SCIENTIFIC

EFFECTIVENESS OF SLOW RATE PRACTICE TECHNIQUES

Function	Name	Date
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Reviewer	Tim Larkin	19 Aug. 2012

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1 EXECUTIVE SUMMARY

- Purpose of this paper is to give scientific insight to the effectiveness of slow rate practice techniques.
- Slow rate practice techniques affect neural pathways greater or cause more “learning” than self-selected speeds.
- Learning increases skill across all movement speeds.
- Movements conducted 60% slower than self-selected speeds causes the most learning.
- External focus or focusing on the effects of movement increases learning and increases efficiency of movement once it is performed at full speed.
- Random target availability practice increases learning.
- Slow movement training is an effective methodology with few limitations.
- Other specific training modes could compensate for the limitations to slow rate training but do not include full-speed non-contact training.

2 PURPOSE

The purpose of this paper is for *GTD Scientific Inc.’s* Dr. Geoff Desmoulin (GTD) to give scientific insight into slow movement training techniques developed and tested by *Target Focus Training’s* (TFT) Tim Larkin. In doing so GTD helps validate, continually improves, and, further develops the scientific basis of TFT training methodology. It is understood that while this work has scientific merit it was not the purpose to have this work accepted by a scientific peer-review publication nor has it been submitted anywhere on that behalf.

All of GTD findings, conclusions, and opinions are rendered within a reasonable degree of scientific and engineering certainty, and GTD reserves its right to amend this report if additional evidence is discovered or GTD should be engaged to collect data on this matter.

3 INTRODUCTION

The efficacy of *Target Focus Training* (TFT) slow rate training methodology is multifaceted although primarily revolves around '*learning*' as defined by motor performance literature. This complicated research area has simplified the definition of learning at the task level as an improved trade off between movement speed and its accuracy (Shmuelof et al. 2012). This definition helps science measure external differences in learning, which, when evaluating specific human combat training methodology is effective and efficient. On a higher-level indicative of the actual anatomical and physiological changes that occur however learning can be defined as neural pathway optimization or simply changes in the brain, specifically the motor cortex (Karni et al. 1998). It is this second definition that is useful to help explain why TFT's slow rate training is effective and may be more effective than full-speed training when human conflict causing grievous injury is concerned.

4 LEARNING INCREASES SKILL AT ALL SPEEDS

With this focus on learning in mind, when humans perform voluntary movements they choose a spontaneously appropriate speed that is known as '*self-selected*'. Positron Emission Tomography scans shows that self-selected movement speed does not require complex neural activation and hence relies more on automatic and easier means of generating motor performance since speed is already optimized during novel movement (Blinkenberg et al. 1996). This concept is confirmed by Naruse and Hirai (Naruse et al. 2004) who show that slow movement training actually increases the amount of learning that occurs with the same amount of training. By measuring reaction time this research group was able to deduce the amount of cognitive attention and therefore the level of complex neural activation required to perform a movement over a range of directed speeds. Since they showed that the level of complex neural activation of performing slower rate movements was greater than self-selected rates we can reason that additional learning is occurring. In fact, movements about 60% slower than self-selected rates cause the most brain activation and therefore the most learning to occur (Naruse et al. 2002).

The above paragraph supports that TFT's slow movement execution training causes additional learning to occur. However, how does the additional learning actually affect movement at full-speed? A good demonstration of the transferability of slow movement practice to fast application comes from Shmuelof et al 2012. They show that movement practice in restricted speed ranges led to a global improvement in the trade off between movement speed and its accuracy, which is a good indication of learning and so agrees with previous statements. In summary, Shmuelof et al 2012 show that constrained rate practice (slow movements) transfer movement skill (accuracy for a given speed) at *all* movement speeds.

5 EXTERNAL FOCUS AND MOTOR IMAGERY INCREASE LEARNING

Another aspect of TFT's slow movement execution methodology is the instructed focus of mental attention *and* mental imagery during the movement. TFT requires that the learner mentally focus on the results of the techniques implemented. The training partner is key here as he/she decides how to respond by moving in a slow but expected response to serious injury based on the type of strike performed, its angle of impact, and the target hit (Larkin 2012). Hence, the learner focuses their mental attention to the reaction of the training partner to gain feedback on whether or not the technique employed and target used was effective. According to several research groups the learner's focus of attention matters and when it is focused on the effects of the movement as opposed to the movement itself, learning increases. The net result of this enhanced learning is quite remarkable as it causes long-term motor memory that is both effective and efficient i.e. more power for given level of muscle activity when the movement is finally performed at full-speed (Zachry et al. 2005).

