# The BASES Expert Statement on the Use of Mental Imagery in Sport, Exercise and Rehabilitation Contexts

Produced on behalf on the British Association of Sport and Exercise Sciences by Dr Tadhg MacIntyre, Prof Aidan Moran, Prof Christian Collet, Prof Aymeric Guillot, Dr Mark Campbell, Dr James Matthews, Prof Craig Mahoney FBASES and Jim Lowther.

**Introduction**

Mental imagery is a popular cognitive simulation technique defined as "a symbolic sensory experience that may occur in any sensory mode" (Hardy *et al.,* 1996, p.28). One of its key applications is in mental practice (also known as 'motor imagery') or the systematic use of mental imagery to rehearse skills covertly, without executing the movements involved. Having evaluated the efficacy of mental practice in laboratory settings, imagery researchers have gradually turned to sport (MacIntyre *et al.,* 2013), exercise (Thøgersen-Ntoumani *et al.,* 2012) and rehabilitation (Grangeon *et al.,* 2012) contexts. Arising from these studies, a significant evidence-base has accumulated on imagery mechanisms and applications (Guillot & Collet, 2010). The present paper provides an expert statement on optimal imagery use in sport, exercise and rehabilitation encompassing the evidence from different contexts.

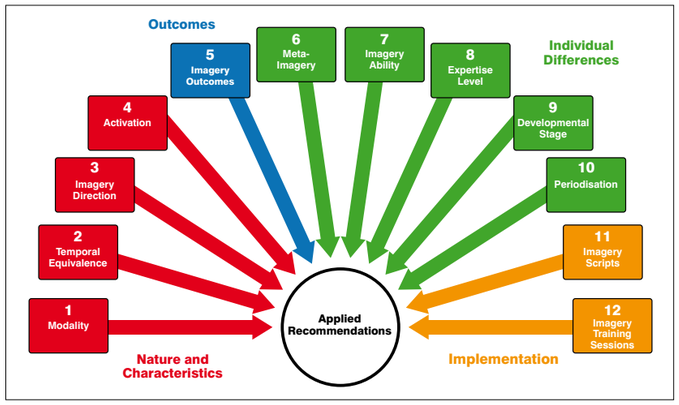


**Figure 1. Applied recommendations for mental imagery.**

**Background and evidence**

The following principles have emerged from recent research on imagery processes. First, imagery is now widely acknowledged as a multi-dimensional, multi-modal construct. Second, there are close parallels between the imagining, perceiving and motor control (planning and executing) of actions. Discovery of these parallels led to the 'functional equivalence' hypothesis (e.g., Jeannerod, 1994) or the proposition that mental imagery shares, to some degree, certain representations, neural structures, and mechanisms with like-modality perception and with motor preparation and execution processes. This functional equivalence approach led to the development of the PETTLEP model of motor imagery, which provided a guiding framework for the application of imagery, but one that was limited in several respects (see Wakefield *et al.,* 2013).

Third, motor imagery processes can be measured objectively using the 'mental chronometry' paradigm. The logic here is that if imagined and executed actions rely on similar motor representations and activate certain common brain areas, then the temporal organisation of imagined and actual actions should also be similar. Consequently, there should be a close correspondence between the time required to mentally perform a given action and that required for its actual execution.

Fourth, the discovery that athletes often move slightly while engaged in mental practice has spawned interest in 'dynamic imagery' (See Guillot & Collet, 2010), which challenges the traditional assumption that imagery requires the athlete to be static and/or relaxed. Fifth, recent research on athletes' 'meta-imagery' processes and the consequence of debilitative imagery in sport (MacIntyre *et al.,* 2013) has augmented earlier findings that indicated that athletes had sophisticated understanding of how to employ mental imagery effectively (White & Hardy, 1998).

Finally, theoretical models of imagery use have been developed for exercise and sporting domains (Guillot & Collet, 2008).

**Conclusions and recommendations**

Based on the evidence adduced above (see Figure 1), we can cautiously assert that practitioners should consider the following 12 recommendations to optimise the use of mental imagery by their clients in a variety of sport, exercise and rehabilitation contexts. Furthermore, in order to minimise risks to client groups and to reduce any unwanted effects, we have highlighted possible contraindications where relevant, but these are merely generalised examples and may not always apply.

