



# **Budo Neuroscience for “Gentle Way” as An Intangible Legacy of Tokyo 2020 : A Dream by The Father of Judo, Jigoro Kano**

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## **ABSTRACT**

As the Tokyo 2020 Olympic Games came to a close, we must reflect on the event's legacy for future generations. The neuroscience of exercise and sport is rapidly expanding, and it is crucial to recognize the value of traditional oriental physical exercises, such as Judo and Karate, as Olympic sports derived from Budo. These sports have the potential to promote human development and well-being, and it is essential to acknowledge their contributions. By further exploring the relationship between the body and mind of self and others, we can form an integral part of sporting culture, adding vitality and fostering bonds. The integration of Budo culture and exercise neuroscience, i.e., Budo neuroscience, can lead to continued progress in physical education, sports, and human development, resulting in a more connected and harmonious society.

## INTRODUCTION

The adage "Standing on the shoulders of giants" has corollaries in other languages such as "温故知新 (*Onko-Chishin*; Learn the old to know the new)" in Chinese, and "稽古照今 (*Keiko-Shoukon*; Reflect on the past to illuminate the present)" in Japanese, which hold a universal significance. As these sayings suggest, even though some sciences may seem pioneering, they often develop by incorporating old wisdom. Indeed, the field of exercise and sport neuroscience has been rapidly advancing in recent years, and it is no exception to this rule.

### 1. Tokyo 2020 and Newly Revised Olympic Motto

During the summer of 2021, the Olympics, a quadrennial celebration of sports and peace, was conducted in Tokyo, Japan (Tokyo 2020), albeit without spectators due to the COVID-19 pandemic. This was the second time Tokyo hosted the Olympics. The first Olympics in Japan (Tokyo 1964), left numerous tangible legacies such as the expressway and the high-speed railway (Shinkansen), symbolizing the country's revival post-World War II. As Tokyo welcomed the second Olympic games as a mature society, there exists a requirement to establish intangible legacies by promoting an authentic sports culture that contributes to the self-actualization, health, and longevity of individuals of all ages and genders.<sup>1</sup> A possible hint towards this goal is the newly revised Olympic motto "Faster, Higher, Stronger - Together."<sup>2</sup>

The newly revised Olympic motto reflects the idea that while the Olympics celebrate individual achievements in sports, these achievements are ultimately the result of teamwork, collaboration, and mutual support. The revised motto emphasizes the importance of unity, inclusivity, and cooperation, which are essential values in today's interconnected and diverse world. The inclusion of "Together" in the revised motto reflects the need for a collaborative approach to sports that brings people together, rather than creating divisions or reinforcing existing inequalities. It also highlights the potential of sports to foster social cohesion, promote diversity, and build bridges between communities.

By promoting an authentic sports culture that values teamwork, inclusivity, and mutual support, Tokyo 2020 has the potential to leave an intangible legacy that goes beyond infrastructure and economic benefits. A sports culture centered on the values of "Faster, Higher, Stronger - Together" can contribute to the self-actualization, health, and longevity of individuals of all ages and genders, promoting social cohesion and understanding.

In this sense, Tokyo 2020 represents an opportunity for Japan to showcase its leadership in promoting a new vision for sports, one that emphasizes the power of teamwork, inclusivity, and collaboration. By embracing this vision, the games can inspire a new generation of athletes and sports enthusiasts to build a more just, healthy, and sustainable world that values sport's potential to bring people together and promote social change.

## **2. The Essence of Judo as “Gentle Way” Shown by Jigoro Kano: *Seiryoku-Zenyo and Jita-Kyoei***

Jigoro Kano (1860-1938), the first Asian member of the International Olympic Committee, left a significant mark on Japanese Olympic history. He recognized the value of sport and led Japan's first Olympic participation in the 1912 Stockholm Games and advocated for Tokyo's bid for the 1940 Olympics, which was later withdrawn unfortunately.

Kano is also renowned for being the founder of Judo, an ancient culture of physical exercise practiced with others, called 武道 (*Budo*; martial arts) in Japan.<sup>3</sup> Despite his physical weakness and emotional volatility in his early years, Kano realized in his youth that the practice of Jujutsu could improve both his physical and mental strength, as well as foster within him the attribute of perseverance. In 1882, he established Judo as a Budo aimed to establish "a gentle way for human education" based on several Jujutsu schools. Kano's guiding philosophy was published as, "精力善用 (*Seiryoku-Zenyo*) - 自他共栄 (*Jita-Kyoei*)" in 1922, that is a century ago.<sup>4,5</sup> This means "maximum efficient use of energy and mutual welfare and benefit," and are the fundamental principles of social activity. This philosophy not only encapsulates the aim of Judo but also that of sport and physical education in a broad sense, serving as a beacon for human development (Fig. 1).

Ramon y Cajal (1852-1934), a pioneer of modern neuroscience from Spain, discovered the neuron in 1888 and was awarded the Nobel Prize in Physiology or Medicine along with Camillo Golgi in 1906.<sup>6</sup> As mentioned above, however, 6 or 24 years prior to that in 1882, Jigoro Kano had already proposed the concept of the "exercise-cognition interaction,"<sup>7</sup> through the

creation of Judo, which highlights the relationship between physical exercise and the central nervous system. He also included the element of "Together," which encourages practitioners to grow and learn together with others. This concept must be regarded as the origin of budo neuroscience toward creating a way for gentle human education.

Kano's vision of Judo as a gentle way is not just about the physical techniques of martial arts, but also about promoting human development and social harmony. It emphasizes the importance of using our energy efficiently, and of working together for mutual benefit and the betterment of society. This vision is still relevant today and can provide a guide for creating a more just, healthy, well-being, and sustainable world through sport and physical education.



