E-Learning Supported Martial-Arts-Training

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Abstract. Teaching martial-arts techniques is one of the most time consuming training activities within the domain of sports. Electronic support to teach movements, techniques and correct body postures is already an increasing factor in the martial-arts. One of the main goals of the martial-arts technique WingTsun is obstructing the reach and efficacy of an opponent's weapons (fists, elbows, knees, feet, head) while attempting to incapacitate. The various approaches to achieving this goal are constantly being refined and evaluated. For this project, data will be collected from various test subjects via motion tracker over the course of one year. All test subjects will receive the same amount of schooling from the same instructor. But one group will be equipped with an additional E-learning self-assessment tool. Both groups will be monitored via motion-trackers throughout the entire training interval (approximately 12 months). The data will then by analyzed regarding the efficacy of E-learning pertaining to an overall improvement and/or a faster advance thereof. The paper will detail the training program, the motion-tracker setup as well as future use cases.

Keywords: Martial-arts · Motion-tracking · E-Learning

1 Introduction

In reality, flight should always surpass as a preferred option to fighting. Yet WingTsun also emphasizes the preventive qualities of offensive measures. The goal is to prevent the entire scope of an attack. A proactive approach is recommended in order to familiarize beginners with a swift and realistic minimum capability to defend themselves [3]. Throughout the unfolding of a conflict the preliminary affirmative use of voice and facial expression, especially eye-contact, and the positioning of the entire body are a key to success. Since the opponent may be capable of any kind of physical attack it seems advisable for a student at beginner level to become acquainted with a universal solution, which can pre-emptively circumvent a majority of various attacks. Prerequisites of a universal solution are timing, a powerful kick at knee-height, and powerful striking. These components should suffice to incapacitate the opponent.

Traditional training aims at establishing a body unit, where maximum strength is extracted by utilizing the entire body when kicking and striking. This maximum cannot be accessed by the student without a stable stand, proper muscle tension of the torso, and various strength amplifying factors such as shifting ones weight or rotating the body [3].

The e-learning approach enriches this traditional method of teaching by adding another didactical possibility of understanding ones own movement as well as the aspired movement. It can be a visual aid as to what the pre-emptive positioning of the body should look like, how striking and kicking strength can be maximized, and in which way a preventative attack should best be carried out. Certain theories imply that motion sequences are adopted more successfully, if the test person is able to view a demonstration of these sequences repeatedly [4].

Once the aforementioned basics have been established in training, both forms of attack, namely striking and kicking, are to be performed simultaneously. Quite often this is perceived to be a difficult challenge by beginner level students. Flaws within the motion sequences are often perceived more precisely by observers. During a preventative attack, which occurs in an extremely limited time span, the entire body is utilized, different movements are initiated and carried out simultaneously (striking, kicking, pacing, rotating, stabilizing, etc.). A critical self-evaluation of this process is beyond the abilities of a student at beginner level. An observer on the other hand is able to notice whether the preliminary positioning is correct, hand and foot impact simultaneously, core stability is maintained, or the final positioning towards the opponent correlates with his positioning. This guided approach seems necessary until the student has attained an increased level of self-awareness allowing him to make these assessments on his own [5]. A motion-tracker can aid the student in controlling his motion sequences and optimizing his movements by allowing a direct and visual comparison with his trainer's movements [5]. The implementation of a motion tracker [2, 6] enables a time-independent and objective analysis of motion sequences which might be a sufficient way of reducing the time investment necessary to be trained [1].

2   Stances

In WT the universal approach is a preemptive attack in order to undermine a pending attack. It aims at incapacitating the attacker via specific kicking and striking techniques at the exact moment he is about to engage [7]. The main advantage of this approach is that the nature of the attack is of lesser importance. Regarding highly stressful situations an inexperienced participant of a fight cannot be expected to identify the nature of an attack and evaluate the appropriate response [7, 8].

The universal approach features many advantages, but it requires a lot of practice. The deconstruction of the entire process into singular motion exercises enables the correct and effective internalization of the full movement. Partner exercises mainly focus on practicing proper timing, e.g. when should the universal approach be applied. There are several factors that must be regarded in order to provide a holistic and reality-based training such as facial expressions, gestures, language, stress, surroundings, etc. These will not be considered at this point in time regarding the e-learning structure of the universal approach.

2.1   Preliminary Stances

Positioning the entire body is a key factor for a successful universal approach. The following description is based on a right handed person. For a left handed person the stance is vice versa.

The defender has an upright, but not tense, posture (image 1a, image 1b).

