Systems Thinking and the Eastern Martial Arts

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Abstract

Rapid scientific progress over the past century has been largely attributed to the reductionist school of thought. Holism has only re-entered mainstream thought recently via the increasing popularity and advocate of systems thinking. Eastern philosophy, in contrast, has always embraced and manifested holism in every conceivable facet of life: from the quotidian routine of meal preparation; to Taguchi quality control; and to the life-saving application of Eastern medicine. These beget an interesting question: is it possible to relate systems thinking to Eastern philosophy from its various incarnations? This paper seeks to answer this question partially via the delineation of the Eastern martial arts practice, an application of Eastern philosophy. Our findings indicate that the language of systems thinking can potentially be a most natural medium for such cross-cultural knowledge transfer.

Keywords: Systems thinking, Eastern philosophy, Martial arts.

Introduction

Back in the 1960s Eastern philosophy was catapulted into a brief renaissance of sorts by the successful industrialization of Japan. With this, came the mass export of Japanese management ideas to the West. The Toyota Production System or TPS (Liker, 2003), for instance, with its focus and insistence on wastage elimination, has been held in high esteem by many practitioners in the West. Processes such as production, transportation, inventory consumption and replenishment are identified as tightly-coupled systems, and managed frequently via practical visual aids such as Kanban (Hopp and Spearman, 2000). Similarly, the Jidoka (Liker, 2003) - through actively engaging and empowering the human to make decisions to stop processes for maintenance and troubleshooting - illustrates the necessary integrated coupling between the human and machines for process improvement. This, in effect, boosts worker morale and improves productivity. In

addition, as problems are rooted out early upstream via quality checks, quality assurance is imbedded within as a systemic property.

The above are exemplars of Eastern- based systems thinking methodologies employing holistic approaches to solving modern problems. Till now, however, the respective methods are still shrouded in mystique and have been at times relegated to being merely buzzwords. The efficacy of such methods in implementation varies from good to marginal, if not bad in certain cases. In many instances, they have been misconstrued as a black box panacea which has most often been applied inappropriately, thus culminating in failure or dismissed as management nonsense. Over time, practitioners and researchers correctly point out that this is due to the lack of a cohesive framework to assimilate Eastern-based management practices to modern industrial problems (Liker, 2003). Obviously, such a cohesive framework goes beyond a mere implementation of tool sets such as Kanban or control charts. A comprehension of the thought-processes behind the tools is required. Thought-processes, however, are necessarily embedded in a cultural context. In particular, Eastern philosophy concepts are often embedded within management practices such as JIT and TPS. Hence, it is imperative that Eastern philosophy be revisited so as to understand the rationale behind their associated procedures. Fostering understanding and knowledge transfer across cultures, however, remains a major challenge and obstacle to be overcome.

In this paper, we propose that systems-thinking, as a language, forms a most natural medium for knowledge transfer and the learning of Eastern philosophy concepts. This proposition arises from the authors' insights and experiences in the Eastern martial arts and recognition of intimately close relationships between the thought-processes imbedded in Eastern philosophy and systems thinking. Eastern philosophy, however, does not exist in a vacuum, but is manifested and applied in almost every aspect of the traditional Eastern way of living, from medicine, to art to warfare. The Eastern martial arts, in particular, is a fertile and apt resource for unearthing such knowledge as every movement of a standard practice set manifests the tenets visually in a unified systemic fashion. Hence, the tenets are amenably articulated, and thus concretized for distillation. This paper is a first attempt at articulating the systems-thinking behind Eastern martial arts, and we hope to open new doors for future study and research in this area.

The rest of the paper is organized as follows. In the next section, we first highlight some obvious parallels between manufacturing best practices and Eastern martial arts principles. This provides the motivation to investigate more broadly and extensively the philosophy and concepts of martial arts practice and its relation to systems thinking concepts. In particular, we discuss through specific examples, that the notions of structural-level problem-solving and the use of systemic archetypical patterns are well-grounded in martial arts history. Finally, using a case example of the partnered practice of push-hands, we demonstrate that the explanation of the underlying martial concepts can be facilitated easily through the language of systems thinking.

Manufacturing Best-Practices: Martial Arts Principles in Action

Martial arts are applications of Eastern philosophy. In the following we argue, via the delineation of martial art combat strategies and training methodology, the existence of parallels in management practices such as JIT and TPS.

First, in JIT, parts are only transferred from warehouses to workstations and from workstations to workstations via 'pulling'. This is analogous to martial art engagement tactics where the practitioner - instead of initiating attacks - reacts only when attacked via pre-empting them. To accomplish this, the practitioner must be free from any suppositions with regard to the impending attack, possessing a neutral and relaxed stance to ensure swift reactionary movements. This facilitates the capability of moving freely without favouring or anticipating any direction, and there is little waste in energy. This is indeed similar to the notion of flexible and agile manufacturing in TPS, which aims to be highly-responsive and sensitive to customer demands. To accomplish this, the manufacturing line must become ‘lean’, i.e. minimal buffer inventories and tool changeover efforts.