Figure 1. Calligraphies created by Jigoro Kano during his seventies, displayed at his birth anniversary at Kodokan Judo Institute in October 2022 (Courtesy of Kodokan Judo Institute, the headquarters of the worldwide judo community).

Right, Seiryoku-Zenyo conveys the concept of maximizing efficient energy use. Left, Jita-Kyoei represents the idea of mutual welfare and benefit. These concepts originated in 1922 and the year 2022 marked the centennial milestone since their inception.

### **3. The Rise of Exercise Neuroscience Toward *Seiryoku-Zenyo***

Later in 1997, Fred Gage and colleagues at the Salk Institute in the United States conducted experiments on mice and found that an enriched environment, which included access to a voluntary exercise wheel, led to an increase in neurogenesis and hypertrophy of the hippocampus, the learning and memory center of the brain.<sup>8</sup> This groundbreaking study marked the beginning of exercise neuroscience. Further research confirmed that regular exercise in humans also increases the size of the hippocampus and improves memory performance,<sup>9</sup> as well as enhancing executive functions mediated by the prefrontal cortex.<sup>10</sup> These findings suggest the potential for exercise therapy in the prevention and treatment of dementia.

In addition, research has shown that there is a positive correlation between aerobic capacity and cognitive function, as well as academic performance in children, highlighting the importance of physical education in school curriculums.<sup>11</sup> Furthermore, the role of the brain in athletes' high performance is also beginning to be uncovered.<sup>12</sup> Molecular neural mechanisms, such as IGF-I, BDNF, androgens, lactate, and glucose metabolism adaptation in the brain, are thought to be involved in the body-mind relationships and effects of exercise, providing biological significance and interest.<sup>13-16</sup> These exercise neurosciences are focused on improving individual performance, which can be seen as the science of *Seiryoku-Zenyo* (maximum efficient use of energy).

### **4. The New Trend of Sport Neuroscience Toward *Jita-Kyoei***

It is indeed noteworthy that non-cognitive skills are gaining more recognition in the field of human development and well-being.<sup>17</sup> While cognitive skills have traditionally been the primary focus of education and intelligence testing, research has shown that non-cognitive skills such as empathy, resilience, and grit are just as important in predicting social success and overall health and longevity. Research suggests that physical contact with others promotes the secretion of oxytocin, a social bonding hormone,<sup>18</sup> and oxytocin might promote dopamine and serotonin release through physical exercise.<sup>19,20</sup> Their neurotransmitters related to a mixture of physical contact with others and exercise, i.e., contact sports, would play important roles in the formation of empathy and non-cognitive skills.

Interestingly, recent studies have also shown that Jujutsu, the predecessor to Judo, can increase salivary oxytocin levels in young adults and high-risk children,<sup>21,22</sup> potentially helping to improve cognitive function and non-cognitive skills as intended by Jigoro Kano.<sup>23,24</sup> There

have been cases where contact sports including martial arts, e.g., Judo, boxing, and football, have helped to rehabilitate juvenile delinquents by curbing their aggression.<sup>25</sup> These trends must promote the creation of "Budo neuroscience" as the new academic discipline targeting the social and emotional aspects of sporting humans, which also could be a solution to loneliness as one of the largest health risks.<sup>26</sup> In the words of Kano, this discipline would be "the science of *Jita-Kyoei* (mutual welfare and benefit)."

The integration of neuroscience into sports has opened up new avenues for understanding the impact of sport playing with others on social and emotional development. As mentioned, research has shown that physical contact and exercise can impact the release of neurotransmitters that play a role in the formation of empathy and other non-cognitive skills. The potential for martial arts, including Judo, to improve non-cognitive skills in young people is also being explored.

This aligns with Kano's vision of Judo as a means of promoting mutual welfare and benefit, both in the physical sense and in the social and emotional dimensions of human development. The emergence of "Budo neuroscience" as a new academic discipline reflects the growing recognition of the importance of non-cognitive skills in overall human well-being and the potential for sport to contribute to these areas.

## Concluding Remarks

The evolution of Judo as a Budo, an ancient Japanese culture of physical exercise founded in 1882, into an Olympic sport in Tokyo 1964 is a fascinating development and is a testament to the power of tradition and innovation. Over half a century later, Tokyo 2020 was completed. During that, the exercise neuroscience that emerged around 2000 has accumulated scientific evidence on the effects of exercise and sport as "a gentle way of human education" based on the relationship between body and mind that Jigoro Kano aimed via Judo, which is the philosophy of *Seiryoku-Zenyo* and *Jita-Kyoei*. This situation can truly be described as Standing on the shoulders of giants, *Onko-Chishin*, and/or *Keiko-Shoukon*, highlighting the aspect that the past informs the present to deeply understand tradition can lead to innovation and progress.

As Tokyo 2020 came to a close, it is important to reflect on the legacy that this event has left for future generations. The neuroscience of exercise and sport continues to expand, and it is important to recognize the value of oriental physical exercises such as Judo and Karate as Olympic sports derived from Budo and their potential for promoting human development

and well-being. By continuing to explore the relationship between the body and mind of self and others, we would form an integral part of sporting culture, adding vitality and fostering bonds. Through the integration of Budo culture and exercise neuroscience, i.e., Budo neuroscience, we can hope to see continued progress in the fields of physical education, sports, and human development, leading to a more connected and harmonious society.

### **Competing interests**

The author declares that he has no competing interests.

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