Searching for the performance 'flow zone'

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The experience of 'being in the zone' or 'with the flow' ('flow zone') has been linked to high scores in target shooting but is an elusive, transitory phenomenon. Voluntary entry to the 'flow zone' is barred, meaning it is not possible to simply step into it but, under certain conditions, it arrives seemingly unannounced and the experience can be "just positive energy … a good feeling … your whole body is involved … nothing else seems to matter … mood can be elevated … movement seems to be automatic, outside conscious control and very fast" (Katwala, 2016). Speaking of the 'flow zone' in 2018, Triple Olympian, David Moore, said "You cannot switch it on at will and if you think about it, it's gone". That 'flow' cannot be switched on is supported by Katwala (2016).The brain has a 'hundred billion neurones, each with a thousand or more synaptic connections to pass messages along neurone pathways and perform complex skills (Sacks, 2017). This awesome power is behind the phenomenon of 'flow'.

The preliminary stages and characteristics of 'flow', drawn from the literature, are shown in Figure 1 which is read from left to right and shows how 'flow' affects the competitor. The first box gives two preconditions for entering 'the flow zone': the presence of a challenge with clear and achievable goals, not too easy and not too hard, and being able to perform the required skills automatically (Katwala, 2016). However, voluntary entry is barred, as mentioned. The shot delivery process, shown at the right, reflects the distinguishing characteristic of 'flow', the shift from conscious to automatic control of the physical actions needed to perform the task. This is a theme running through the centre of Figure 1, shown by the arrows and is a key to understanding 'flow'. That top shooters can switch between conscious and automatic modes depending on the situation, is discussed later.

