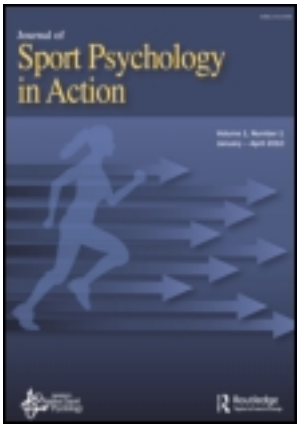

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Perfecting Practice: Applying the PETTLEP Model of Motor Imagery

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Holmes and Collins' (2001) PETTLEP model of imagery provides a framework for the effective execution of imagery interventions. The model includes seven key components to consider when developing an intervention, denoted by the acronym PETTLEP (Physical, Environment, Task, Timing, Learning, Emotion, Perspective). Over recent years, the model has gained much research support. This paper explores the research that has tested the model and provides recommendations for those interested in implementing PETTLEP-based imagery interventions, including a summary of our points as a brief take-home guide to implementing PETTLEP interventions.

Imagery is a key psychological skill, with a remarkable array of studies testifying to its efficacy in enhancing performance of a wide variety of motor skills (for a review, see Weinberg, 2008). Virtually all applied sport psychology textbooks and self-help books include information on imagery, and there are at least two textbooks focusing solely on imagery (Morris, Spittle, & Watt, 2005; Sheikh & Korn, 1994). Despite this apparent consensus that imagery is an important psychological skill, there has been little agreement in the sport psychology literature as to how imagery should be used. Additionally, research studies on this topic have spanned many areas, including sport psychology, mainstream psychology, cognitive psychology and neuroscience journals. As a result of this, it has often been challenging for applied sport psychology practitioners, coaches and athletes to make use of this information in their practical work. Realizing the need for a model based on solid theoretical and empirical foundations to help guide practitioners' use of imagery, Holmes and Collins (2001, 2002) devised PETTLEP. This is an acronym representing a seven point checklist of guidelines to be followed when devising an imagery intervention. These are Physical, Environment,

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Task, Timing, Learning, Emotion, and Perspective. The PETTLEP model is based on findings from sport psychology, cognitive psychology and neuroscience, and aims to provide practitioners with a set of practical guidelines to aid their imagery use. Perhaps the most fundamental difference between the PETTLEP approach and more traditional imagery methods is that imagery has often been thought of as something completely separate from physical practice. However, PETTLEP conceptualizes physical practice and imagery as being on a continuum, and posits that the closer towards the physical end of the continuum that imagery interventions lie, the more effective they are likely to be. For example, an intervention that involved an ice hockey player standing and assuming the correct position will be a closer representation of physical practice than imaging whilst lying down.

Recently PETTLEP has been a hot topic in the applied sport psychology literature, with quite a few studies testing both the model as a whole, and its various tenets (e.g., Wakefield & Smith, 2009; Wright & Smith, 2007). As readers will see from our later sections, in its application the PETTLEP approach is radically different from traditional imagery interventions. These more traditional methods often include suggestions of adopting a comfortable position (Cabral & Crisfield, 1996) and minimizing distractions by being in a quiet room (Williams & Harris, 2001) before attempting to visualize the skill, namely an approach that is commonly used in the applied setting. These approaches may be useful as a transitional stage before progressing to PETTLEP imagery, but this is an area that warrants future research. Therefore, researchers have been particularly interested in comparing the efficacy of PETTLEP-based imagery with that of more traditional approaches. This research has mostly strongly supported the efficacy of PETTLEP imagery, and found it to be more effective than traditional, visualization-based methods (Smith, Wright, Allsopp, & Westhead, 2007). Similar findings have emerged with the long jump (Potter, Devonport, & Lane, 2005), golf (Smith, Wright, & Cantwell, 2008) and strength tasks (Wakefield & Smith, 2011; Wright & Smith, 2009). However, the original PETTLEP papers, and the research testing the model, are quite technical in nature and have been published in journals that are not very accessible to coaches and athletes. Therefore, despite the strong research support, the model is not widely known and used outside academia in our experience. For example, we are often asked at conferences where we present our PETTLEP research, for practical tips regarding its implementation. This, therefore, was the aim of the present article, namely to provide specific, research-based guidelines on how to apply the PETTLEP model for best effect, in a way that is accessible to those who need to apply the information (i.e. sport psychology consultants, coaches, and athletes).