Head: The head rests centered between both shoulders, chin slightly pulled inwards, while stretching the crown of the upper head upwards. Image 1c depicts an ineffective posture. The head is set frontally too far beyond the torso. This posture is very common, especially amongst people who spend a majority of time working in a seated position (Fig. 1).

Fig. 1.   Image 1a, Image 1b, Image 1c

Shoulders: The shoulders are relaxed beside the torso at equal hight (image 1a, image 1b). They should not be pulled upwards (image 2a) or rotated towards the hips (image 2b).

Arms: The left hand is regarded as the 'ManSao' (Image 1a, image 1b) or 'the searching hand'. The left hand is positioned concetrical to the torso. Both hands are folded upwards, open palms directed at the offender. Both ellbows are set at an angle, one more than the other, yet both pointing towards the floor. The ellbows should not point to the sides (image 2c) (Kernspecht 1994).

The right hand is regarded as the 'WuSao' or 'the protecting hand' (image 1a, image 1b). As the left hand the right one is also concetrical to the torso and at hight of the neck. In comparison to the left the right hand is positioned further back towards the torso in order to protect and also gain more momentum when striking without having to pull back and therefore sacrifice protection (Fig. 2).

The core: The core is engaged and continuously pulled inwards in order to strengthen the stance and avoid bending sideways.

Hip: Hips are parallel to the shoulders, aligning shoulders and hips. The hips should not be inverted or outverted, but placed loosely on the legbones, tailbone pulling towards the floor.

Fig. 2. Image 2a, Image 2b, Image 2c

Legs: The feet are slightly inverted and placed parallel to each other. The space inbetween the midst of the feet is in accordance to one shoulder-length. Ideally the entire body weight is on both feet. The frontal leg should always bear the same amount of weight or less than the back leg.

The entire body is aligned towards the front including eyes and hands. The body should be engaged but not tense and perform each singular movement as an entity [8].

2.2   The Universal Approach Sequences Sans Partner

The left knee is pulled upwards without adjusting the angle between calf and thigh (image 3a). Toes are engaged, pulling towards the knee in order to stabilize the foot and lower leg. The knee is pulled up to the left elbow, hence lower leg and lower arm now protect a large portion of the entire body. The sole of the foot should be visible from the front (image 3b).

Arms and legs should move simultaneously, which will require practice in order to master the correct timing (image 3c). The left hand pushes straight forward while the left foot propels a stomping kick forwards and downwards. Before the left arm is entirely stretched out the right hand surpasses, delivering the next punch, while the left hand is drawn back simultaneously (image 3d). The same process is then initiated with the left hand again, hence delivering three punches/striking/pushing movements and returning to the initial stance of ManSao/WuSao (image 3f). The energy for kicking and stomping is provided by the gluteus maximus and not by the leg muscles. The right leg accelerates the entire body by pushing into the ground and as soon as the left foot touches ground the right one is pulled along, all the while maintaining and coming back to the original stance [8]. The core is constantly engaged keeping the upper body in an upright position (Figs. 3 and 4).

Fig. 3.   Image 3a, Image 3b, Image 3c

Fig. 4.   Image 3d, Image 3e, Image 3f

Most common mistakes

- The arms are extended too far (image 4a)
- The torso is bent backwards (image 4b)
- The kicking leg is not pulled up to the elbow (image 4c)
- Foot and lower leg are not engaged, the knee is simply pulled upwards (image 4d)
- When kicking the foot is extended and then retracted towards the calf, creating a jerking movement instead of a stomping one
- The core is not engaged allowing the torso to bend backwards while kicking (image 4e)
- The back leg is not locked in with the rest of the movement, hence it does not follow forward. In this case after completion of the movement the entire bodyweight rests on the frontal leg (image 4f)
- Kick and punch are not synchronised, the striking does not occur until after the kick (Figs. 5 and 6).
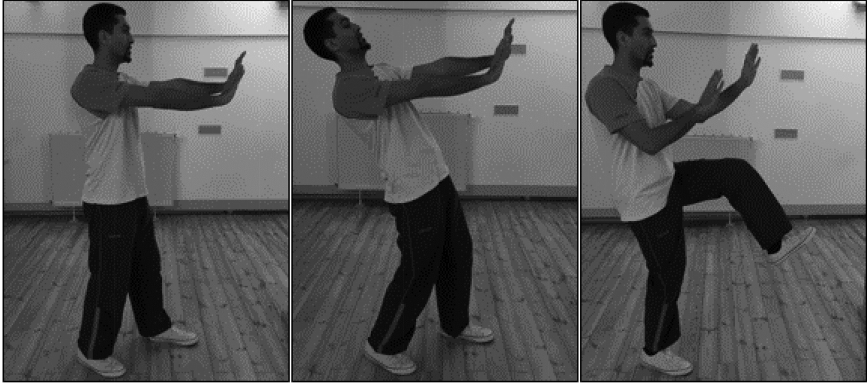
Fig. 5. Image 4a, Image 4b, Image 4c

Fig. 6. Image 4d, Image 4e, Image 4f

2.3 The Universal Approach Sequences with Partner

The body is positioned as mentioned above. The distance between both training partners must be beyond kicking or striking distance (image 5a-d). This requires some experience since each partner has an individual reach [8] (Figs. 7 and 8).

