Changing the World with Jumpulse

by Benjamin Li, ASPE

> *Touching something with your hand is a common, everyday experience. But when a robot finger touches an object, the finger bounces off the object and mirrors the way a ball bounces off a racket.*
> —Benjamin Li

Introduction: In Honor of Ta-You Wu, Chinese Father of Physics, Inventor of Jumpulse

Jumpulse (Figure 1) is a new physics concept that is based on prolonged contact. Jumpulse was first introduced in a paper by the Chinese Father of Physics, Ta-You Wu, as an extension of impulse.[1] *Jumpulse* is a term coined by Wu to denote a sudden change of *force*—as opposed to Newtonian *impulse*, which is defined as a sudden change of *momentum*. The potentially revolutionary impact of jumpulse on robotic touch, automobile shock absorbers, and collision-mitigation systems will be discussed later in this article and may be of interest to mathematicians, computer scientists, physicists, and the like.

History of the Contact Problem in Physics

The "contact problem" in physics was unsolvable by Newton, Hooke, and all other scientists and physicists since Newton for 300 years. Isaac Newton defined force—as either a push or a pull—with the equation, Force = Mass x Acceleration. However, something must make *contact* before it can push. The static-contact problem was solved by Heinrich Hertz. Still, the dynamic-contact problem (the problem of how to keep two objects from bouncing off each other after a collision) was never solved until the introduction of jumpulse and its applications to double-hitting.

In ball-and-racket sports, can impact occur *without* the ball immediately bouncing off the racket after a collision? Yes, because after the ball makes contact, the racket could carry the ball for a short period of time as the racket accelerates and then pushes the ball off the racket. While the ball is carried on the racket, the two would share the same position, velocity, and acceleration. Achieving the same position, velocity, and acceleration *at the very point of contact* allows an individual to carry the ball, to some extent—and this is the secret to consistency in racket sports.

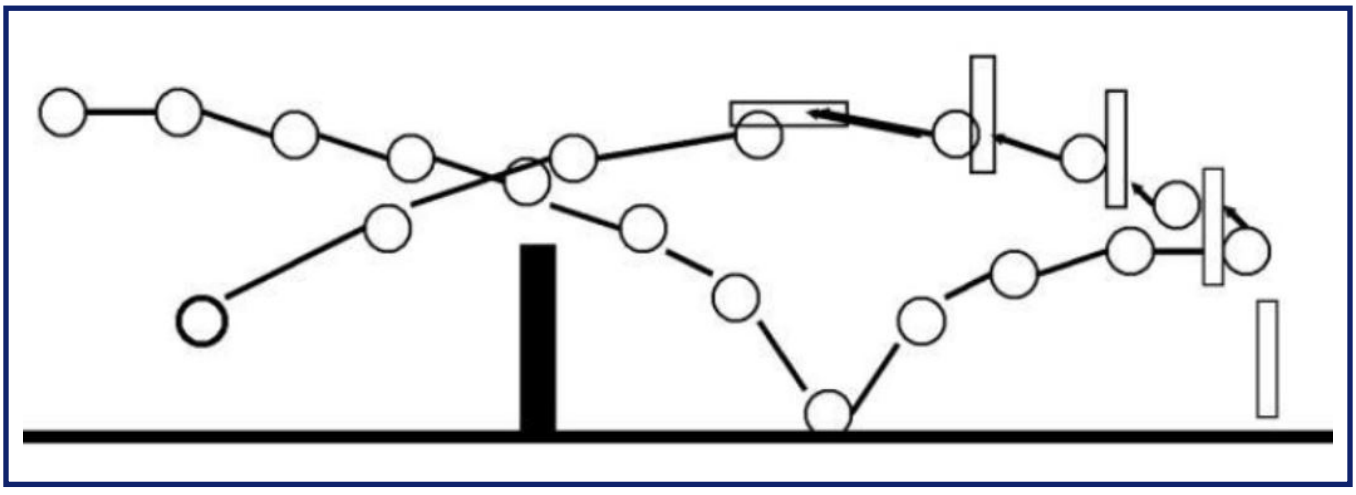


Figure 1: A ball stays on a racket for an extended period of time.[2]

Personal Experience

In the summer months of 2020, during the COVID-19 lockdown, I had the opportunity to learn how to keep a ball on a racket for an extended period of time, which allowed me to perform "double-hitting" utilizing one smooth stroke. Up until that point, I had witnessed double-hitting in the game of tennis when it occurred by accident only. When a tennis player performs an *intentional* double hit using a second, deliberate swing or push, it is illegal. However, even if the ball contacts the racket twice in one swing, a hit can be deemed legal provided that the swing motion was continuous—without a second, intentional swing or push.