Second, TPS, via TQM (Total Quality Management), emphasizes quality by ensuring that correct process execution takes precedence over the final product. In other words, the prerequisite for a quality product is good process execution and control, or that result of good process execution is quality products. To run counter to this is akin to putting the cart before the horse. The underlying tenet is that prevention - to do it right the first time - is better than rework or correction, monetarily or efficiency-wise. Similarly, in the eastern martial arts, the importance of proper practice cannot be overemphasized. To derive the maximum power through minimal effort, the entire torso must be employed in a unified manner. To achieve this, proper routine practice is mandated. In martial arts training, the beginning student is usually taught a set of standard forms. All forms must be practised sequentially: each form must be tested to the exacting detail by the instructor before the student is allowed to proceed with the next technique. This process parallels the Jidoka, of which the workstations are akin to the different techniques of the training set, the instructor being the quality-vetter, and the student being both the initial and final product. Only when the forms are assimilated and fully internalized, can the student be capable of withstanding the rigors of battle. In production, a shoddy product will only result in a loss of customer goodwill which is not restorable. Analogously, if skills are not handed down and mastered properly, death is an imminent certainty in combat. This is because, in the heat of actual combat, there is no recourse for the correction of poor skills.

Systems Thinking in the Martial Arts

Technique Execution in Aikido: Exploiting System Structure in Problem Solving

Aikido (Ueshiba, 1987), commonly known as "Way of Harmony" is Japanese martial art which relies on blending with the attacker's motion so as to redirect the attacker's energy - rather than clashing head-on with it – for use in subjugating or throwing the attacker without inducing harm. It aims to develop the individual holistically via the integration and utilization of the spiritual, mental and physical aspects.

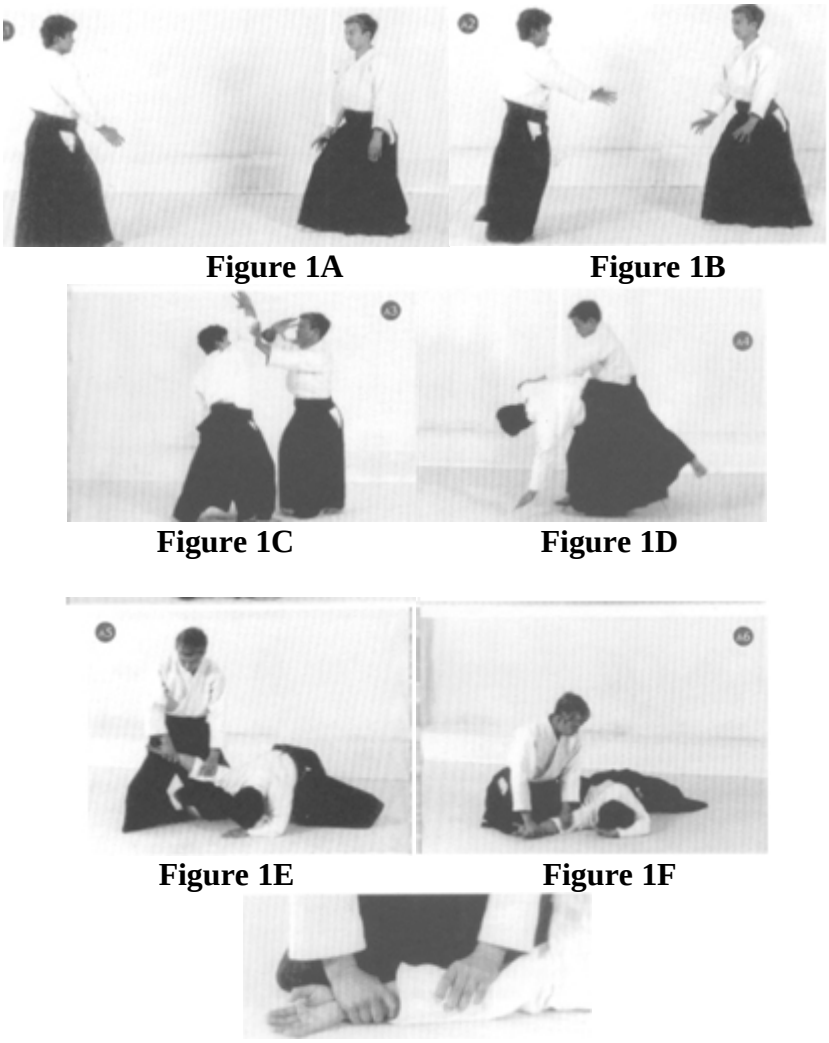


Figure 1A **Figure 1B**

Figure 1C **Figure 1D**

Figure 1E **Figure 1F**

Figure 1G

Figure 1 The Ikkyo Technique of Aikido *(Reproduced from Ueshiba, 2002)*

Ikkyo (translated as "first technique" of Aikido, see Figure 1), illustrates a fundamental concept in systems thinking: i.e. that a system is a cohesive whole and is greater than its sum of parts (Meadows, 2008). Consequently, one should always strive to improve the

efficacy and efficiency of the entire system as opposed to individual constituents. Although an almost cliché statement, this in real-life problem-solving can be extremely challenging to realize, as it requires an almost internalized understanding of the system structure.

