recreational participant)	Entertainment (competitive, performance outcomes, recreational observer, sport)
Feminine	Masculine
Process outcomes	Performance outcomes
Qualitative	Quantitative
Unrestrained	Restrained

Within higher education, all too often the focus has been on the *differences* rather than the *similarities* between “dance” and “exercise science.” Some of this likely has to do with mission alignment. For example, a Dance Department housed within a College of

1) These are *potential* versus *absolute* differences. Several of the word pairs listed fall on a continuum. The closer to the center of the continuum, the more blurry things become. The words might also have different functional or operational purposes across genres.

Fine and Performing Arts along with other arts-based disciplines (e.g., art, music, theatre) must work collaboratively, cooperatively, and synergistically with other units within the college structure to advance the college's mission and create the best possible educational experience for the students enrolled in the college. By contrast, an Exercise Science Department housed within a College of Public Health and Human Sciences along with other science-based disciplines (e.g., biostatistics, epidemiology, health behavior and health promotion) must likewise do the same. Importantly, we are not laying blame here, nor claiming authoritative knowledge of institutional configurations, histories, or individual personalities that might have resulted in such arrangements in the first place.

Rather, we are here to consider the question: *What if* dance and exercise science were interconnected in the fashion of a Möbius strip? We believe such an arrangement would *expand* the possibilities for each. Why do we say this?

### 1. Interdisciplinarity: Expanding Potentiality Through Collaboration

Higher education leaders in the 21st century are increasingly interested in interdisciplinary work (Basken, 2012; Committee on Facilitating Interdisciplinary Research, 2005), as was the literary genius Virginia Woolf who wrote against the divisive nature of higher education in the middle of the 20<sup>th</sup> century:

The aim of the new college, the cheap college, should be not to segregate and specialize, but to combine. It should explore the ways in which mind and body can be made to cooperate; discover what new combinations make good wholes in human life (Woolf, 1952, p. 62).

Woolf's words ring equally true today. And dance and exercise science can prosper from such an arrangement whether they reside in the same academic college or department. Though by no means an exhaustive listing, Figure 1 illustrates some potential conceptual relationships among dance and exercise science, and Figure 2 illustrates some potential operational relationships (i.e., commonalities) among dance and exercise science.

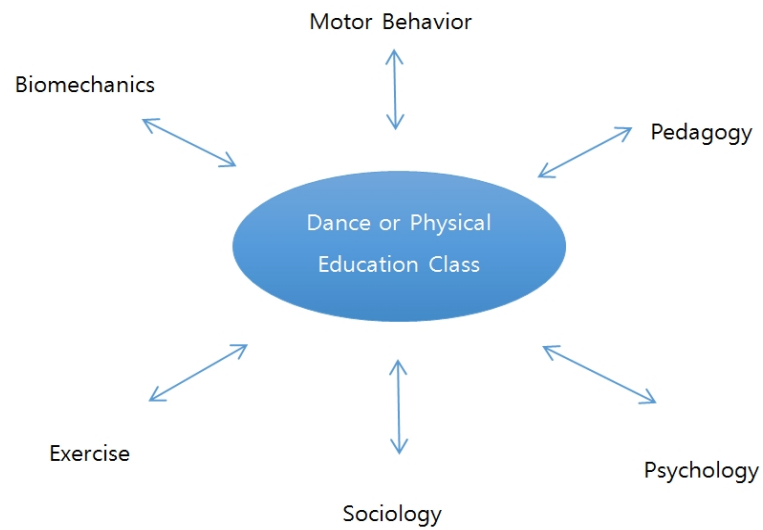


Figure 1. Conceptual Relationships Among Dance and Exercise Science.