I began learning how to perform double-hitting by throwing a tennis ball into the air and then catching the ball on the racket's strings *without* allowing the ball to bounce off. Then, I tried to lift the ball, but this resulted in topspin. So, I realized it was necessary to hit with a flat stroke with no spin. While topspin originally seemed like a reasonable way to increase the dwell time of the ball on the racket's strings, it was extremely challenging to perform double-hitting in that way. Moreover, in those first attempts at performing double-hitting, I had missed the point of jumpulse—the acceleration. I had solid form, but what I needed to do was to suddenly accelerate (jumpulse) the ball with a flat stroke (without topspin) and with the correct timing. Frustrated, I took some time off to think about a new strategy.

With my second attempt, I finally managed to pull it off. I changed my plan to incorporate acceleration *immediately* after the racket and ball had reached approximately the same velocity during impact. My new strategy was to hold the ball for a split second to allow the racket and ball to reach nearly the same speed and then *push* the ball with all my energy. An analogy that helped me accomplish this stroke was based on my knowledge of physics (position, velocity, and acceleration). I considered two particles, such as a ball and a racket or a hand and some other object. These two objects move together when they have the same *position*, the same *velocity*, and the same *acceleration*. In the case of a ball and a racket, when the ball hits the racket, it has the same *position* as the racket and will, for a very short moment during the exit phase, have the same *velocity* as the racket. I hypothesized that if a jumpulse—a sudden change of acceleration—could be applied to the racket at the very (short) moment when the ball and the racket have achieved the same velocity, then the ball and the racket will have the same *acceleration* and, thus, achieve prolonged contact. I discovered that the interaction of the ball and the racket—the moment of impact—should not produce any sound until acceleration happens, though a possible crackling sound may occur if double-hitting is correctly achieved.

I made my racket approach the ball at a low speed so as to minimize the impact velocity, and then I quickly accelerated. This technique finally helped me achieve double-hitting and consistent strokes. When performed properly, the ball feels heavy during the contact phase. I was able to correctly execute double-hitting about 20% of the time. However, my stroke with double-hitting lacked power and precision; so certain aspects of the technique needed further work. To add more power and spin, I needed to finish over the shoulder and build up the muscles in my biceps and triceps. Overall, the experience with double-hitting was fantastic and had a profound impact on my understanding of the secret to consistency in racket sports.

Double-hitting is a complex process, of course, as you must learn the precise timing required and lock that knowledge into muscle memory. You will need to learn how to wind up, and you must also master the skill of sudden tightening and releasing of the two balancing muscles. Very, very few people can do this by instinct without studying the concept of prolonged contact. Building muscle and gaining experience can help you to learn more quickly. All in all, the primary point is that even though the stroke is extremely complicated to perform, it is possible to perform it intentionally and consistently.

Nowadays, I can perform double-hitting in both table tennis (ping-pong) and in regular tennis, though it is much more difficult to accomplish in regular tennis. Mainstream acceptance of the double-hitting technique in the racket-sports community will change our entire understanding of consistency. Double-hitting truly is the best way to practice prolonged contact.

Controversy and Skepticism

Within the racket-sports community, jumpulse has been criticized by some as a pseudoscience—a theory that cannot be disproven. Even with high-quality, slow-motion video, it is difficult to see double-hitting. However, later in this article, I will provide links to video proof that should convince any reasonable individual that intentional double-hitting in one smooth stroke is possible. It will be important for future additional evidence of jumpulse to involve frame-by-frame analysis rather than just slow-motion video to demonstrate the prolonged contact. However, some people who do already accept the existence of jumpulse have questioned the stroke's legality, while others have labeled the stroke as useless for practical purposes.

Double-hitting is not often mentioned within the rules of tennis, despite recent updates.[3] At first, I, too, was skeptical about the idea of intentional prolonged contact between a ball and a racket. It didn't seem possible for an individual to hit a ball (or its equivalent) twice in one fluid stroke, deliberately and consistently. The actual dwell time is so short that the idea of a human somehow controlling the stroke just before impact in order to extend the time of contact seemed absurd. However, once it is adequately understood and executed, its truth is evident.

Considering how fast a person swings a tennis racket or a ping-pong paddle, and assuming a minimal amount of dwell time, skepticism about double-hitting is understandable. I reasoned that a ball has to decelerate to zero and then accelerate back in the opposite direction in a tiny amount of time. Deceleration and acceleration take time, and a ball travels at a very high rate of speed upon leaving a racket. Therefore, a ball must reach an extraordinarily high acceleration. How is the human hand able to accelerate anywhere near that speed? In addition, the hand is not stationary, as it is already swinging quite quickly.

It would be interesting to ask all of the top professional players and coaches in both tennis and table tennis about this idea. Such a survey has not yet been attempted, but a future in which double-hitting is acceptable is intriguing. Anecdotal experience tells me that the average recreational player is unsure what to think about double-hitting (some believe it is against the rules whether it is done intentionally or unintentionally), coaches generally appear to be strongly against it, and highly ranked junior and adult players seem to love the idea, despite all the skepticism about its practicality.