In the partnered practice of Ikkyo, one party plays the antagonist (attacker) and the other the protagonist (defender). During a frontal forehead strike by the attacker (Figure 1B), an inexperienced defender of similar physique will typically raise his arm to parry the blow in fear of the attack. In this case, he will have to use an extremely large amount of upper body strength, in particular in the arms, to counter the attack. This, however, is highly inefficient, as the maximum amount of arm strength that could be generated is far less of that generated by a full-force frontal strike. Besides, the attendant disjointedness in movement causes an unbalanced posture which exacerbates the situation. This is analogous to inability of the incipient subsystems to coalesce effectively to perform its intended function. As a consequence, no matter how strong the individual components (size of the arm muscles) are, the defender is easily overwhelmed by the power of the attack.

On the other hand, in a properly executed Ikkyo, the superior strategy of the defender is to enter into the space of the opponent with the entire torso (Figure 1C-D) within the small time-window as the attacker raises the arm to swing at him. The movements of the defender's arms must be synchronized with the entering movement of the torso. In fact, all movements must emanate from and be dictated by the power of the torso. Here the attacker is easily overcome with minimal effort, no matter how strong the attack is. Akin to the Pareto rule, 80% of the power of proper Ikkyo is derived from 20% effort, i.e. a small movement of entering the entire torso is used to overcome a much stronger attacker. This, however, is by no means easily executed and can take many years of practice. The 'secret' of success of the technique lies in the fact that system structure is fully exploited. Firstly, the relationship between attacker's and defender's positions and timing are key factors to success, rather than the sheer muscular force. This is exactly analogous to a game of chess where given the right position and timing, even a pawn can take the queen. Secondly, all sub-systems are seamlessly coordinated to deliver maximum functional efficiency. As a result, huge marginal benefits are derived by viewing and optimizing the system as a whole rather than the individual parts.

Kata: System Archetypes of the Martial Arts

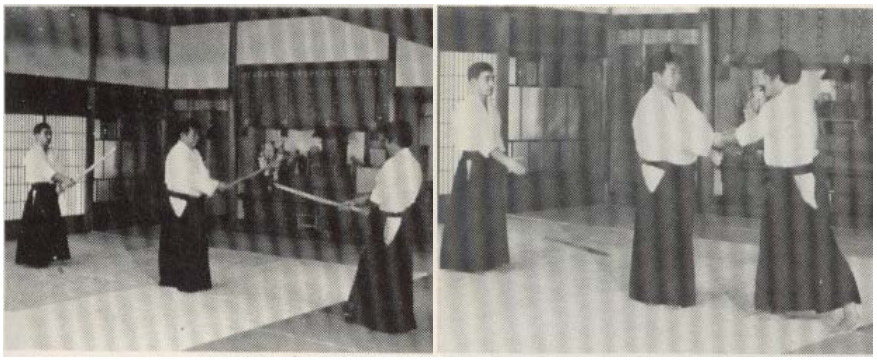
In Japanese martial arts, Kata (Kane and Wilder, 2005) refers to the detailed choreographed movement patterns which are either practiced alone or in pairs. It is primarily used as a tool for honing reflexes to elicit the appropriate physical and behavioral response patterns when attacked. Via daily practice, internalization is made possible: a generic mental structure of the possible patterns of attacks, and counters which can be used for not only generic scenarios but also specific situations is then imprinted onto the practitioner's psyche. This coupled with experience, allows the practitioner to quickly invoke effective strategies learned from the Kata when faced with an incoming attack or encounter.

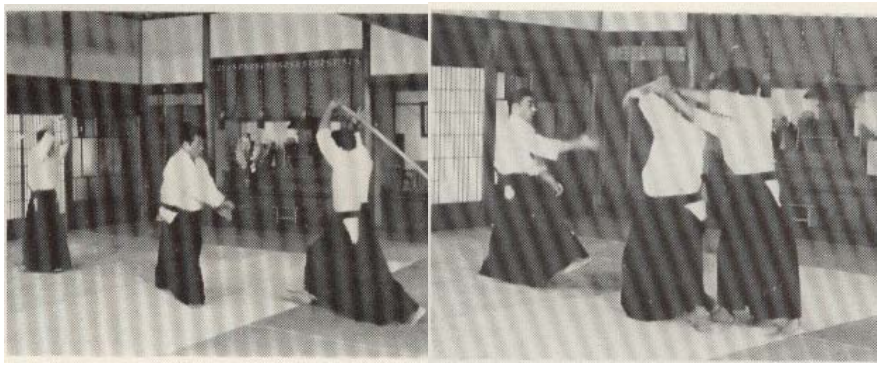
It is obvious that the Eastern concept of Kata mirrors precisely the purpose of system archetypes (Senge, 2006) used in systems-thinking for problem-solving. In the following we further this argument more elaborately through a study of the structure of Aikido's combat strategies.

