

TESTS FOR EVALUATING EFFECTIVENESS OF AN EMBODIED VISUALISATION METHOD FOR  
TRAINING THE MUSCLES OF SINGING ©Nicola Harrison, Alan Watson 2016

**INTRODUCTION**

The effective training of the professional singing voice involves the precise activation of numerous muscles in various combinations. This is a challenge for vocal coaches, as there is no objective evaluation of the action of these muscles whilst undergoing training. This is because their movements cannot be seen and often not felt. This study uses an image-based protocol to access and train the muscles involved in supporting the singing voice. It was developed empirically over 9 years of pedagogical research involving over 90 trainee singers. To validate any teaching method, an objective approach is essential to determine whether the theory matches the outcome.

**DEFINITION OF IMAGE-BASED PROTOCOL**

Two groups of nine post-grade 8 singers (18-24 years)<sup>1</sup> were given a range of standard technical exercises and a song to perform in an immediate Before/After visualisation study. There was no break between the two sets of recordings. The first set of exercises and song were performed without intervention. In the repeat set, six images were incorporated into these standard vocal exercises in two ways:

- A. By showing an image to create a mental picture for the singer.
- B. By mimicking the shape of the image through a gesture.

After the vocal exercises, a selection of these images were then incorporated into the performance of a folk song 'Bobby Shaftoe.' This was achieved through the action of drawing these images at appropriate points in the score. This made the association between the image and the gesture required in the song. This was actioned by the singer during the test.

**METHOD**

Electromyographic (EMG) electrodes using Spike 2 software for analysis were placed on the skin surface over key respiratory and postural muscles in torso, back and neck.<sup>2</sup> Respibands (plethysmography) monitored chest and abdominal movement. This was to distinguish between inhalatory and support phases of singing.

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<sup>1</sup> GROUP 1: Schola Cantorum (Oxford), post-grade 8 undergraduates/music graduates.  
GROUP 2: RWCMD, First year to post-graduate/MA vocal and choral students.

<sup>2</sup> Muscles whose activity was measured: internal and external oblique, rectus abdominis, transversus abdominis, erector spinae, latissimus dorsi, trapezius, pectoralis major, scalenes and sternocleidomastoid.

Sound recording traces were taken to assess changes in volume. Separate video/audio recordings were made using Zoom 2 video camera. This was to identify unusual or extraneous movement (sway, gesture, head movement etc) that might show on recorded muscle activity during singing and could interfere with interpretation of the muscle recordings.

The main objective of Group 1 was to evaluate immediate changes in sound quality. Anonymised BEFORE/AFTER audio recordings were presented in random order to a panel of expert vocal coaches<sup>3</sup> to see if they could hear any difference in vocal quality after the use of the image-based protocol. It also served to test the efficacy of the EMG recording method and guided the choice of muscles to be recorded from in Group 2.

The aim of Group 2 was to provide a statistical evaluation of the immediate underlying changes in the activity of key muscle groups after Embodima training.

## RESULTS

In 80% of subjects (76.9% with a modal preference for 85.2%), the Group 1 aural assessors favoured the post-training recording of 'Bobby Shaftoe.' In both groups, EMG showed increased activity in abdominal and back muscles following visualisation. Despite the relatively small sample size, analysis of Group 2 was either statistically significant ( $p \leq 0.05$ : latissimus dorsi, erector spinae and trapezius), or close to significant ( $p \leq 0.06$ : external oblique high, rectus abdominis, scalenes and sternocleidomastoid).

## CONSTRAINTS

Time and financial constraints imposed limits on the scale, duration and measurement period of the study.

Despite similarity in vocal experience, the singers' response to the protocol varied.

Physical constraints were imposed by the electronic equipment.

Some of the muscles of singing were too deep to record from the skin surface.<sup>4</sup>

Ability of assessors to maintain concentration through listening to numerous samples.

The influence of stylistic preference on their choices.

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<sup>3</sup> The expert vocal assessors used for this study were heads of singing, speech and voice professors and well-known professional singers or pedagogues.

<sup>4</sup> e.g. transversus abdominis, internal and external obliques and diaphragm.

**CONCLUSION**

This study shows that after only 15 minutes of Embodima (image+gesture) muscle training, a demonstrable change of use in the abdominal muscles of singers can be both observed and heard.

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**Note:** this research into an image-based training technique was developed over 9 years and tested scientifically over 4 years in collaboration with neuroscientists and anatomists from UCL (Professor J. Rothwell, Dr Damon Hoad) and University of Cardiff, Wales (Dr A Watson).