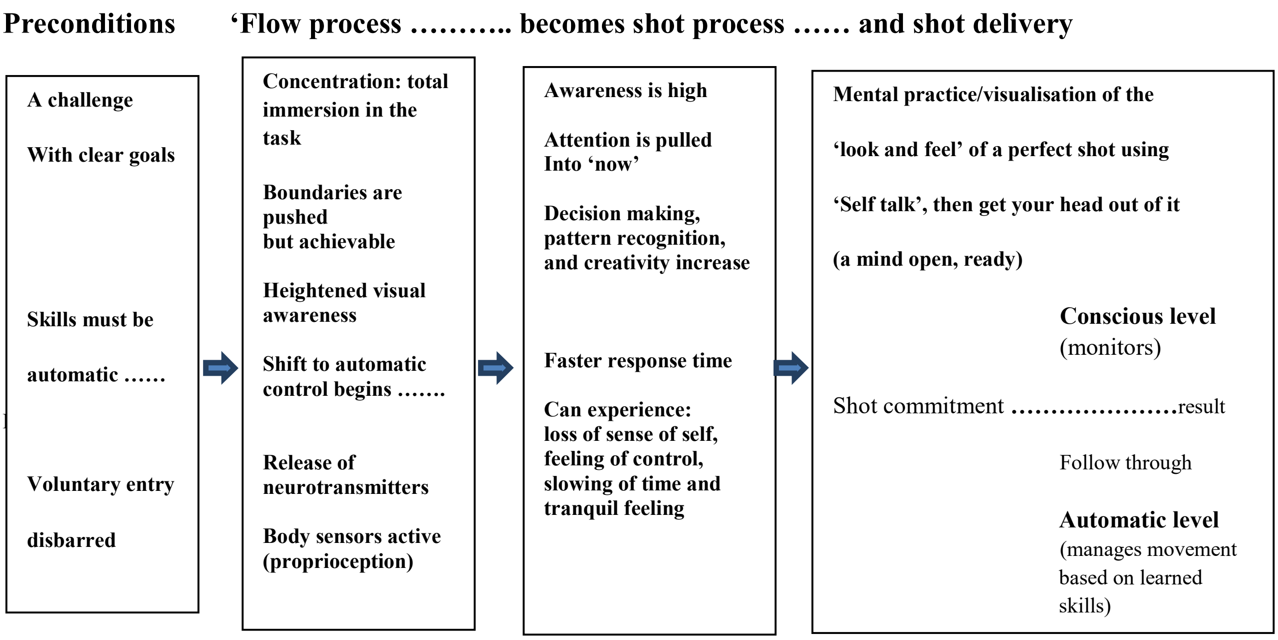

FIGURE 1: THE 'FLOW ZONE': STAGES AND CHARACTERISTICS

The second box, under the heading 'flow preconditions', reflects what Cotterill (2018) called an "optimal psychological arousal state "which includes controlling the heart rate, having done the training and experienced competition. ‘Flow’ requires total immersion in the task. Boundaries (goals) are pushed to the limit of skills. Deep concentration brings heightened visual awareness.

Response speed increases considerably in automatic mode because movement is carried out without conscious decision (Katwala, 2016). The brain can initiate muscle movement several hundred milliseconds before it registers in the conscious mind (1 second = 1000 milliseconds). For example, a sprinter in the ‘flow zone’ could be three metres down the track before becoming aware that the race has started (Sacks, 2017).

Among the tools that the brain possesses for managing movement is the feedback loop mechanism described by Ramachandran (2011).The brain makes a copy of the signals it sends via the spinal cord to the muscles of the arm and hand to initiate action, for use in error correction, if needed. This mechanism runs continuously as signals are sent to direct action, so the brain is constantly ready to readapt (Sigman, 2015).

Conscious control remains during the shift to automatic processing (Sacks, 2017). What is its role? Cotteril (2018) believes that the conscious level controls strategic aspects of performance. Another view is that the conscious level ‘has the ability to edit, modify or censure actions’ (Sigman, 2017). Accounts given by those who have experienced ‘flow’ confirm that the conscious mind can direct strategy, such as to correct an error, or do nothing if the automatic process is proceeding correctly.

The second box in Figure 1 refers to the release of neurotransmitters in the brain. These cause the brain’s processing system to kick up a gear and are described as a four stage process by Katwala (2016). In Stage One the body prepares to boost mental focus, alertness, and to raise the heart rate. The chemical basis here involves release of stress hormones; cortisol, adrenaline and norepinephrine, which increases arousal, emotional control and attention and the neurotransmitter dopamine which helps electrical signals to move between neurones and promotes engagement and creativity (Kotler, 2014). In ‘flow’, dopamine, along with norepinephrine boosts the brain’s ability to recognise patterns, heightens the senses and helps to stay focussed on a task (Katwala, 2016). Alpha waves, favourable to ‘flow’ due to their calming influence, need to be present and also a spike in theta waves (Katwala, 2016).The end of the second phase is accompanied by a body wide release of nitric oxide which is said to rid the body of stress hormones and begins a calming state ‘to signal the start of flow’ (Katwala, 2016).

The third stage is ‘flow’, a tranquil feeling created by endorphins. The final stage sees the release of serotonin which has been associated with a ‘happy afterglow’ (Katwala, 2016). The combined effect of neurotransmitters probably accounts for much of the effects attributed to ‘flow’ and are likely to be present anyway when shooting well.

The activity of body sensors (proprioceptors) increases the amount and detail of information flowing into the brain about the shot process. Awareness is heightened. Attention is pulled into the ‘now’ and decision making, pattern recognition, creativity and response time all increase (Katwala, 2016).

According to Katwala (2016) a person in ‘flow’ can experience a loss of a sense of self as concentration on the task reaches virtually total, energised immersion. Also the inner voice of doubt can become switched off due to insufficient attention being available to be conscious of the sense of self; so that it seems ‘the body disappears’. A feeling of tranquil control over the situation can develop during the performance of the skill.

The brain can slow the perception of time. During 'flow', the conscious level of brain activity can fashion a perception of time which is elastic and can be compressed or expanded (Sacks, 2017). He gives an example of the brain manipulating time by capturing a moment of perception as a slice of time: a baseball pitch can be perceived to be 'almost immobile in the air'. Since time moves on and the registration of it in the brain is always after the fact, trying to pick the perfect moment to fire the shot is risky. It is possible for the sights to appear stopped in the aiming area when, in fact, they are moving; inducing the shooter to make the shot prematurely, deflecting the aim. A counter is to watch the sights through to recoil and afterward (follow-through). With precision shooting, it is better, after committing to the shot, to have it occur within a half to two seconds to help facilitate smooth, constantly increasing trigger pressure. This has to be faster in rapid fire but the same principles apply.