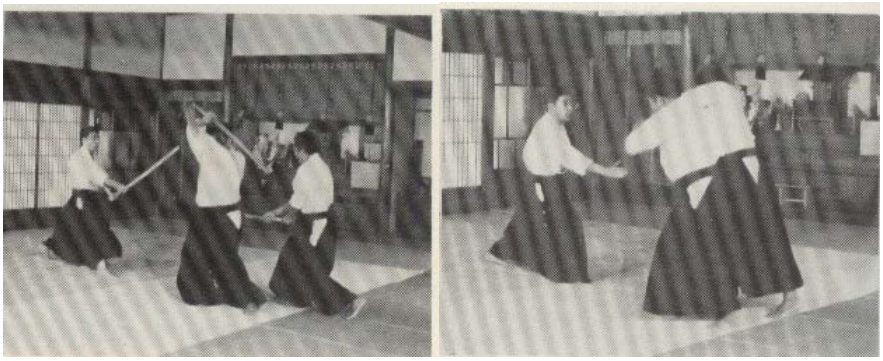
Aikido and System Structure: From Sword to Empty-Hand Defense

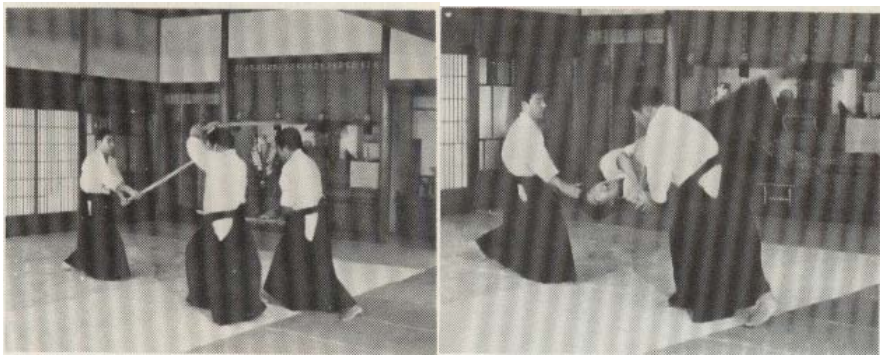
The development of the martial arts in Japan harkens back to her feudal militaristic roots before her eventual unification as modern Japan. Swords - deemed superior to other weapons -were the prized weapons of the warrior class. Hence, in most events involving combat, swords would often be the primary weapon. With the prevalent use of swords for combat, patterns evolved with most tactics and strokes being sword-centric - as evidenced by the manifestations of the various combinations of slashing, cutting, parrying, feinting movements of different schools strung together to form respective defensive or attacking sequences. For the Samurai – skirmishes are an ongoing and everyday affair. It would thus be pragmatically efficient and effective to build on their present sword-centric skill set, as opposed to picking up new skills which are built upon structures other than the sword.

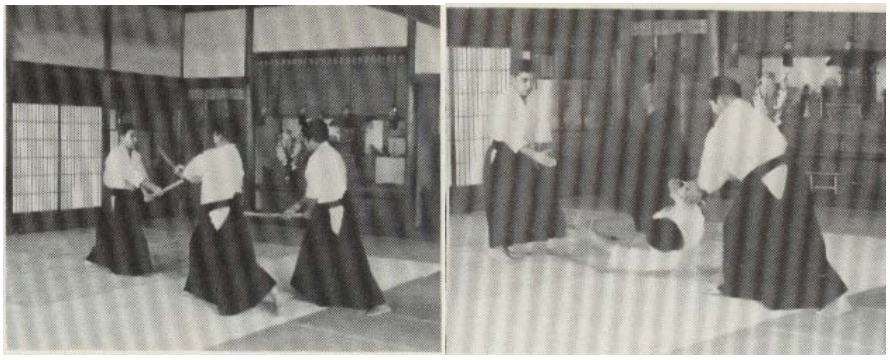
Aikido, a crystallization of the traditional samurai fighting arts, best exemplifies the underlying sword-centric structure. The stance employed whether one is wielding a weapon or vice-versa; the pattern of movements in response to an attack, or even defense, is similar with only minimal cosmetic adjustments. The weapon of choice can be just the empty arm, or the sword, or staff - weapons are merely extensions of the empty hand and vice-versa. An example of sword technique (Shomen-uchi Shiho-nage Omote) and its empty-hand counterpart is shown in Figure 2. This once again exemplifies the intimately-related worldviews of systems thinking and the Eastern martial arts. In particular, both emphasize identification of recurring system structures in problem-solving, as opposed to 'fire-fighting', event-driven approaches. The only difference is that such approach is seldom explicitly articulated in the Eastern arts. It is almost standard-de-facto in everyday life and ubiquitous in all Eastern arts and culture.