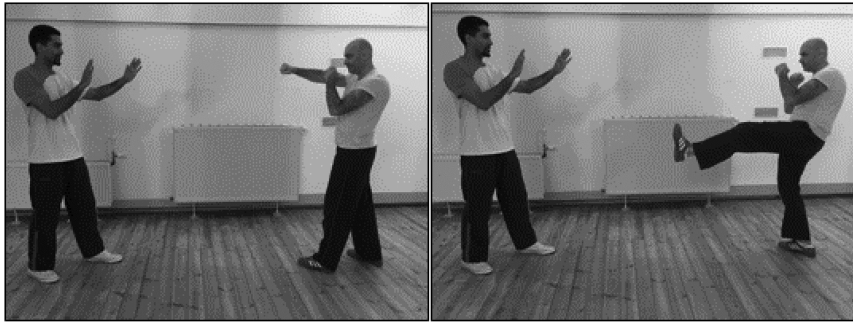**Fig. 7.** Image 5a, Image 5b

Fig. 8. Image 5c, Image 5d

The moment the attacking partner is about to curtail the safety perimeter with a step (image 6a) the defending partner initiates the universal approach. An important element of this exercise is reaching the attacking partners knee with the stomping kick just as he sets his foot on the ground (image 6b). It is at this exact moment that the attacker has the least amount of stability and the stomping kick has the maximum effect (Fig. 9).
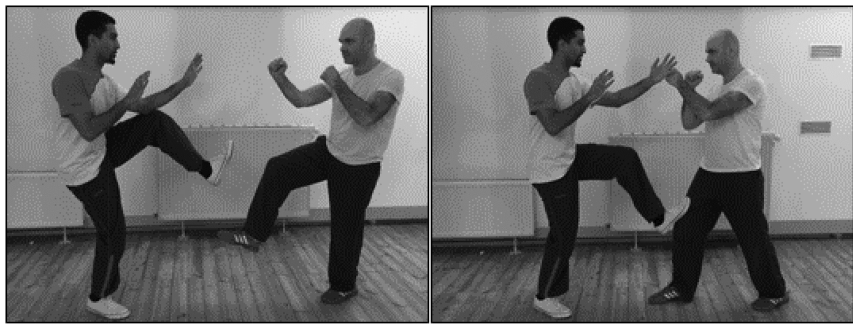

Fig. 9. Image 6a, Image 6b

Simultaneously the ManSao strikes towards the attackers face. Whether the defending partner's strike reaches the face or the arm is irrelevant at this point.

As the kicking foot touches the ground the right arm takes over and strikes and the right leg is pulled in. At the same time the left lower leg is in contact with the attacking partner's leg ensuring his inability to deliver any kicks (image 6d). While the right leg pulls in, the third strike is executed, hence obtaining the original stance (image 6e) (Fig. 10).

Fig. 10.   Image 6c, Image 6d, Image 6e

3   Motion-Tracking Validated E-Learning

The Prime 13 [6] measures 1.3 MP at a Framerate of 240 FPS. It has a horizontal field of view of 56°, and vertically of 46°.

For the validation, the aforementioned instructor poses will be recorded and integrated into a standard web based training software. This software will then present the poses and explain both the practical and theoretical components of each stance. Afterwards, the training process continues.

By using the same setup as for the recordings of the instructors, every two months the students' progress is recorded by the OptiTrack system. By comparing the intended body postures against the recorded ones, progress can be determined for each individual student.

4   Conclusion

Within this paper, the process of an e-learning supported martial-arts-training regiment was described. The traditional form of person-to-person instructions is a well established tradition in martial-arts-training. But while a teacher is only capable of judging correct stances and movements from a position of experience and training, motion-tracking-hardware is far more objective. Especially when studying stances in which balance and a correct weight distribution is of critical importance, the objective eye might be a very influential tool to foster the specificities of each pose.

Our preliminary tests are scheduled for the third quarter of 2017 with the start of new class of martial-arts-students.

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