Each letter of the PETTLEP acronym represents an important issue to consider when implementing imagery interventions. The model was originally designed to be used as a minimum checklist when designing imagery interventions (Holmes & Collins, 2001) and researchers have suggested that

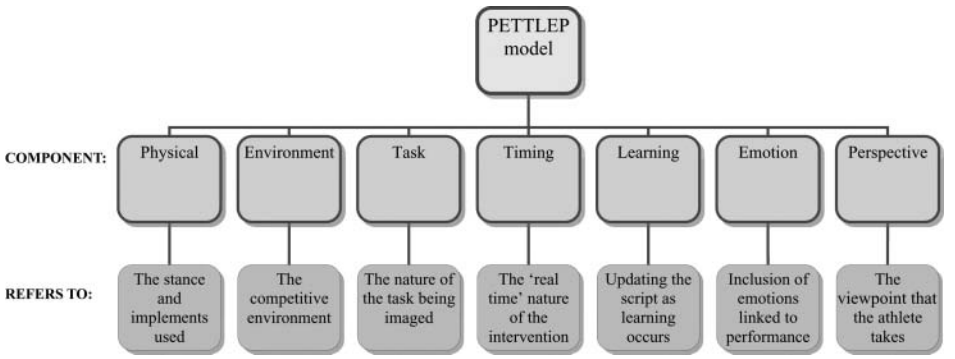

FIGURE 1 The seven components of the PETTLEP model.

omitting certain elements may compromise performance facilitation (Ramsey, Cumming, Edwards, Williams, & Brunning, 2010). However, introducing all seven components at one time my be impractical and create overload for the athlete. Therefore, we suggest that practitioners focus on those elements pertinent to the athlete and incorporate as many of these as possible. The seven components will now be discussed in more detail, but for a summary of what each component relates to, please see Figure 1.

THE SEVEN COMPONENTS OF THE PETTLEP MODEL

Physical

The component "Physical" refers to the importance of making the imagery experience as physical as possible. Indeed, as noted above, Holmes and Collins (2001) conceptualize imagery as a quintessentially physical experience rather than a purely mental one. Put simply, sports skills are physical in nature and therefore imagery should be too. This physical approach to imagery interventions could include not only the obvious step of imagining the kinesthetic sensations felt when performing the skill, but also wearing the same clothes as when performing and holding any associated implements. For example, when attempting to improve the performance of a bicep curl task, Wright and Smith (2009) encouraged athletes to sit at the weight machine and grasp the handles when completing their imagery. In our view, this is arguably the most crucial element of the PETTLEP model, and its importance is strongly supported by research (e.g., Smith, Holmes, Whitemore, Collins, & Devonport, 2001). Given the centrality of physical sensations to the sporting experience, such as the burning sensation of lactic acid in the muscle and the lungs gasping for air, it is clear that visualization-based imagery approaches that do not emphasize such feelings are not likely to provide a realistic imagery experience. It is well worth the practitioner spending time with individual athletes finding out which kinesthetic sensations are most

relevant to them and incorporating these as much as possible. For example, if an athlete feels his or her heart pounding at a particular time point when completing a skill, this should be incorporated into the imagery (cf. Lang's bio-informational theory of imagery; Lang, 1979, 1985). In our experience, practitioners would be making a grave error if they assume that everyone performing the same task experiences identical kinesthesis. We have been amazed in our research how much individuals vary in their perceptions of the physical responses, even with relatively small movements. The bio-informational theory (Lang, 1979; Lang, Kozak, Miller, & McLean, 1980) suggests that imagery ability is not a static trait, but rather it can be improved upon through a process known as response training. In this, athletes are trained to focus upon their physiological and behavioural responses to the scenario to be imaged and to incorporate these into the imagery. Therefore, where an athlete does not have very strong kinaesthetic perceptions, we would recommend the careful use of response training to enhance the vividness of his or her kinaesthetic imagery.