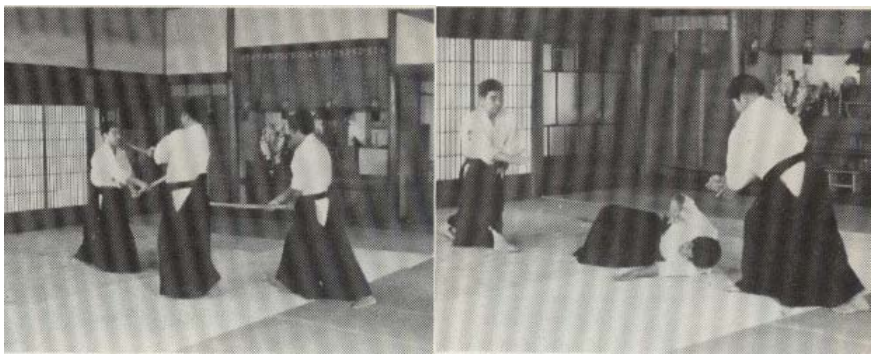


Figure 2: Combat Strategy Structure of Aikido. *The panels in the left column illustrate an execution of a sword technique. The panels in the right shows the identical strategy applied to an empty-hand encounter. (Graphics reproduced from Saito, 1973)*

Martial Arts as Complex Systems

In Eastern philosophy and the martial arts, the spiritual, mental, and physical dimensions are intimately intertwined and thus inseparable and must be treated holistically. Martial artists adopt the worldview of practicing as a way to improve health, physique, self-defense, moral cultivation and even spiritual cultivation simultaneously. Folklores and stories frequently warn of the failure and doom of the artist who pursues only the fighting aspect and neglects moral cultivation. Each martial art exponent can be regarded as a complex system by himself. Beyond the self, the martial arts are ultimately concerned with the engagement of combatants in a conflict resolution situation. Hence, during combat, these individual systems interact, giving rise to further complex behaviors. In the following, we demonstrate how a typical partnered practice routine in martial arts can be viewed rigorously through the lens of a systems-thinker.

Elucidating the Principles of Push-hands: A Systems Approach

Taijiquan (Cheng and Smith, 2004) also known as the "supreme extreme fist", is steeped in the Book of Changes - I-Ching and Tao Te Ching. The concept of yin and yang, drawn from I-Ching, pervades all facets of taijiquan. Yin and yang - though, polar opposites - are always tightly coupled. Yin can be defined to be finesse while yang to be hardness. The overarching principle is for the practitioner to maintain the delicate mutual balance of yin and yang within oneself, at all times of combat: to meet force (yang) with finesse (yin) by yielding so as to redirect it while maintaining one's balance.

Push-hands (Cheng and Smith, 2004) is an exercise in control where success is achieved by unbalancing the one's partner via pushing. It seeks to improve one's balance, poise and reflexes while in contact with another person who is moving. During push-hands, each party attempts to maintain balance and remain in light contact with the other party's arms while attempting to unbalance the other party when opportunity arises. When one party is pushed or pulled off balance, he will usually stumble out of his prior position and have to reset his stance to resume play.

Figure 3. The Ancient Taijiquan Partnered Exercise of Push-hands

Push-hands has been described aptly to be akin to two persons sawing a log together (Cheng, 1985). To be able to saw effectively, the actions of both parties must be in unison. When party A is pulling, party B must push along in the same direction to keep up. As the action of one party is always perceived with respect to the other, the opposite must also apply. Taking reference with respect to the party B, when party B is pushing, party A must pull along in the same direction to assist. Hence, in a typical Taijiquan push-hands exercise, both parties are constantly engaged in a cyclic routine of transmitting and receiving energy.

It should be noted that in real bouts, the switching and demarcation of roles from defender to attacker and vice-versa is not easily perceptible. Both parties are constantly influencing each other. Action and reaction occurs in a continual circular and cyclical fashion: the defensive reaction of one party might be perceived to an attack to the other party thus initiating his own respective defensive action. Here, both parties are viewed as two highly interacting sub-systems housed within a main system. Each attempts to unbalance his counterpart whilst striving to maintain his balance.

In the ideal situation, both parties are always attuned to the movement and intention of his counterpart. Failure to respond appropriately in a timely fashion would result in defeat. To maintain dynamic equilibrium, via using the wrists as receptors, both parties should be able to follow up in the correct direction with the optimum force. The importance of using correct speed and accuracy of the receipt of information cannot be overemphasized, as stated by Sun Tzu (Giles, 1910): *"It is said that if you know your enemies and know yourself, you will not be imperiled in a hundred battles; if you do not know your enemies but do know yourself, you will win one and lose one; if you do not know your enemies nor yourself, you will be imperiled in every single battle."* Hence, information feedback must be spontaneous and accurate, so that both parties can track each other's movements with synchronicity. The wrists, serving as extensions of the torso, project the power generated and channeled by the torso and legs; or receive the power to be redirected to the ground via the lower extremities. This is akin to the synchronization of all pertinent subsystems to maintain the systemic dynamic equilibrium.

Figure 4 illustrates the system structure of the push-hands practice. Given the interconnectedness of the body, proper postural alignment is paramount to ensuring balance during movement. As the spiritual, mental, physical aspects of the practitioner are tightly coupled, it is important to ensure that the three are attended to adequately. Should one aspect be wanting, it will affect the other two. In effect, via this mind-body connection, a balanced, upright and relaxed torso almost ensures a free, flexible and relaxed mental attitude which is neither confrontational nor passive and vice-versa (Cheng, 1985, 1999). In the following we explain each of the relevant dynamic processes in Figure 4 in greater detail.