Further, during this time the learner *imagines* both performing the movement at full-speed and the grave injury intended to be imparted when practicing slowly with his or her training partner. While imagining the imparted injury is important to TFT training methodology it will not be dealt with in detail here. However, imagining performing the technique at full-speed causes the brain to neurally activate similarly to when the movement is actually performed at full-speed (Yuan et al. 2010). Since limb dynamics (forces and torques to move limbs) are somewhat "hard-wired" in the brain, imaging the movement at full-speed activates the brain as if full-speed was actually occurring. This fact makes TFT's slow rate learning somewhat context independent. To elaborate the concept; internally within the brain the event being practiced '*is*' at full-speed with grievous consequences to the adversarial role player even though the movement being performed externally is slow.

6 RANDOM TARGET AVAILABILITY INCREASES LEARNING

Yet, another aspect of TFT's training methodology is the gradual and random approach to available targets when performing the techniques slowly. Yet, again we see the effects of enhanced learning as a result. Introducing targets slowly (one at a time) and allowing for random target variation once a few targets have been taught can induce meta-learning or learning that can more easily transfer to a different but similar scenario (Braun et al. 2009, Turnham et al. 2012). For example learning to target the side of the neck with the ulnar aspect of the forearm when the adversary is standing, kneeling, or on all fours in a random manner increases the movement's success when presented with a similar but different scenario. Hence, when presented with the adversary on their feet, leaning forward and slightly angled with respect to the side plane, which could be considered a similar but new event to the previously stated learned events, success is greatly improved. TFT training methodology works this system by providing opportunity for '*free-flow'* practice at a slow rate. 'Free-flow' practice is comprised of utilizing learned techniques in a random and varied manner while the designated role-playing training partner reacts to the strikes as if it were causing dire injury. This way the orientation of the targets appearance changes randomly and so to does the decisions made to engage them. The result of this type of training is that increased learning occurs compared to non-varied learning. Leading to increased skill transfer when full-speed applications of the techniques are required in the random world of violent events.

7 LIMITATIONS TO SLOW RATE TRAINING

In my opinion human conflict training *must* integrate slow-rate training methods as described above. However, as with all single mode methods of performance training there will be limitations. This is not to say that the stated limitations are or aren't being addressed by other TFT training techniques or methodologies but the limitations to slow-rate training by itself are:

- While limb dynamics controlling the speed v. accuracy trade off are accounted for, force perturbations upon strike impact are not (Cerritelli et al. 2000).
- While muscular abilities such as power are influenced, reactivity is not (Fontani et al. 2007).
- While target placement is trained, the effect of geometry (shape), and tissue composition of the human body upon full-speed impact is not (Desmoulin, 2012). This limitation is common among ***all*** training methods that do not strike human geometry at full speed and force.
- While the response to imparting grievous injury is trained the load to cause the injury is not experienced and therefore remains novel (Desmoulin, 2012). This limitation is common among ***all*** training methods that do not strike the human body or an accurate analog at full speed and force.

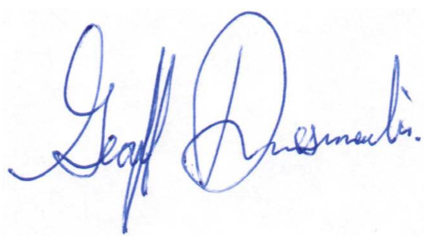
8 CONCLUSION

Overall, TFT's slow movement training methodology is a valid and effective means of training for human conflict. As a by-product of this slow movement training is the creation of a safer learning environment for students. It also increases learning while giving the learner many feedback aspects to training (visual cues of success) that practicing fast with human targets do not provide. Further, research have taught us that visualization increases skill even without movement practice; and while slow movement is not the sole aspect to TFT teaching philosophy, the methodology combines movement and visualization that further increases the learning of the skill at all movement speed levels.

9 DISCLAIMER

It should be noted in closing that motor performance literature is highly varied in both movement tasks investigated and the methodologies used to analyze them. However, the global scientific approach used by all peer-reviewed publications cited in this paper allows us to generalize across tasks and apply the results to human combat training methodology at a white paper level.

SINCERELY,



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11 REVISION HISTORY

v1	Initial Release of White Paper: 19Aug2012
v2	Update Formatting and minor edits: 28Feb2020