The fourth box in Figure 1, titled shot delivery, shows the conscious processes of making the shot, including the set up phase, giving way to automatic control of movement. The chain of action when setting up for the shot can be focussed on the task by use of mental practice and visualisation of the 'look and feel' of a perfect shot or series and by mental rehearsal of the feel of a perfect trigger release. Visualisation gives the look, mental practice gives the feel. It has been demonstrated that mental practice of an action is registered by the appropriate muscles though they do not spring into action due to a mechanism suggested by Ledermann (2010) called 'force control' which works something like a light dimmer, in the off position no muscle response occurs.

Visualising the perfect outcome has been found to be a valuable tool in improving athletic performance (Katwala, 2016). It can shorten reaction time by focussing on what is essential to a successful outcome. The purpose of 'self talk' (pertinent instructions to self about what works best) is to cue particular actions which the individual has found to be essential for a good outcome. Cotterill (2018) suggests that 'self-talk improves the execution of movement. Building anticipation, based on correct technique, can shorten reaction time through muscular positioning (Katwala, 2016).

If using the technique of merging mental practise of the shot seamlessly into the actual shot (Anderson, 2015), this conscious control of the set-up phase should give way to automatic control of the process of sighting, trigger release and follow-through. 'Get your head out of it' advises Katwala. (2016). He states that when someone who can perform the skills automatically, starts to think consciously about doing them, the pre-frontal cortex of the brain, dominant when learning new skills, seizes control, making movements slow and less fluent. This can unravel skills already possessed (Cotterill, 2017). Excessive attention being applied to the execution of movement, 'leads to eventual breakdown in performance and/or chocking under pressure' (Bertollo, and others 2016). Overthinking can be reduced by squeezing a rubber ball in the left hand if shooting right handed (Katwala, 2016).To avoid overthinking the shot process, stop giving yourself instructions just before making the shot.

Having clear goals are essential for entry into the 'flow zone', as mentioned. Goals which are effective are specific, measurable, action-related, realistic, and timetabled (Cotterill, 2018). Goals based on a skills analysis of what is critical for success in a particular task, enable the brain to learn how a successful outcome looks and feels by reading the messages received from thousands of proprioceptors(body sensors) and can accelerate skills acquisition by teaching the brain, via feedback, what is important for accurate shooting.

What do you see when you see the sights? Research has found that experts spend more time than novices looking at what counts for a successful outcome - a phenomenon referred to as 'quiet eye' - a quiet phase observed just before trigger action of expert shooters. It reflects a 'drop in neural activity as experts are about to activate the trigger and is believed to result from different regions of the brain stopping communicating with each other (Katwala, 2016). He also notes that expert basketballers looked at the target of their throw, the rim of the basket, far longer than did novices. Borrowing from this, one way to increase concentration before the shot or sequence, could be to gaze intently at the centre of the target while mentally running through what you are about to do.

The finding that the brain can initiate muscle movement several hundred milliseconds before it registers in the conscious mind, could explain why it is difficult to consciously enter the ‘flow zone’. The first step could be outside our conscious control. Total immersion in the task is also required, accompanied by the shutting down of brain functions not needed for the present task, the release of neurotransmitters in the brain and that the actions of shot delivery do not encounter difficulties requiring conscious correction of errors.

Although ‘flow’ is associated with high achievement in many areas, in target shooting, chance is always present. The bullet could have been fired pointed into the nine ring but due the grouping ability of the barrel, the shot landed in the ten ring by chance. Or, the wobble pattern of the aim could have been flicking into and out of the ten ring but, over several shots, by chance they landed favourably with a good result wrongly attributed to ‘flow’.