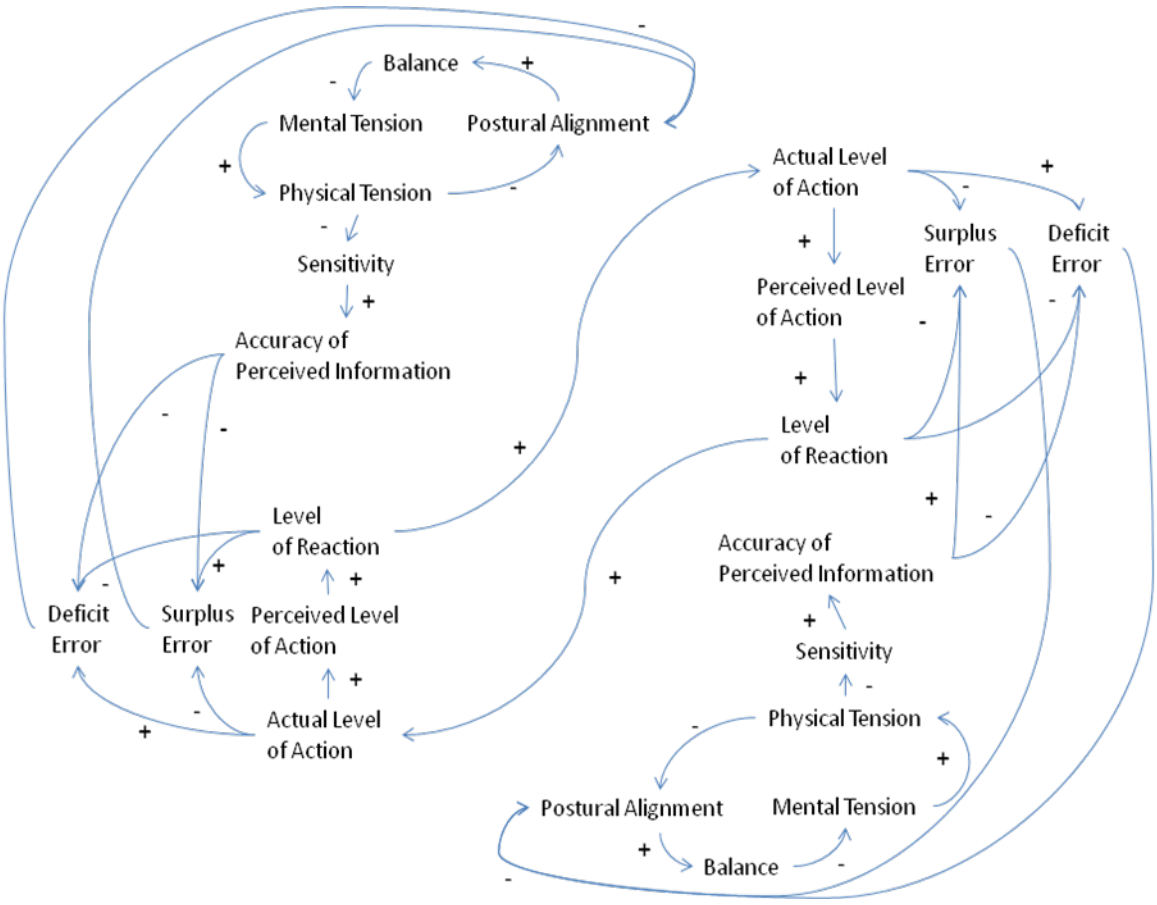


Figure 4. The Structure of Push Hands Practice

Postural alignment lends the structure of the physical dimension (body) of the practitioner. Only when this is proper, are the physical constituents of the system – the limbs, hips, and torso – able to function optimally (Cheng, 1985). In addition, for maximum efficacy and efficiency, the movements of all extremities must be dictated by the hip. Upon the detection of power, it is imperative that the torso and legs of the receiving party compensate adequately to ensure a quick restoration of balance, and hence dynamic equilibrium. As the wrists are the first to receive the power, they will provide the necessary feedback to kick-start the appropriate compensatory action. For the wrists to be able to absorb the incoming energy of the transmitting party, the postural alignment of

receiving party must be proper to ensure unimpeded transfer of power from the hip to the wrist. Improper postural alignment will exacerbate the loss of balance which will culminate in an increase in mental and physical tension, especially in the upper torso (Postural Loop in Figure 5).

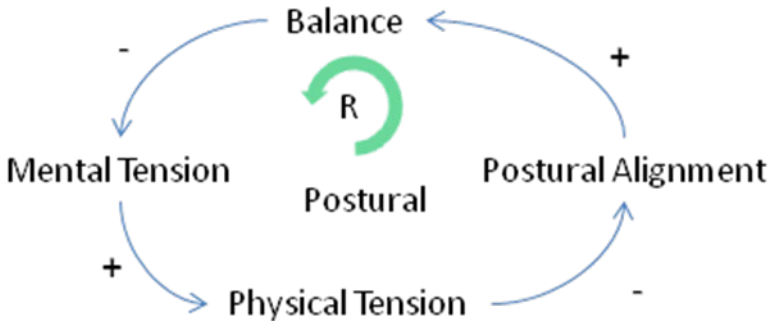


Figure 5. The Postural Reinforcing Loop

Tension desensitizes the practitioner's attunement to incoming information. It is readily manifested by the stiffness of the practitioner's wrist. Stiffness of (upper body) the wrist results in the reversal of power transmission, i.e., from the (upper body) wrists to the legs via the torso, which disrupts the practitioner's stability. When wrist is stiff, inaccuracy of the perceived level of attack is compounded resulting in either over-compensation or under-compensation. In addition, the stiffness will telegraph the defender party's intention to the attack thus increasing the accuracy of information that is fed to the attacker.