Applications to Performance in Racket Sports—Achieving Consistency

Incorporating jumpulse into racket sports can reduce the number of mishits and unforced errors (missed shots and lost points). Recreation-level players tend to miss a lot of hits, which can lead to short rallies and lack of winning matches. Many recreational players may argue that the double-hitting stroke is too weak while requiring too much force, leads a player to tense up, and is overall impractical. They may also assume that, even if jumpulse is well accepted, it is not as great as it is hyped-up to be and cannot enhance performance in-game. These doubts arise because players slow their rackets down just before they begin the swing, and the follow-through swing is so broad that one might be able to hit someone standing behind them. Despite these criticisms, players should note that, *most* of the time, double-hitting is not useful; but no stroke can be utilized at *all* times, because players must mix up their strokes in-game and employ a variety of different stroke types (cross-court, down-the-line, drop-shot, lob, topspin, slice, angle, overhead, volley, half-volley, etc.).

Double-hitting is essential for pusher-type players, as double-hitting allows them to "push" the ball into the court with more precise direction.[4] The typical pushers force their opponents to make mistakes and hit the ball back onto the court using lobs, slices, and weaker strokes. Pushers who master consistency with full-swing strokes will be far more effective, controlling where they hit the ball. Employing jumpulse would enable players to combat the annoying pusher play style. Jumpulse not only would help players to miss their hits much less often but would also allow them to move around the court and close out strokes nearer the net.

Perhaps double-hitting becomes more potent as skill level rises. In professional tennis, players must stay inside a 10-meter court for over three hours while chasing around a ball that may exceed speeds of over 200 kilometers per hour. To be efficient, players must have the agility to run 10 meters—a distance shorter than a sprint. It is also ideal for players to have the stamina to last three hours—which is longer than a marathon—and the reflexes and hand/eye coordination to track a ball that's traveling faster than the pitches of professional baseball players. Tennis players also need to master a variety of techniques to hit various shots in different conditions and locations, develop the control to send the ball exactly where they want it, and have the mental strength and decision-making skills to perform all possible actions consistently while playing alone (without the support of teammates). If players are lacking in one of these skill areas, they will have trouble against other players. It is best to be well-rounded, but the ideal player will reach the top level in every aspect of the game. Therefore, players who achieve mastery and consistency in all strokes will be a step above all other players in the competition. One may argue that double-hitting expends lots of energy, but the benefits of consistency through prolonged contact are worth the price. Remaining calm through confidence, preventing other players from over-hitting, and having the ability to force opponents to move around the court are immediate benefits for competitive players.

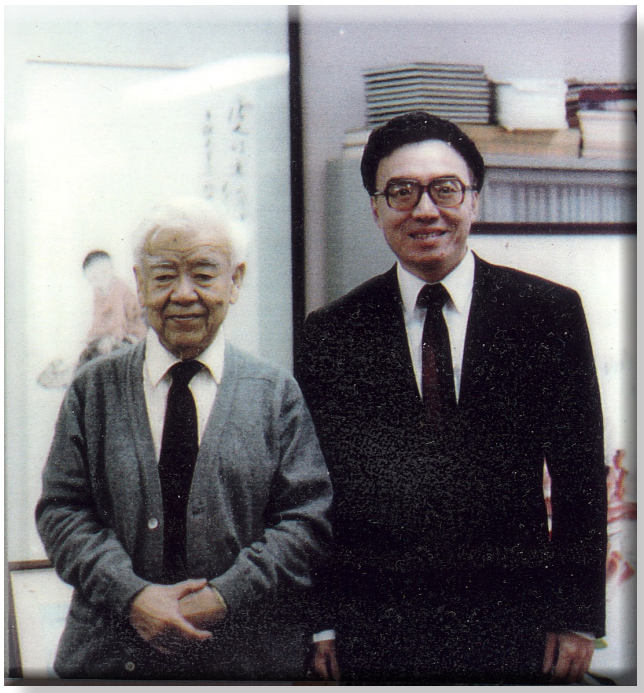


Figure 2: Left: Dr. Ta-You Wu, "Father of Chinese Physics." Right: Dr. Hugh Ching, "Father of Post-Science."[5]

Inspiration for Knowledge—Solving the Contact Problem

A major influence for me regarding the benefits of jumpulse was Dr. Hugh Ching, the "Father of Post-Science."[6] Dr. Ching received his bachelor's, master's, and doctoral degrees from the Massachusetts Institute of Technology (MIT) in electrical and nuclear engineering, where he was twice the table-tennis champion. He eventually became a professor at MIT, University of California at Berkeley, Tsinghua University, and other universities. Dr. Ching later became a mathematician at the Courant Institute for three years, and he spent eight years as a research associate in the Philosophy Department of the University of California, Berkeley, alongside Paul Feyerabend.

Dr. Ching introduced me to the new physics concept of jumpulse—increasing acceleration during the swing of the racket.[7] The idea of prolonged contact in racket sports was conceived

by Dr. Hugh Ching in 1968. His book, *Table Tennis: Scientific Analyses for Coaches and Intermediate Players* (1978), predicted the common yet accidental occurrence of jumpulse in table tennis, tennis, and golf.[8] Double-hitting in one smooth stroke was legalized in 1982 in tennis[9] and in 2004 in table tennis.[10] Originally, double-hitting in one smooth stroke was assumed to occur only accidentally; but solving the contact problem showed that this stroke could be performed intentionally.