‘Flow’ is a relatively rare phenomenon and difficult to observe in a research setting. It emphasises the role of automatic execution of skills, during total, energised, immersion in the task, with the conscious attentional process taking a supervisory role, provided nothing occurs to disturb the smooth flowing process of making the shot. However, target shooting often presents situations requiring sudden adjustment of movement and/or timing. This is reflected in the research described next.

Switching between conscious and automatic control

The performance of ten elite international competitors, who each fired 120 International Sport Shooting Federation (ISSF) air pistol shots, was examined by Bertollo, and others, (2016). They used a mobile EEG (electroencephalogram) skull cap containing sensors to analyse alpha and theta brain wave patterns believed to be involved in achieving good shooting scores. Their purpose was to detect brain wave patterns which occur during automatic shooting, when the brain is in a supervisory role, akin to a ‘flow-like state’. They also wished to detect any interplay between conscious control and automatic control of shooting, as would be revealed by changes in alpha and theta brain waves, such as would occur if dealing with non-typical events during shot production. The brain wave measurements were at intervals from three seconds to the moment the shot was fired. The SCATT computer based training system shows that shots can deflect from the “x-ring” to the ‘7 ring” or worse in the last fraction of a second before shot release. Such bad shots, if they occurred in the tests by Bertollo, and others (2016), could have been undetected.

They concluded that two modes of shooting are effective in producing good scores and that elite shooters used different types of functioning, conscious control and automatic control, to achieve optimal performance. That is, they could switch between the two modes. The two modes are:

Type 1: Optimal automatic: where the athlete is directing physical and mental energies toward accomplishing the task which is running smoothly, a flow condition not requiring available working memory capacity. This mode gives efficient processing (meaning shooting scores) and fluid performance, similar to that reported for ‘flow’. Here the conscious mind, the attentional process, plays the role of supervision, and efficiency occurs as a result of the disengagement of brain areas that are irrelevant for a given task, along with the simultaneous engagement of highly-relevant areas' (Bertollo, and others 2016).

Type 2: Optimal controlled: where processing requires conscious effort and involves working memory. This holds temporary information needed to perform a current task (Katwala, 2016). Although effortful processing using short term memory undermines fluid, automatic movement, it can produce a performance outcome close to that of Type 1 (Bertollo, and others, 2016). In Type 2 mode, effortful shooting is needed as non-typical events are encountered and require adjustment of movement. An example of the use of working memory is given next. In the rapid fire event while traversing across the five targets, the aim may have moved out of position requiring a diagonal left correction on target three. The task of working memory is to calculate the start point and end point to move the aim diagonally down left, then to fire shot three and, if OK, to speed up the last two shots. This may need a very fast benefit-cost analysis: Do I have enough time to correct the error without risking a worst next shot? These situations which require working memory to be opened up and used, point to the value of including non-typical events in training to develop appropriate, flexible response strategies which can be recalled and used, rather than having to be worked out on the run. With practice, a repertoire of corrective strategies ends up in long term memory for fast retrieval.

Figure 2, below, shows the shot delivery process alternating (switching) between conscious and automatic control due to the need to analyse and respond to non-typical events occurring during the shot process, using working memory to make the error correction calculations..To avoid overthinking the shot, it is suggested that the mental chain of events for setting up the shot should be cleared away leaving the mind open and ready to act in the brief moment before commencing the actions which will make the shot. When the errors are corrected, automatic processing can resume, and a 'flow-like state' becomes possible.