When facing an attack, for instance, if the defender elects to counter with a lower level of defence, he will be overwhelmed by the intensity (and speed) of the incoming attack. Due to under-compensation - caused by the incorrectly perceived attack - the rear lower limb of the receiving party will not be bent sufficiently low, so as to displace the torso rearwards adequately whilst keeping the torso upright and ensuring stability. This results in receiving party being unable to yield sufficiently in order to lead the projecting party deep enough to be unbalanced. In the worst scenario, the defender's upper torso will be arched backwards relative to his stomach. The difference in level of attack from the level of response is deemed a deficit error. This culminates in postural misalignment which exacerbates the loss of balance and the increase in tension, thus resulting in a vicious cycle (Deficit Reinforcing Loop, Figure 6). The defending party will either be unbalanced by his postural misalignment, or by the incoming attack whose error has been minimized (i.e. accuracy has been increased) by the defending party's (physical) tension which has increased the accuracy of the incoming information that is fed to the attacker.

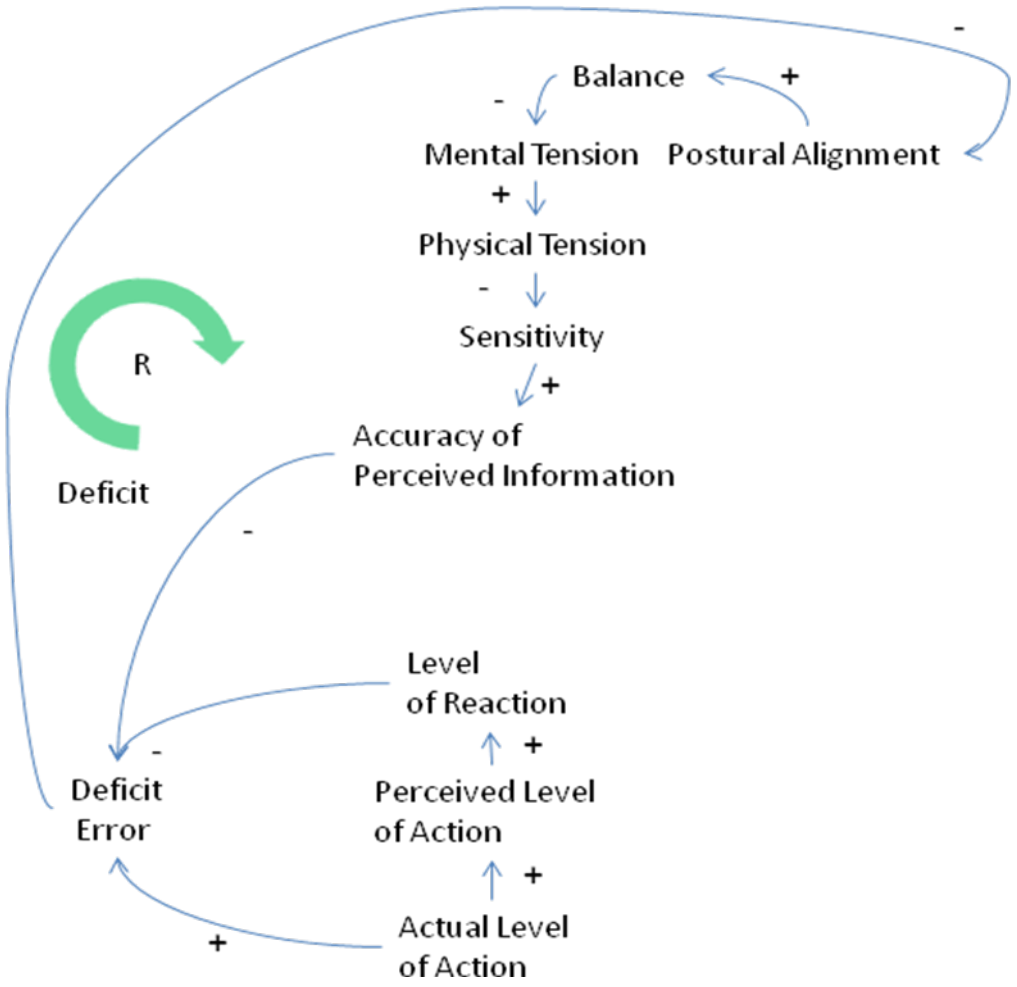


Figure 6. The Deficit Reinforcing Loop. *If the defender elects to counter with a lower level of defence, he will be overwhelmed by the intensity (and speed) of the incoming attack. Due to under-compensation, the receiving party will be unable to yield sufficiently in order to lead the projecting party deep enough to be unbalanced, thus causing deficit error. This culminates in postural misalignment which exacerbates the loss of balance and the increase in tension, thus resulting in a vicious cycle.*