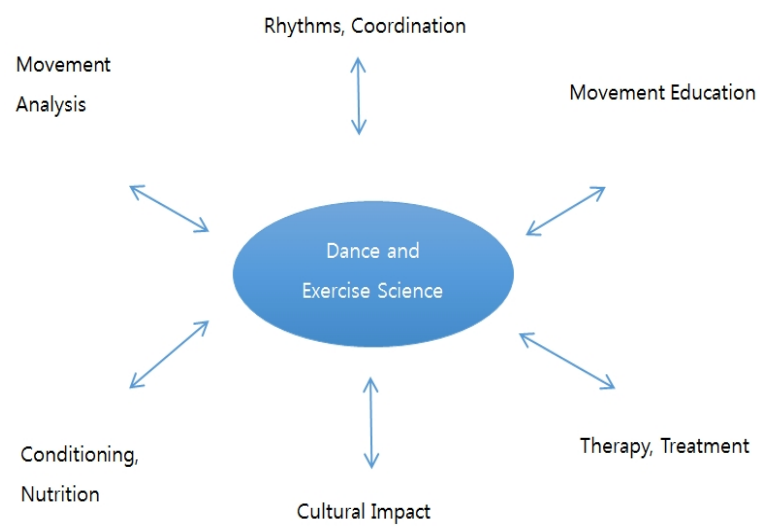


Figure 2. Operational Relationships Among Dance and Exercise Science.

## 2. The Dance and Exercise Science Nexus

While dance and dance training are often linked to sports with stereotypically “artistic elements” such as figure skating and gymnastics, dance and dance training have proven beneficial for athletes in other sports as well. In part this is because of the obvious and not-so-obvious movement connections. For example, Theys (2010) quoted Guillermo Asca, a dancer with Alvin Ailey American Dance Theater, as saying,

A parallel second-position plié is the same stance as a free throw in basketball or a lineman’s stance in football, or a batter’s stance in baseball. A golfer’s swing is like the turn-the-back in Graham technique. The other day I was watching tennis player Rafael Nadal and he hit the ball right at his feet and did a single tour with his arms down in fifth. I see dance in sports all the time.

Theys (2010) also wrote about legendary Hall of Fame Football player, Lynn Swann – “the Baryshnikov of football”, – who played professional football with the Pittsburgh Steelers of the National Football League. Mr. Swan studied ballet, tap, and jazz dance for many years, even appearing on a television special with Gene Kelly, Peter Martins, and Twyla Tharp in the 1980s. Theys quotes Swan as saying that studying dance, “...helped with body control, balance, a sense of rhythm, and timing.”

This extends to other settings as well. For example, at Oregon State University, Associate Professor Carol Soleau teaches PAC 135 (n.d.), *BalletSport: Ballet Skills for Athletes* every academic term throughout the year. The course focuses on improving the sport performance of athletes by teaching them, “*Fundamental ballet technique to enhance balance, agility, alignment, strength and rhythmic movement in sports. Stretching techniques and Pilates mat-work included. No prior dance experience needed.*” Athletes from sports such as basketball and football enroll in the course regularly, learning to use their bodies in ways that are often neglected through sport-specific training exclusively. Roni Mahler, founding Director of the dance program at Kansas State University (1974-1980), developed *A Ballet Class for Dancers and Athletes* some 40 years ago (Mahler, 2013, n.d.a), which was later tailored for the Cleveland Browns of the National Football League (Mahler, n.d.b).

These examples highlight how dance might benefit sport performance in a practical

sense (i.e., body awareness, body control, flexibility), and they begin to demonstrate the potential interconnectedness of dance and exercise science, at least in a biophysical sense (e.g., biomechanics, kinesiology). But the exercise sciences might also add value to dance in other distinctive ways.

### 3. Informing Dance Through Exercise Science

Consider, for example, the topic of performance anxiety. Surely dancers can benefit from the knowledge generated by a sport psychologist who studies such issues among athletes. Likewise, athletes no doubt would benefit from knowledge generated by studies of performance anxiety among dancers. One of the new American Psychological Association (2014) journals, *Sport, Exercise, and Performance Psychology*, the official journal of Division 47 (Exercise and Sport Psychology), acknowledges precisely that. First published in the spring of 2012, the journal seeks to publish papers that discover and apply important psychological principles aimed at facilitating peak performance across a variety of domains (e.g., dance, exercise, sport).

Taylor and Taylor (1995) have also written about the *Psychology of Dance*. In their book they address motivational factors, confidence, psychological skills (e.g., concentration, imagery), burnout, career transitions, and the psychology of injury rehabilitation. These topics (and others) are addressed in Weinberg and Gould's (2014) text, *Foundations of Sport and Exercise Psychology*, as well. Building on just one of these topics, the psychology of injury rehabilitation, the framework outlined by Hinderliter and Cardinal (2007) would seem generalizable enough to apply to dancers even though it evolved out of research on athletes from a sport and exercise psychology perspective and the clinical experiences of athletic training and sports medicine personnel. Regardless, the six principles of their framework (i.e., social support, confidence and competence, referral, accommodation, psychological skills, and education) would seem a nice fit with dancers trying to recover from injury.