I have had the pleasure of working closely with Dr. Hugh Ching; and, in 2021, we jointly authored (along with scholars Chien Yi Lee and Mahadi Hasan) a paper called "Culture Level Quotient," which was published in the *Journal of Research in Philosophy and History*.[11] Our paper discusses the prediction of human and cultural progress worldwide by comparing different cultures throughout history, and we outline 16 "Fishbowl Culture Levels" (see Figure 4). We predict that Fishbowl Culture Level 7, "Fuzzy Incomplete Empirical Verification," will span the years 2050 to 2100, in an age of post-science which we describe as follows: "Solutions of value, software, and touch plus fuzzy logic will be implemented by the establishment. For example, the solution of touch will be solved based on the fuzzy jumpulse mechanism, which will create robotic bounce-less, collision-less, and autonomous automobiles." (I will discuss the application of jumpulse to cars and robots later in this article).

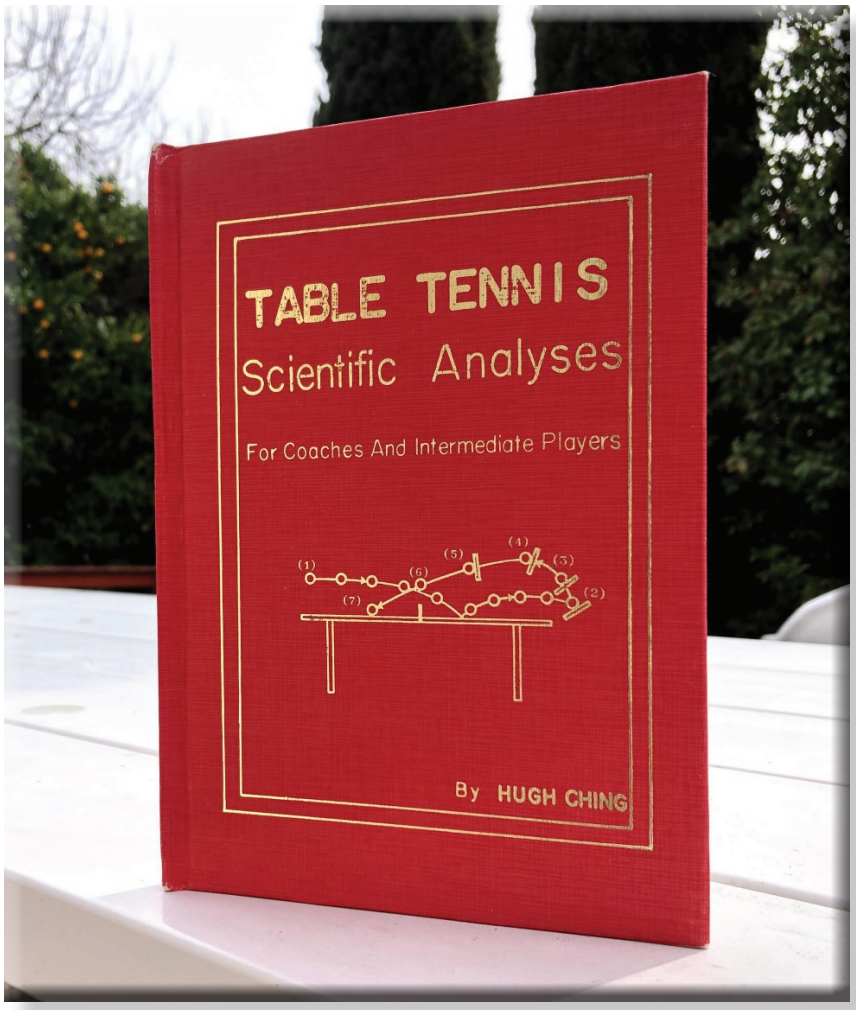


Figure 3: Dr. Hugh Ching's book, *Table Tennis: Scientific Analyses for Coaches and Intermediate Players*.[12]