Environment

The component "Environment" relates to the place where the imagery is performed. According to PETTLEP this should be as similar as possible to the performance environment; it would be ideal if the imagery could be performed in the competitive arena but of course during training this will not usually be practical. If it is not possible to perform imagery in an environment that is at least similar to the competitive one then video, audio and photographs could be used to assist the imagery experience. We have achieved great success in our PETTLEP interventions from having participants perform their imagery in the actual performance environment, such as hockey players imaging whilst stood on the hockey pitch, and gymnasts imaging whilst stood on the beam (Smith et al., 2007). Where this is not possible, improvisation can be extremely useful. For example, Smith, Wright and Cantwell (2008) had golfers image their bunker shots whilst stood in a tray of sand. Where such alternatives are not practical, video can be a useful alternative, such as in a recent study that found video-assisted imagery effective in enhancing strength performance (Wakefield & Smith, 2011). Here, participants completed their imagery of a bicep curl whilst watching a video of themselves executing the task. This served to control the timing of the movement and to ensure that the intervention was individualised and evocative to the participant. Researchers have also been advocating observation as a stand-alone strategy (Holmes & Calmels, 2008). Now that video footage is easily shot, stored and transported (e.g., portable DVD players, iPods and cellular phones) the use of such is easier than ever and future technological developments may make it easier still.

Task

The component "Task" emphasizes that the content of the imagery should be appropriate to the skill level and individual preferences of the athlete, particularly with regard to attentional focus. Konttinen, Lyytinen, and Konttinen (1995) found that elite and non-elite athletes focused their attention on different aspects of performance, strongly suggesting that the content of the imagery should be specific to the level of the performer. For example, elite tennis players may focus on the hip rotation during a task, whereas novice players may focus more on the more basic facets of the skill, such as looking at the racquet head. We have found it very useful, when planning an imagery intervention, to confer with the athlete regarding his or her attentional focus during performance. This will allow the imagery intervention to be tailored to the specific needs of the athlete.

Timing

The component "Timing" refers to the pace at which the imagery is completed, the idea generally being to perform imagery in real time wherever possible as timing is often crucial to the successful execution of sports skills. This suggestion seems to be in accord with the preferences of elite athletes. For example, Moran and MacIntyre (1998) examined the kinesthetic imagery experiences of elite canoe-slalom competitors, finding that the time taken to image the race was highly correlated to the actual race completion time. Indeed, Gould and Damarijan (1997) argue that imagery should be completed at the correct pace as techniques are rarely performed in slow motion or faster than normal. However, more research is needed on this issue as it may be that slow motion imagery is useful in situations where slow motion physical practice would also be completed (e.g., correcting style errors in form-based skills).

Learning

The component "Learning" considers the skill level of the performer, emphasizing that the content of the imagery should be adapted as the individual becomes more skilled. This component of the model has not received much research attention so far, but one recent study (Wakefield & Smith, 2011) found that a longitudinal imagery intervention in which the content of the imagery was updated regularly to reflect the progress of the participants was very successful in enhancing performance. Here, at the midpoint of this intervention, athletes rerecorded their imagery videos to ensure that the video still provided an accurate representation of their skill level. For more complex skills, imagery interventions have attempted to reflect the physical training

by mirroring the developments made in technique. For example, if a cricketer masters the general bowling action, he or she would then move on to train the intricate wrist work involved in directing the ball; thus the imagery should also be altered to reflect this change. In addition, in the consultancy work the authors have carried out with bodybuilders, we have found it necessary to update the imagery instructions to reflect increases in weight lifted, increased muscle gains and changes in body fat levels. Without such updating, the imagery will cease to effectively and realistically replicate real life. The imagery intervention should not just be updated in terms of changes in skill level, but also changes in psychological states such as confidence and motivation should be taken into account.

