The important role of sleep in developing shooting skill

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Abstract

Walker's (2017) research into how the brain processes and stores memories has implications for the development of shooting skill. His research has found that during sleep, skills learned in an athletic sport during the day, are moved at night from short term memory into long term memory storage locations in the brain. The process uses "filters" which in Walkers (2017) conceptualisation, appear to act as reference standards which the brain uses to guide selection of memories to place in long term memory storage, a previously unknown mechanism and not yet fully understood.

The value of pushing boundaries (striving for excellence) in training is known. Now sleep research appears to confirm that this is likely to accelerate skill acquisition by setting higher standards for what the brain "filters" store in long term memory. Breaking through plateaus where scores have stagnated, could be helped by systematically raising the standard for the "filters" for each critical input for accurate shooting for the individual. Coaching for new shooters should continue to focus on helping individuals to adopt, early in their development, techniques which produce good shooting outcomes (and to avoid ineffective methods), as this helps the brain in selecting which skills to keep.

Getting eight hours sleep as new skills are being developed, is beneficial. Alcohol diminishes the ability of sleep mechanisms to effectively store information and impedes the contribution that sleep mechanisms make to skill development. More needs to be known about how memories are filtered for placement in long term memory.

According to Walker (2017) during sleep the skills learned during the day are shifted from short term memory located in the hippocampus region of the brain to a safer, long term memory located in the cerebral cortex. The information transferred can include "skill memory from the day's training session (whether you are earning a musical instrument, an athletic sport, a surgical procedure, or how to fly a plane" (p.123). The transfer occurs electro-chemically by "packets of information" carried by "sleep spindles which are formations of linked brain cells (neurones) (Walker, 2017, and Sejinowski and Destexhe, 2000). "Loops of electrical current pulsing throughout the brain that are repeated ever 100 to 200 milliseconds" pass along these sleep spindles (Walker, 2017:110). This allows the brain's long term storage site to check with the internal filters in the frontal lobes, an area of the brain important in learning (Katwala. 2016), allowing selection of what to keep and what can be discarded (Walker, 2017:49).

In target shooting the "filters" would include instructions to muscles for executing the techniques which unite for accurate shooting such as stance, sighting, trigger action, timing, and follow through. Mental preparation would use this information in setting the body to execute these tasks. The "filters" appear to function as a set of reference standards which the brain uses in deciding what to keep or discard. For a new shooter, the "filters" would begin as a mental representation of a goal to be achieved.

How the brain filters information being put into long term storage is not yet understood and would make a useful research topic. One could speculate that the mechanism could involve the brain comparing memories (information about skills) encoded as electrical wave patterns in the brain's frontal lobes (acting as "filters") when deciding what to store in long term memory and to be tested and refined in subsequent practice sessions.

The process of transferring memories (information) to long term storage occurs during NREM sleep (named because no Rapid Eye Movement is present (Walker, 2017:49). This is followed by REM sleep (where Rapid Eye Movement is present) which interconnects those raw ingredients with each other, with all past experiences, and, in doing so, builds a more accurate model of how the world works, including innovative insights and problem solving abilities (Walker, 2017:53).

For expert shooters, knowledge and skills would already be in long term memory from extensive practice, as in the case of elite athletes. It appears that REM sleep can fuse new information onto to existing knowledge. This means that as humans we have the capability to continually improve performance and, if Walker (2017) is correct we can do this by improving the references standards used by sleep mechanisms to sort information into long term memory for later use.

Walker (2017) began to examine how sleep improves and stabilises information after a concert pianist related his experience of trying and failing to learn a new piano musical score until a night's sleep has passed enabling him to play it perfectly (Walker, 2017). He argues that knowledge of how to play the piece correctly is a result of processing of the information during "NREM" sleep. "A key function of deep NREM sleep, which predominates early in the night, is to do the work of weeding out and removing unnecessary neural connections. in contrast, the dreaming stage of REM sleep, which prevails later in the night, plays a role in strengthening connections" (Walker, 2017:45).

Walker (2017 proposes that there is a strong research link between what was learned and the amount of NREM sleep experienced. The implication is that cutting sleep short is unwise as it reduces the time which the brain has to do its work of processing and stabilising memories. According to Walker (201) "All things learned before sleep are generally enhanced the next day" (p.118). However, this process may take several nights, according to Walker (2017). He draws attention to the "innovative insights and problem solving abilities of REM sleep processing because this phase can throw up new solutions to problems.

The author has experienced, that after sleep problem fixes and alerts, have been thrown up, e.g., time to change the firing pin before an important match.

Research into the "Flow State" (Flow Zone) associated with high athletic achievement, shows the importance of making shooting skills automatic through extensive practice (summarised in Anderson, 2019). One example of a shooting skill is the use of "working memory". Research by Bertoli and friends (2016) shows that elite athletes use working memory – akin to a scratch pad on which to make notes – to calculate muscle movements to correct errors, such as the sights slightly out of position. Working memory is closed when the action is completed. We can suppose that, from extensive practice, an elite shooter will build up a repertoire of corrective manoeuvres and, over time, these will not need to be re-calculated, merely retrieved which is faster. The establishment of reference standards in the brain frontal lobes for making skills automatic and for retaining effective working memory" routines would help the brain in selecting what to keep during sleep processing and is an example of the brain selecting "filters" for many processing and adding neural routines for skilled actions.

How much sleep is advised?

No one type of sleep (NREM or REM) is more essential than another" as each offers different brain benefits at different times of night" (Walker, 2017:108). "The brain always requires a new bout of sleep and its varied stages each night so as to auto-update our memory networks based on the events of the prior day." (Walker, 2017:45). Sleep six hours or less and you are short changing the brain of a learning restoration benefit that is normally performed by sleep spindles (p.112). Sleep before learning refreshes our ability to make new memories. "Alcohol is one of the most powerful suppressors of REM sleep that we know of … "(Walker, 2017:222)

Conclusion

Walker's (2017) sleep research, except for avoiding alcohol and getting a good night's sleep, does not require an athlete to do anything different.

The research throws light on the role of sleep "filters" in skill development. In the context of skill development in target shooting, "filters" would include both goals seeking, and feedback-loop, processes. When the brain is given a goal to be achieved, it works to achieve the goal using feedback from previously attempts to progressively learn what has to be done to achieve the goal. In shooting, this means instructions to muscles to move in specific ways which can take time to get right.

Improvement in motor (movement) skill performance is known to continue for at least 24 hours following training, yet the relative contributions of time spent awake and asleep are unknown. He provides evidence that a night of sleep results in a 20% increase in motor speed without loss of accuracy, while an equivalent period during wake provides no significant benefit. Furthermore, a significant correlation exists between the improved performance overnight and the amount of stage 2 NREM sleep, particularly late in the night. This finding of sleep-dependent motor skill improvement in long term memory may have important implications for the efficient learning of all skilled actions in humans (Walker, et.al 2002

Walkers (2017) research suggests that pushing boundaries in training and competition (searching for excellence) will likely sharpen the capability of sleep "filters" to refine skills placed in long term memory and increase the likelihood of benefiting from the sleep mechanisms which he has identified.

Breaking through "plateaus" where scores have stagnated, could start with improving the quality of these "filters" for each of the critical inputs to accurate shooting for the individual (mental practice, set-up, stance, hold, aiming, trigger, timing and follow-through) and integrating these during simulated match practice and in competition.

The individual who uses information sources such as skilled coaches, reading, self-discovery and self-analysis, to set high standards for all the important inputs for accurate shooting could progressively improve their skills with the help of sleep.

More needs to be known about how the brain forms and uses "filters" to sort memories during sleep.

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