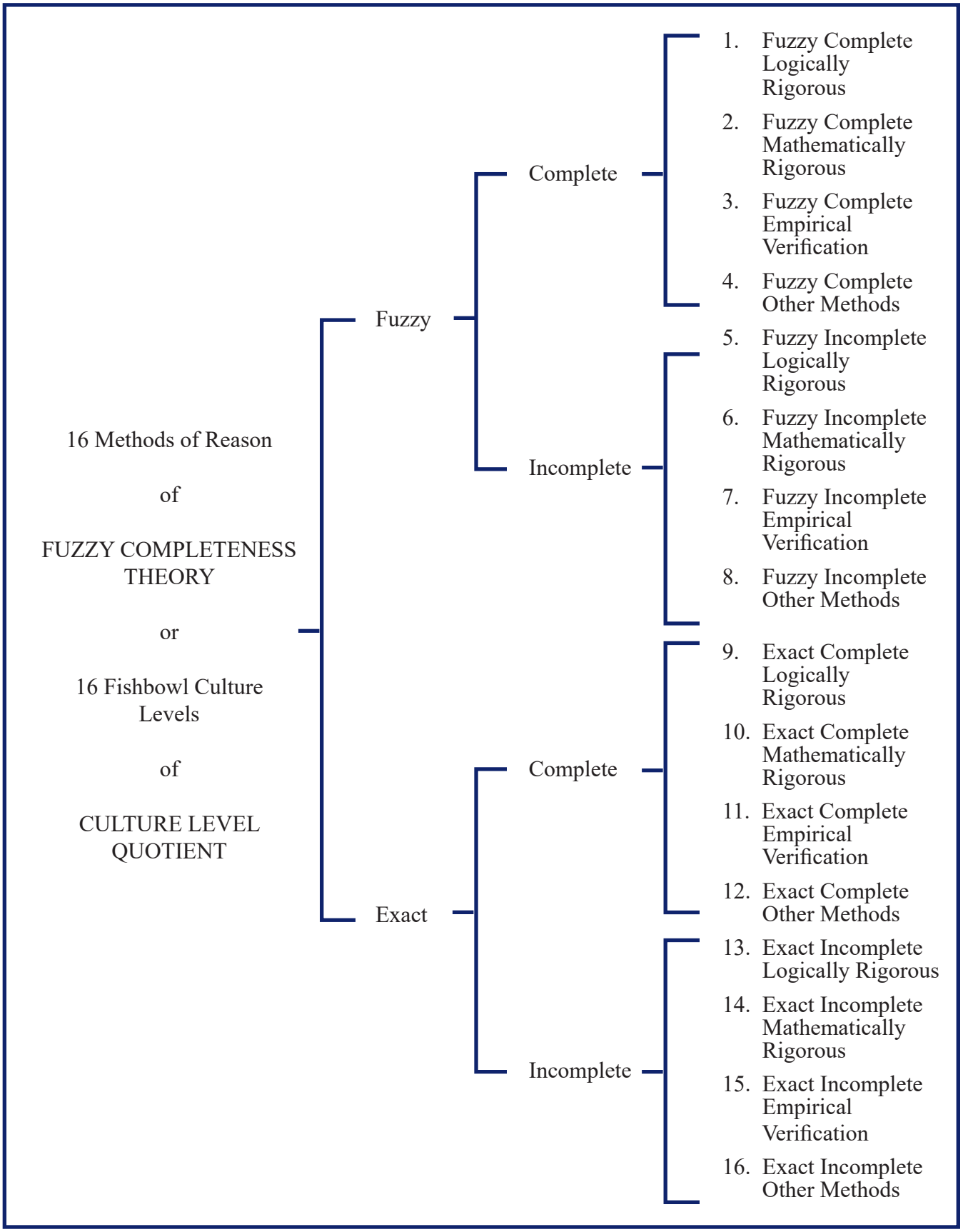


Figure 4: The 16 Fishbowl Culture Levels outlined in the paper, "Culture Level Quotient."[13]

Figure 5: Lotfi A. Zadeh, "Father of Fuzzy Mathematical Logic."[14]

Jumpulse and Fuzzy Logic—The Genius of Lotfi A. Zadeh

Another researcher who was an inspiration to me was Lotfi A. Zadeh (February 4, 1921 - September 6, 2017), who was a computer science professor at UC Berkeley and was known as the "Father of Fuzzy Mathematical Logic."[15]

As explained by Lotfi Zadeh, *fuzzy logic* changes our perception of the very nature of knowledge; and individuals who endorse fuzzy logic see solutions as defined within specific parameters. In his entry, "Fuzzy Logic," in *Encyclopedia of Complexity and Systems Science*, Zadeh discusses forcing one objective value with no possibility for leeway.[16]

Lotfi Zadeh has resolved the incompleteness and impossibility of logic and made logic complete and knowledgeable within a new concept called *range of tolerance*. This concept is explained thoroughly in the following two articles.

First, in "The Fuzzy Completeness Theory," Dr. Ching Hugh explains, "When a solution is newly defined as an answer within the Range of Tolerance of the solution, Fuzzy Logic resolves the incompleteness in logic and becomes the new foundation of knowledge, replacing Exact Logic. With this definition of a solution, Fuzzy Logic covers the incomplete or the impossible parts of the solution by expanding sufficiently the Range of Tolerance to make reason complete and knowledge reliable, but only within the Range of Tolerance."[17]

Second, Dr. Ching's article, "Fuzzy Logic: The Genius of Lotfi A. Zadeh," expounds, "The greatness of Lotfi A. Zadeh can be realized from the ubiquitous effect of fuzzy logic on all knowledge that, henceforth, a solution should be defined as all the answers which lie within the fuzzy range of value or tolerance of the solution."[18]

These two articles demonstrate that the best solution to problems of logic lies arbitrarily defined within expressed boundaries (like fuzzy sets with continuous intermediate gradations) rather than within binary logic (true/false, yes/no, 1 or 2, etc.). The conclusion is that the most accurate description of knowledge should not be exact but fuzzy, where the range of tolerance is finite.