Emotion

The component "Emotion" relates to the fact that competitive sport is an emotion-laden experience, and therefore for imagery to be realistic the emotions felt during performance should be mentally recreated during imagery practice. Perhaps it is not surprising, therefore, that Smith et al. (2007) found the PETTLEP interventions in their study to be more effective (i.e., a greater improvement in performance was apparent) than imagery that was preceeded by instructions to relax. After all, very few sports skills are performed in a state of complete relaxation. In our experience in both research and consulting, including realistic emotions in the imagery instructions makes the imagery much more evocative, and may therefore lead to a more vivid imagery experience. This suggestion is supported by a recent study (Wilson, Smith, Burden, & Holmes, 2010) where personalized, emotion-laden imagery scripts led to greater muscle activity and higher self-rated imagery vividness compared to more generic interventions.

Perspective

Finally, the component visual "Perspective" refers to the viewpoint of the performer during imagery. This can be internal (through the eyes of the performer) or external (seeing oneself performing as if watching on TV). As imagery should be as similar as possible to the physical performance, Holmes and Collins recommend an internal visual perspective for the most part, but recognize also that for some form-based skills, such as gymnastics, the external perspective can be very effective (e.g., Hardy & Callow, 1999). It is very important to consider individual preferences, which should be done by working closely with the athletes and experimenting with different perspectives in a practice setting. In fact, the issue of individual preference is absolutely crucial for successful interventions, and the compiling of a successful PETTLEP intervention should be seen as a partnership between

the consultant/coach and the athlete. Whilst it may be theoretically desirable, for instance, to adopt an internal visual perspective in many cases, there is some evidence that elite athletes switch perspectives throughout the imagery (Smith, Collins, & Hale, 1998), and also some athletes just prefer external imagery or find internal imagery difficult. In such cases, it is always preferable to accommodate the athlete's wishes as far as possible so that the athlete is comfortable with what he or she is being asked to do. If the athlete wishes to focus on an aspect that is not realistic or will not be productive, such as setting an unattainable performance goal, we recommend that the athlete is steered away from this, but athlete preference can be a very useful aspect to take into account. Preference can be established by interviewing the athlete, followed by a trial period of imagery and an evaluative discussion. By catering for individual preferences, the athlete is more likely to be motivated to complete the imagery as advised.

USING THE PETTLEP MODEL TO GUIDE PRACTICE

Some studies have found completing PETTLEP imagery to be as effective as physical practice in some circumstances (Wright & Smith, 2007, 2009). For example, Wright and Smith (2009) compared physical practice to PETTLEP imagery (amongst other conditions) on a bicep curl strength tasks. The results revealed no significant difference between the improvements in the two groups, with the PETTLEP imagery group increasing weight lifted by 23.29% compared to 26.56% in the physical practice group. Therefore PETTLEP imagery may be a viable alternative to physical practice in situations where further physical practice is not possible or advisable, such as through fatigue, boredom or injury. Additionally, it should be remembered that a combination of physical practice and imagery is likely to prove more effective than either method on its own (cf. Weinberg, 2008). Therefore, we would recommend using physical practice complemented as much as possible with PETTLEP imagery for best effect.

Of course there are different uses of imagery depending on the outcome that the coach or athlete is aiming to achieve, such as increasing confidence, improving the performance of a specific skill or increasing motivation. The PETTLEP model would be useful in achieving each of these aims as they are incorporated into the PETTLEP model, but the relative emphasis can be shifted as appropriate. There are also a number of ways in which the effectiveness of the imagery can be evaluated, which not only include performance but other important effects such as changes in motivation and confidence. However, we give a word of caution about adopting a realistic timeframe when evaluating the effectiveness of the imagery because, as with any skill, it requires time and practice to master.