Many dance scholars have applied exercise science theories and methodologies to their career's work. Examples include: anatomy and kinesiology (Clippinger, 2007); biomechanics (Laws, 1984); sports medicine and injury prevention (Solomon, Solomon, & Minton, 2005); motor learning (Kimmerle & Côté-Laurence, 2003); nutrition, diet, and

weight control (Chmelar & Fitt, 1990); sociocultural aspects (Cardinal, 2013); and dancer wellness (Cardinal, 2009, 2014; Cardinal & Hilsendager, 1997). Medical doctors (Peterson, 2011) and psychologists (Hamilton, 1998), among others, have written advice books for dancers on these and related topics. Exercise science and dance scholars have also collaborated to bring exercise science, sports medicine, and pedagogical knowledge to the dance community (Clarkson & Skrinar, 1988). Today there is mounting organizational and student interest in the intersection of dance and exercise science.

#### 4. Organizational Interest

Learned societies continue to evolve in their understanding and recognition of the inseparability of “dance” and “exercise science.” Though not meant to be an exhaustive list, two examples will be highlighted in this section: The International Association for Dance Medicine & Science (IADMS, n.d.) and Athletes and the Arts (n.d.).

IADMS was formed in 1990. Its aim is to enhance, “...the health, well-being, training, and performance of dancers by cultivating educational, medical, and scientific excellence.” IADMS hosts an annual conference, provides additional continuing education and educational resources, and publishes *The IADMS Bulletin for Dance Teachers* (freely accessible) and the *Journal of Dance Medicine & Science*, among other specialty publications.

Founded by the American College of Sports Medicine (ACSM), Loyola University (New Orleans, Louisiana), and the Performing Arts Medicine Association (PAMA), the Athletes and the Arts (n.d.) initiative has grown during its short history to become a collaboration of 14 organizational members. Its mission focuses on, “*Integrating the science of sport and the performing arts for the mutual benefit of both.*”

Both IADMS and the Athletes and the Arts initiative would seem to align with the movement Möbius strip described in this paper. That is, they each acknowledge the synergistic value of integrating dance and exercise science. Students are also seeing this.

#### 5. Student Interest

Within higher education, we are seeing more dancers expand their educational repertoire by completing double majors. Not only does this expand their career prospects, it



also allows for a more complete understanding of movement and movement's potentiality. Some examples of combinations of disciplines (i.e., majors) include dance and exercise science, dance and psychology, dance and education, dance and athletic training, dance and pre-physical therapy, and dance and nutrition and/or dietetics. Such degree combinations may also assist with career transitions, offering some buffer support in case of career burnout and/or injury.

## II. Conclusion

In this paper we contend that dance and exercise science are inextricably linked. We liken this to a Möbius strip. A Möbius strip is mathematically superior (i.e., stronger, more enduring) to that of a loop. The common denominator of dance and exercise science is movement. Viewed in this manner, dance and exercise science have much to offer one another and each can benefit from reciprocal connections. This perspective is also consistent with the interdisciplinary emphasis of 21<sup>st</sup> century higher education. There is mounting organizational and student interest in this arrangement too. While the end results of such efforts are yet to be determined, ultimately we believe that such connections will *expand* the possibilities of each. As art begins to inform science, and science begins to inform art, dancers, choreographers, teachers, and scholars will all benefit. Moreover, at the converging point of the two, something very special can happen – including the dawning of something never seen before. That creative element is another common denominator of art and science, and it leads to a deeper understanding of humanity for us all.

## III. Acknowledgment

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## Abstract

### A Movement Möbius: Intersecting Dance and Exercise Science

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Martha Graham reputedly said, “a dancer is an ‘athlete of God’” (Theys, 2010). Yet dance and exercise and sport science (herein referred to as exercise science) are often viewed as unique entities, sometimes dividedly so. Our contention is that dance and exercise science mutually benefit when the two disciplines are interconnected. In this paper we advance our position, providing theoretical, historical, and contemporary practical examples of how each can benefit by recognizing their similarities versus focusing on their differences. An analogy based on the mathematically derived Möbius strip is used to illustrate the value of our approach.

Keywords : history, interdisciplinary, movement education, movement science, physical education

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