Likewise, jumpulse must occur within boundaries—within the very short interval of impulse. In tennis, jumpulse needs to exploit the full advantage of the range of tolerance of the system, which is represented by the rules of the sport. Intentional double-hitting with one smooth stroke functions within the boundaries of knowledge and is well within the range of tolerance for stroke legality. Jumpulse not only fully supports fuzzy logic but also may place fuzzy logic in the spotlight.

Jumpulse Mechanism in Robots

Robots are defined as intelligent machines that can safely come in contact with their environments. Contact—or touch—is achieved through a fuzzy jumpulse mechanism. A human being engages in touch over a thousand times a day without even noticing the complexities of touch; however, touch is a difficult experience for

robots. In general, humans move with jumpulse, while robots move with force. Humans are gifted with a sufficient range of tolerance and achieve touch with ease. The future of artificial intelligence must be modeled after humans handling fuzzy logic and explore all opportunities in an unpredictable eventuality.

Humans and robots move differently from one another. While robots can operate on their own without any intervention from humans, difficulties arise because robots cannot replicate the motion of a human arm or hand.

Jumpulse in humans is performed via the process of removing one of two opposing forces, such as those of the biceps and the triceps muscles. A robot, however, uses force only. In humans, two opposing muscles tend to be tightened together. Muscles tense up for fast motions, and when one muscle is released, the other tightens. With a collaboration of movement, two muscles produce the jumpulse—a sudden change of force. Likewise, robots must employ a human-like action for jumpulse to occur, and the jumpulse mechanism is the solution to a more perfected robotic touch. Through the use of jumpulse, robots will continue to become more human-like in their movements, allowing them to safely have prolonged contact in an uncontrolled environment. Most important, only robots with the ability to perform human-like touch can substitute for human physical labor. If robots can achieve human-like dexterity—touching things without bouncing off—a scientific breakthrough will occur.

Robots and Jumpulse Dance

In 2008, the Post-Science Institute introduced the Jumpulse Dance.[19] The dance was designed by world-leading thinkers Ta-You Wu (the Chinese Father of Physics) and Hugh Ching (the Father of Post-Science). The dance was designed to make humans look beautiful in motion or, at least, lessen the garishness of human dancing through the practice of the jumpulse mechanism.

Current-day robots cannot perform the crucial dance action of *sliding*. For example, robots cannot do the dance move called the *treadmill* because they cannot apply a jumpulse.[20] Robots can do the *running man*, but they cannot slide on one foot.[21] This is because sliding while standing on one leg requires jumpulse to overcome the active static friction between the bottom of the foot and the ground.

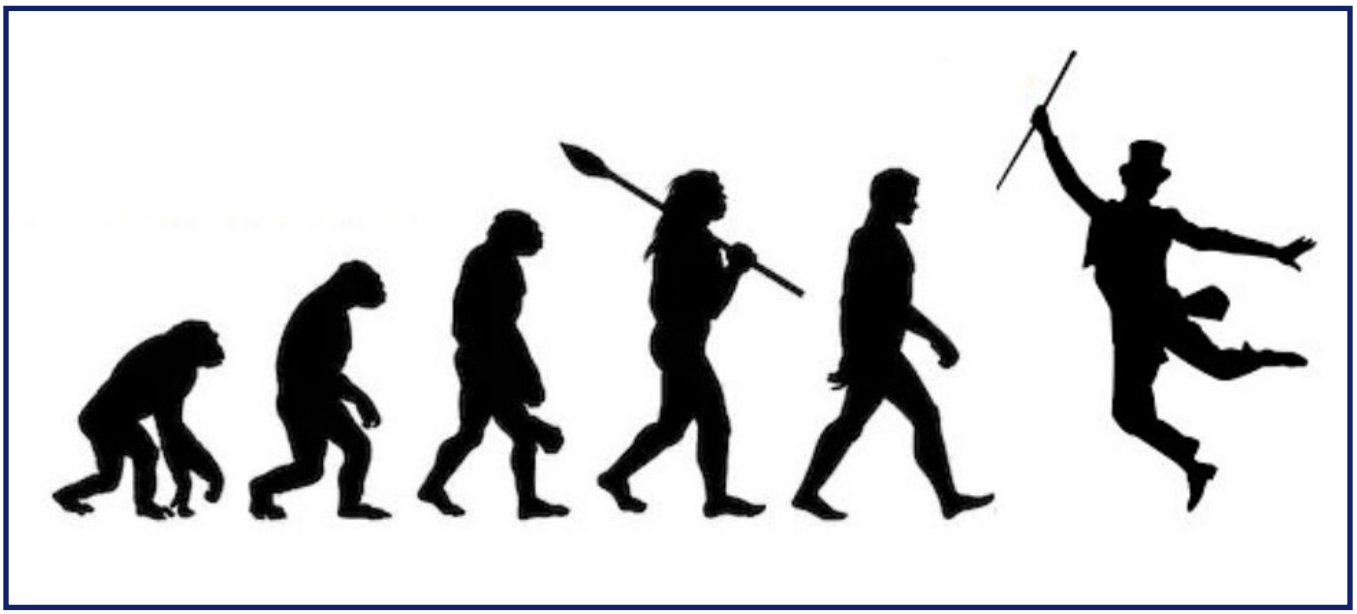


Figure 6: Evolution of man to the most logical of modifications.[22]