Other key issues to consider are the volume and frequency of imagery needed to produce optimal results. In other words, "how much?" and "how often?" are questions that need to be answered to enable PETTLEP intervention effects to be maximized. Only two studies to date have examined imagery frequency with regard to the PETTLEP model specifically (Wakefield & Smith, 2009, 2011). Wakefield and Smith (2009) found that PETTLEP imagery improved netball shooting performance when completed at least three times per week, but less frequent PETTLEP imagery was not effective. However, Wakefield and Smith (2011) found that, although three imagery sessions per week improved bicep curl performance to a greater degree than less frequent imagery, as little as one session per week also led to significant strength increases. Therefore, we recommend that PETTLEP imagery is used as often as possible (preferably $\geq$3 times per week) to maximize the effect on performance, but that even once per week might be beneficial if more frequent imagery is not possible due to time constraints.

Using this paper as a guide, practitioners should now be aware of the main considerations when implementing PETTLEP interventions with athletes. However, we recommend that a strong working relationship is built with the athlete prior to implementing such interventions. This will ensure that the athlete, trusting in the consultant, is comfortable completing imagery using this method. It will also allow the intervention to be individualized to cater for the athlete's specific needs, something that is crucial for the success of this method. It may be wise to consider implementing the various elements of the model progressively into the athlete's mental training program, to limit the possibility of overload and to assess which aspects are useful for the individual athlete. This will also allow for evaluation of the effectiveness of PETTLEP with specific athletes. As with all psychological skill training, we recommend that the PETTLEP imagery intervention is introduced and rehearsed thoroughly in the practice setting to ensure that the athlete is at ease with using it prior to competition.

CONCLUSION

The PETTLEP model is very applied in nature and has many practical implications for the planning and execution of imagery interventions. Though PETTLEP research is still at a relatively early stage, with the first PETTLEP study being published in 2005, the findings to date have been very supportive of the model, across a variety of tasks varying in cognitive complexity. The results of research studies have also provided much useful information for the applied practitioner, which we have attempted to integrate in this paper. In Table 1, the key recommendations based on the PETTLEP model, along with practical examples, are summarized. We hope and trust that readers will find this approach as fruitful as we have.

TABLE 1 Key Recommendations for Implementing PETTLEP Imagery Interventions (based on Wright, 2007)

Element	How can this be achieved?	Examples
Physical	The athlete should adopt the correct stance, wearing the same clothes and holding any implements that would be used during performance.	A golfer could image holding his or her club and standing in a tray of sand. A 400m runner could image while in the starting blocks, wearing a running vest and shorts.
Environment	The athlete should complete the imagery in the same environment where the performance or task will take place. Where this is not possible, videos, photographs, or a similar environment can be used as a substitute (e.g., a rugby player standing on grass in his or her back garden).	A vault gymnast could image in the performance arena, standing at the beginning of the runway. A figure skater may use photographs of the ice arena when imaging his or her pairs routine.
Task	The task being imaged should be identical in nature to the task actually being performed, and this should be altered as the skill level of the athlete improves.	A rifle shooter would mimic the precise elements of the skill to be improved.
Timing	The imagery should be completed in "real time" and should take the same length of time to complete as physically performing the task.	A golfer would image a tee shot in real time, rather than in slow motion. Research has shown that real-time imagery is aided by holding implements associated with performance. A hurdler would image in real time, as timing is crucial to stride pattern.
Learning	As the athlete becomes proficient and autonomous at the task, the imagery should be updated in order to reflect this learning, and remain equivalent to the physical level of the athlete.	A diver would update his or her imagery to reflect the specific dive that he or she was working on. Also, he or she may focus on the more refined elements of the dive when becoming competent of the basic shapes.
Emotion	Any emotions associated with performance should be incorporated into the imagery. This can be aided by the use of stimulus-and-response training.	A soccer player would include all emotions, specific to his or her experience, into his or her penalty kick performance. For example, nerves or excitement about the task to be completed.
Perspective	The imagery should usually be completed from an internal perspective (i.e., through the athlete's own eyes). This can be aided by the use of video. However, external imagery may be useful for some form-based tasks and personal preference should also be taken into account.	A basketball player would image from an internal perspective when completing a free throw shot A gymnast may image his or her floor routine from an external perspective, as form is important and it would allow him or her to see the entire movement.

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