**Modality:** Practitioners should encourage clients to use multi-modal imagery, focusing especially on the sensory modalities that are most relevant to the skill in question. Also, the advantages and disadvantages of using different imagery perspectives (i.e., first-person/or third-person) should be considered. These factors are influenced by individual preferences and task characteristics. For example, the use of an external visual imagery viewpoint in a morphokinetic task (e.g., gymnastics routine) may be advantageous as it may enable the movement form to be analysed. **Contraindication:** Engaging in imagery using senses (e.g., taste, smell) that are irrelevant to the task may diminish the working memory resources required for image generation.

**Temporal equivalence:** To improve the efficacy of mental practice interventions, practitioners should encourage clients, where possible, to try to achieve congruence between the duration of their imagined and actual actions. **Contraindication:** Slow-motion imagery may produce involuntary modifications of movement time.

**Imagery direction:** Where possible practitioners should recommend facilitative rather than debilitative imagery, unless the goal is specifically to enhance an adaptive emotional response to an event (e.g., increase resilience). If the client unintentionally engages in imagery of performance failure then s/he should be encouraged either to restructure it or to generate a positive alternative image. **Contraindication:** Ideal performance images may be unrealistic and lead to heightened expectations.

**Activation:** The optimal use of imagery requires congruence between the clients' arousal state and the physiological activation level required for the task. If the imagery is intended to enhance motor skills, it is important that the clients' arousal state matches that required by the performance. Dynamic imagery may be useful as it may assist in matching the level of activation. **Contraindication:** Unnecessary use of gross limb movements during dynamic imagery may cause fatigue and deterioration of performance during motor execution.

**Imagery outcomes:** Practitioners should clarify the precise outcome that is desired from any given imagery intervention and, where possible, seek to devise and implement an individualised imagery script for the client. Typical (but not exclusive) outcomes include skill enhancement, improvement of psychological processes (e.g., motivation) and rehabilitation of muscular movements. **Contraindication:** Uncertainty of desired outcome from imagery may reduce adherence to the imagery training programme.

**Meta-imagery** Before developing an imagery script, practitioners should try to elicit the client's knowledge, control and understanding of his/her own imagery processes, because this may influence his/her imagery ability and application. Knowledge of imagery processes does not equate with imagery ability, which should also be evaluated.

**Imagery ability:** Practitioners should assess clients' imagery abilities to ensure that they are able to imagine the motor skill appropriately. **Contraindication:** Assessment may be skewed if only one measure is applied, particularly if this is a self-report measure.

**Expertise level:** Imagery is beneficial to all levels of performers, from novice to elite, but may be more effective for experts. It should be noted that one should not assume that elite performers have competencies in imagery abilities, because sport-specific demands may lead to wide variations in these abilities even among elite sporting samples.

**Developmental stage:** The cognitive developmental stage of the client should be considered before designing and implementing an imagery intervention. Imagery can be used with children but practitioners must be aware that the content of the imagery should account for their cognitive development trajectory. Limiting the complexity of the tasks may not provide sufficient variety for the athlete so the imagery context should be reviewed regularly.

**Periodisation:** Before implementing an imagery intervention, it is important to consider the time of season, the environmental context, and the stage of injury, if relevant. This is dependent on the desired outcomes. **Contraindication:** Performance and motivational decrements are possible from incorrect timing of interventions.

**Imagery scripts:** It is recommended to create an individualised imagery script, with a variety of imagery content and clearly defined outcomes. The content should be updated as the client increases his/her level of performance expertise or as he/she, for example, increase frequency and/or types of activity. Each script should have a discernible beginning and end point, in order to control the temporal congruence of the imagery, if relevant. **Contraindication:** Imagery scripts should be adapted and modified regularly to prevent client boredom with the rehearsal of the simulated action.

**Imagery training sessions:** Short imagery intervention sessions are recommended dependent upon the planned outcome and the mental load constraints. In order to ensure the optimal frequency of imagery training, the practitioner needs to be aware of the clients abilities, the specific skill being rehearsed together with the time the client has available to practise imagery of the motor skill. Combining imagery and physical practice should be promoted when possible, but imagery is a good alternative when physical practice is not available. **Contraindication:** Possible fatigue effects of imagery training may result. ■

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