Jumpulse Mechanism in Cars

In addition to applying the jumpulse stroke in racket sports (the secret of consistency) and in robot movement (solution to touch), the jumpulse mechanism can help prevent car collisions and save millions of lives. In fact, jumpulse has the potential to eliminate all bounces in cars. When two vehicles collide, the impact could be absorbed using the jumpulse mechanism. By adopting jumpulse, driverless cars could be utilized without fear of collision (when collision *mitigation* is deemed to be more valuable than collision *avoidance*). The YouTube video by Hugh Ching called, "Two Car Collision Without Bouncing Off Each Other" shows this plan in action.[23]

Future Space Robot Wars

The previously mentioned paper, "Culture Level Quotient," states, "Robotics is represented by the Fuzzy Jumpulse Mechanism, which will help a nation dominate sports and robotics with the solutions of prolonged contact and touch."[24] This point reveals the significance of the mechanism, because the first country to utilize jumpulse in all domains will dominate racket sports and will unlock the potential for robotics to boost the economy. Of course, whichever country dominates space will have military domination, and future wars could be fought with drones and robots in space. The Post-Science Institute wants to promote the idea of future robot wars in space as the post-science solution for human peace on earth. Future robot wars in space could reduce human war casualties to zero. Technology that is used in space would be based on the most advanced knowledge available. Therefore, future space wars employing robots would move the world from today's money-oriented society—or the old politics-oriented society—to a knowledge-oriented society.

Milton Friedman proposed a money-oriented society (which employs trade wars) to replace the politics-oriented society (which uses military wars).[25] Today, we see the downfalls of a money-oriented society in which the interest in short-term monetary returns puts marketing above research. The economic problem of today is no longer a problem of productivity but of distribution. Most of the world's recent financial crises were caused by over-productivity, not by scarcity. What society does not know is how to distribute that abundance. The solution is the correct determination of supply and demand based on properly setting the price—the solution of value.

A money-oriented society should advance to a knowledge-oriented society which funds both short-term and long-term returns as well as monetary and non-monetary returns. In addition, in a money-oriented society, all people would be given a universal basic income, because productivity would cover all the necessities of life for everyone. To balance the low rate of return from the investment in a universal basic income, there should be funding of all innovative research projects which are justified by the "solution of value."[26]

Post-science also contributes to one of the most advanced technologies in robotics: fuzzy jumpulse mechanism. Fuzzy jumpulse mechanism combines the most advanced knowledge of range of tolerance of fuzzy logic with the innovation of jumpulse—a sudden change of force and the solution of robot touch. The fuzzy jumpulse mechanism involves fuzzy logic, jumpulse, and deep learning of AI, of which post-science has the solution.[27] Jumpulse will dominate electric vehicles, robotics, control systems, and AI.

It is virtually impossible to stop humans from fighting or competing, individually or collectively, and war is the ultimate form of competition, in which the stakes are human lives. Therefore, a strategy for peace cannot eliminate the factor of competition. However, human culture has grown to the stage in which most people value human lives enough to accept future robot wars in space as the way to peace. In other words, military conflict on earth would no longer be allowed, mainly to avoid the killing of humans. If nations needed to compete militarily,

they could develop space technology to compete in space, where there are no humans. Any grievances could be taken out on robots in space, not on humans on earth. Thus, the most important job of robots would be to die in place of humans.

The Jumpulse Stroke in Action—Courtesy of Jumpulse Dance and Hugh Ching

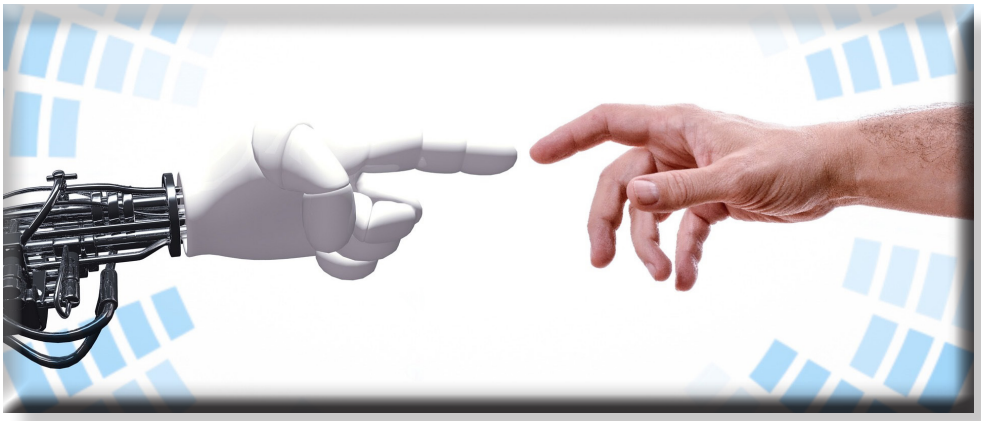
The YouTube video, "Jumpulse Prolonged Contact in Ping Pong with Shake-Hand Racket," by Dr. Hugh Ching, is undeniable video proof of intentional double-hitting in one smooth stroke.[28] Set the playback speed to 0.25, and allow the super-slow motion to reveal the deceleration before contact. The ball appears to make contact with the paddle, then fall off slightly before the paddle quickly hits the ball again within one smooth stroke. Listen to the specific sound of the stroke, which indicates a properly executed double-hit.