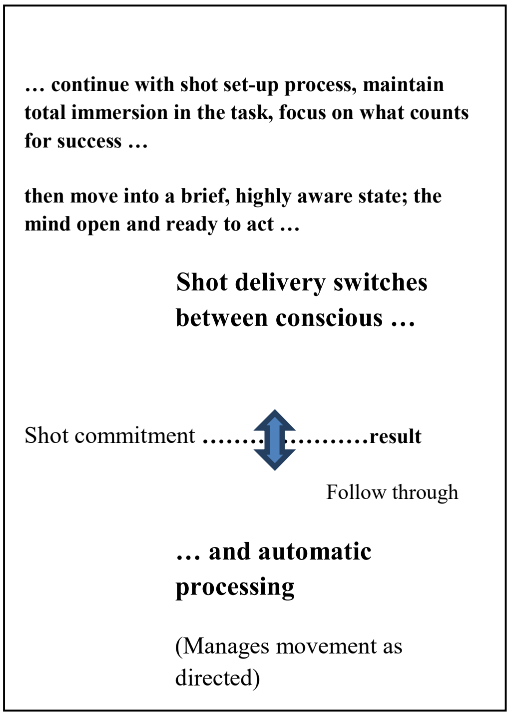

FIGURE 2: SWITCHING BETWEEN CONSCIOUS AND AUTOMATIC CONTROL DURING SHOT DELIVERY UNDER CONTROLLED EFFORT

Training strategy

The implications for training of the research into 'flow' and that of Bertollo, and others (2016) are as follows. Total energised immersion in the task must be achieved along with the ability to carry out the necessary skills automatically, with the conscious mind in a supervisory role but able to step in at any time to correct error by retrieving actions or strategies developed through analysis and practice. This is why training should include practice in responding to non-typical events. To avoid the conscious process taking too dominant a role – overthinking the shot - setting up for the shot should end with the mind open, in a high state of anticipation, and ready to act. This moment, when instructions to self cease, can be brief since the brain can initiate muscle movement within several hundred milliseconds.

Errors which are not corrected are likely to become 'trained in'. Katwala (2016) notes that the brain can detect errors about 50 milliseconds after we make a mistake' and our awareness of it 'comes between 100 and 500 milliseconds later'. Removing errors requires extensive practice to rewire the brain neurones and pathways which have become encoded with the errors and the strategies and the muscle instructions to execute them.

The importance of training for the actual performance, not just for the acquisition of skills alone, was stressed by Cotterill (2018). Kotler, (2016) suggests practising for a situation requiring high level output by using a challenge set within reach just above our existing skill levels. To achieve total immersion in the task, requires practice in learning to concentrate deeply and to be calm, e.g. using relaxation and breathing techniques which would also help learning to 'get your head out of it'.

According to Katwala (2016), there have been attempts to shorten the time needed for skills mastery by using computers and simulations to train the brain. (I believe he was not referring to computer based trainers such as the SCATT system which connect to a competition pistol to show what happens during aiming and follow through). Katwala (2016) advises that brain training should zero in on the key mental attributes required for the sport. At the end of a training session, both Katwala, (2016) and Ledermann (2010) recommend performing the complete sequence of actions, with the actions similar to the actual event and done in the same time frame. This is to capitalise on the boost (neural plasticity) given by training to changing the brain's neurone pathways as new skills are acquired. Note that repetition is required to move this new knowledge into long term memory.

An approach to competition shooting

First, find out what key skills should be made automatic by doing a skills' analysis of how best to fit yourself to the skills required to successfully compete in the match. Then encapsulate this in a checklist, written or held in the mind, to help build awareness and focus concentration when setting up for the shot or series. Strip the checklist down to the minimum, necessary elements so as to avoid the danger of overthinking the shot or series. Practice until you can flow through it almost without thinking.

1. Train to shoot in a relaxed state but with heightened concentration and visual awareness; aiming to achieve total, energised, immersion in the task as you would be if in the 'flow zone'.
2. Train to make key actions automatic, selectively in the beginning, e.g. linking trigger action to aiming to follow-through, in a smooth flowing process.
3. Work out how to get your conscious brain out of it as you move into the shot delivery sequence (or rapid fire pistol string), for example, by merging the mental process of setting up for the shot into a brief, highly aware state where the mind is open and ready to act.

4. Train against a challenge either real, as in competition, or manufactured during practice and include 'non-typical' events to develop and practice coping strategies.
5. Correct technical errors during the match (and during practice), as they emerge, revealed by comparing the impact point of the shot with where you thought the shot would fall (calling the shots) or from analysing the reasons for scores stagnating.

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