On the other hand, if the defender reacts with a much higher level of defence than necessitated (i.e. over-compensation), he will be lead off-balance due to postural misalignment. The attacker, via retreating suitably, has enticed the defender to enter deeply to the extent of compromising his balance. When the defender has realized his loss of balance, he would be affected psychologically to the extent of tensing his torso which would further facilitate his unbalancing. An element of deception is in full play here. It concurs with one of Sun Tzu's aphorism (Giles, 1910) *"All warfare is based on deception. Hence, when we are able to attack, we must seem unable; when using our forces, we must appear inactive; when we are near, we must make the enemy believe we are far away; when far away, we must make him believe we are near."* In this scenario,

the defender's upper torso is bent forward relative to his stomach. The surplus arising from the difference in the level of attack from the level of response is deemed a surplus error. Similarly, the abovementioned vicious cycle ensues (Surplus Reinforcing Loop, Figure 7).

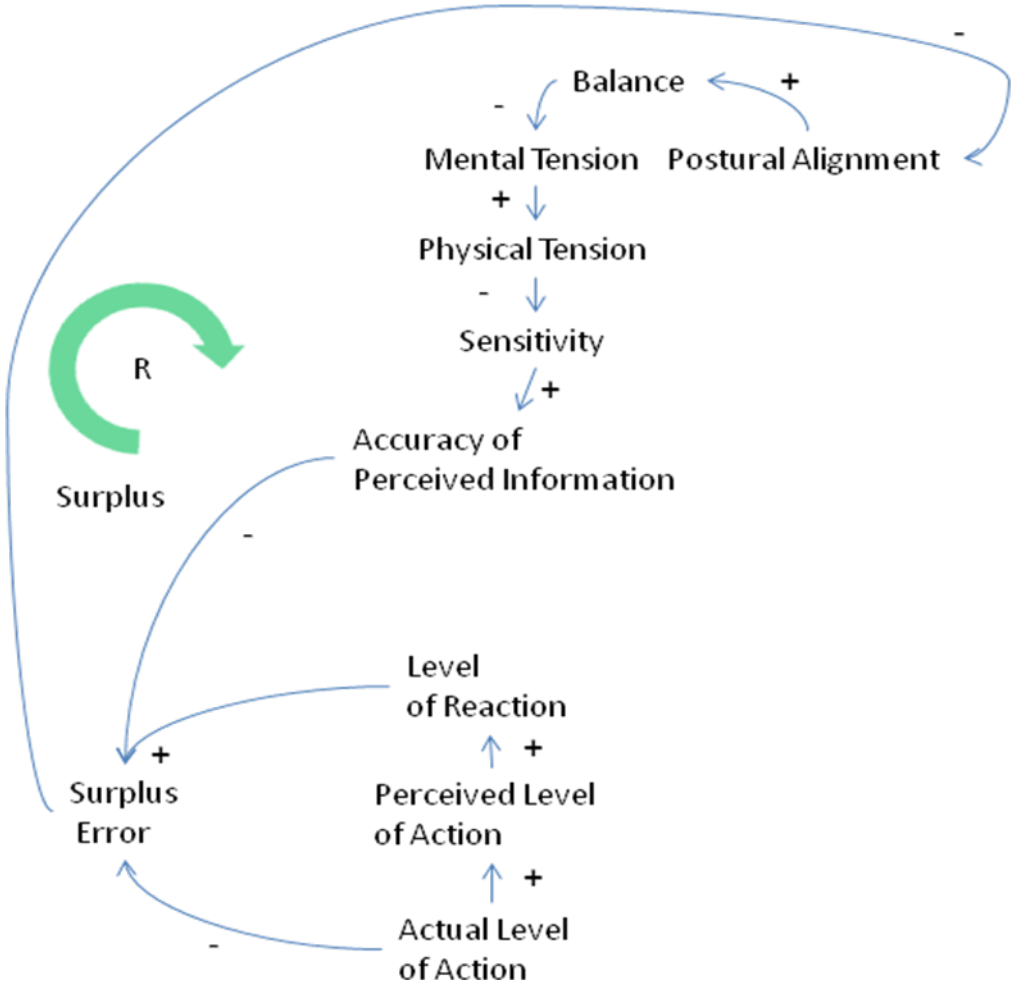


Figure 7. Surplus Reinforcing Loop. *If the defender overcompensates with a (much) higher level of defence than necessitated, he will be lead off-balance, due to postural misalignment (and mistiming), thus causing a surplus error. The attacker, via retreating suitably, has enticed the defender to enter deeply to the extent of compromising his balance.*

Conclusion

In this paper, we have demonstrated the intimate relationships and parallels of Eastern martial arts and the principles of systems thinking. Consequently, we argue that the language of systems thinking has the immense potential to serve as a bridge to the knowledge embedded in the Eastern arts. Indeed, valuable lessons are still waiting to be gleaned from unearthing such ancient wisdom for applications to modern life. Systems thinking can also have rich pedagogical values in the instruction and transmission of the Eastern arts in the future.

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