A video showing double-hitting in tennis is "Jumpulse Tennis Prolonged Contact with Double-Hitting video" by YouTube channel *jumpulsedance*.[29] Again, use a playback speed of 0.25 to see, in super-slow motion, the deceleration before contact once again.

Another video, called "Jumpulse Table Tennis," by YouTube channel *jumpulsedance*, shows double-hitting by a relatively new player.[30] If you set the playback speed to 0.25, you can see a Chinese boy perform double-hitting in the video at the time marker of 1:09. Since the ball has no forward or backward momentum—because the ball went straight down onto the table—the peak of the ball's bounce makes it stationary for a very short amount of time. The first hit happens because the paddle slows down before contact. Because the ball is nearly still for a split second, the first hit does not cause the ball to bounce off excessively, which leads to a quick drop-off of the paddle. This very slight dink (a short drop shot) of the ball allows the paddle to initiate contact for a second time, accompanied by extreme acceleration in the swing.

Conclusion

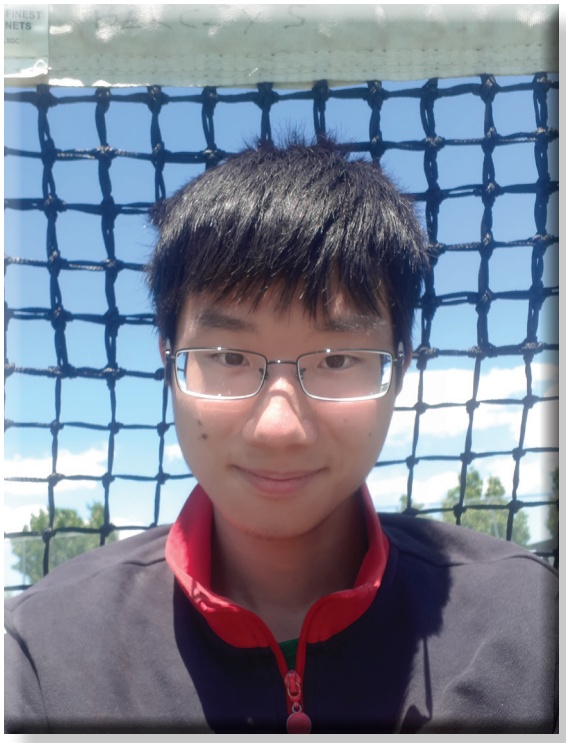
There is much skepticism about double-hitting through prolonged contact in racket sports, so double-hitting has not yet been wholly accepted by mainstream fans, players, or coaches. However, the stroke is essential to study. Whether or not jumpulse is practical to use in racket sports as the key to consistency, the endless possibilities of jumpulse have yet to be explored—not just in racket sports but also in various other domains around the world. Readers will have to decide for themselves the legitimacy of the jumpulse mechanism and its ability to alter real-world phenomena.



When a robot finger touches something without bouncing off, jumpulse has begun to take over.
—Benjamin Li

About the Author

Benjamin Li is a member of the Post-Science Institute and became a self-taught tennis player at the age of 11. Since then, he has been awarded 12 trophies and 6 medals from active participation in high school tennis, tennis club tournaments, and league play matches.[31] He was the York Region Athletic Association (YRAA) champion for High School Boys in 2016, 2017, and 2018, as well as the Most Valuable Player for his high school tennis team in all three of those years. Currently, he is a Certified Jumpulse Tennis Coach and is looking forward to teaching the jumpulse stroke to other tennis players and promoting all of its possible applications outside of the sport. Some consider Benjamin Li to be the world's leading authority on the concepts of Jumpulse and Culture Level Quotient. In the future, he hopes to inspire others to solve the fuzzy-logic aspect of the Fuzzy Jumpulse Mechanism (or to tackle the challenge himself), which he believes could lead to a scientific breakthrough in the field of physics.



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“Remember, science fiction’s always been a kind of first-level alert to think about things to come. It’s easier for an audience to take warnings from sci-fi without feeling that we’re preaching to them. Every science-fiction movie I have ever seen, any one that’s worth its weight in celluloid, warns us about things that ultimately come true.”

—Steven Spielberg