

Perceptual-Motor Learning Theory Applied to Voice and Alexander Technique Teaching Strategies

MICHELE A. CAPALBO

Perceptual-Motor Learning Theory Applied to Voice and Alexander Technique Teaching Strategies

TABLE OF CONTENTS

PART I: PORTFOLIO	1
PERCEPTUAL-MOTOR LEARNING THEORY APPLIED TO VOICE STUDIO TEACHING STRATEGIES.....	1
INTRODUCTION AND RATIONALE	1
CONTEXT	1
LEARNING AND DEVELOPMENT AIMS	3
METHODS AND RESOURCES.....	3
OUTCOMES.....	5
TIMESCALES AND REVIEW DATES	5
LITERATURE REVIEW	5
<i>Learning</i>	5
<i>Practice</i>	8
<i>Feedback</i>	11
<i>Perception</i>	13
<i>Performance</i>	14
CRITICAL REFLECTION	15
<i>Introduction</i>	15
<i>Reflection</i>	15
<i>Description</i>	16
<i>Feelings</i>	16
<i>Evaluate</i>	17
<i>Analyse</i>	18
<i>Conclusion</i>	19
<i>Action Plan</i>	20
SUMMARY	21
PART II: WRITTEN ASSIGNMENT	22
PERCEPTUAL-MOTOR LEARNING THEORY AND AT/VOICE INTEGRATION: HABIT, ATTENTION AND EXPERTISE ...	22
INTRODUCTION	22
THE ALEXANDER TECHNIQUE AND PERCEPTUAL-MOTOR LEARNING THEORY	22
<i>Means Whereby</i>	22
<i>Unlearning</i>	23
<i>Conscious Control, Expertise and the Role of Automaticity</i>	25
<i>Locus of Attention</i>	27
AT/VOICE INTEGRATION	30
<i>Touch</i>	30
<i>PML Guidelines for Explorations</i>	31
<i>Explorations</i>	32
Semi-Supine	32
Exploration #1: Respiratory awareness through the autonomic breath	33
Exploration #2: Kinesthetic memory	33

Monkey.....	33
Exploration #3: Autonomic breathing in an upright position	35
Exploration #4: Simple vocal task.....	35
The Whispered “Ah”	36
Exploration #5: Whispered /a/ into unvoiced semi-occluded vocal tract (SOVT) articulation	37
Exploration #6: Whispered /a/ into paired unvoiced/voiced SOVT phonation	37
Hands on the Back of a Chair.....	37
Exploration #7: Simple vocal task, changing frequency	38
Exploration #8: Simple vocal task, changing amplitude.....	39
Exploration #9: Messa di voce	39
IMPACT ON LEARNING.....	40
APPLICATION TO PRACTICE	41
CONCLUSION	41
REFERENCES	43
APPENDICES	60
<i>Appendix A: Glossary</i>	<i>60</i>
<i>Appendix B: Student Goal Setting</i>	<i>75</i>
<i>Appendix C: Learning and Performance Guidelines</i>	<i>76</i>
<i>Appendix D: Ralston Repertoire Difficulty Index</i>	<i>77</i>
<i>Appendix E: Key Technical and Artistic Principals for Classical Voice Training</i>	<i>78</i>
<i>Appendix F: Strategies for Breaking Habits and Expert Skill Maintenance.....</i>	<i>79</i>
<i>Appendix G: Semi-Supine, AT Procedure</i>	<i>80</i>
<i>Appendix H: Monkey, AT Procedure.....</i>	<i>81</i>
<i>Appendix I: Whispered “ah”, AT Procedure</i>	<i>82</i>
<i>Appendix J: Hands on the Back of a Chair, AT Procedure</i>	<i>83</i>
<i>Appendix K: Semi-Supine Explorations.....</i>	<i>84</i>
<i>Appendix L: Monkey Explorations.....</i>	<i>85</i>
<i>Appendix M: The Whispered “ah” Explorations.....</i>	<i>87</i>
<i>Appendix N: Hands on the Back of a Chair (HotBoaC) Explorations.....</i>	<i>89</i>
<i>Appendix O: Bibliography.....</i>	<i>91</i>

Perceptual-Motor Learning Theory Applied to Voice and Alexander Technique Teaching Strategies

Key concepts are identified in ***bold italics*** for clarity and future reference (Appendix A).

PART I: PORTFOLIO

PERCEPTUAL-MOTOR LEARNING THEORY APPLIED TO VOICE STUDIO TEACHING STRATEGIES

INTRODUCTION AND RATIONALE

My private voice studio is a bipartite hybrid focused on training classical singers through traditional methods and the Alexander Technique (AT). In the United States, where my studio is based, there is a strong focus on core competencies for voice teachers including ***perceptual-motor learning*** (PML) theory (Helding, Maxfield and Bozeman, 2020; Titze and Verdolini Abbott, 2012, p. 218). This independent study will investigate PML theories with two primary aims. The first assessment relates to a future goal. It investigates the nature of learning and performance in order to design strategies and best practices specifically optimised for teaching applied voice lessons at a university. The second assessment also draws on motor learning theory with a focus on my current independent studio. The topics investigated relate to ***unlearning*** chronic habits. AT/voice integration exercises incorporating PML theory are also presented.

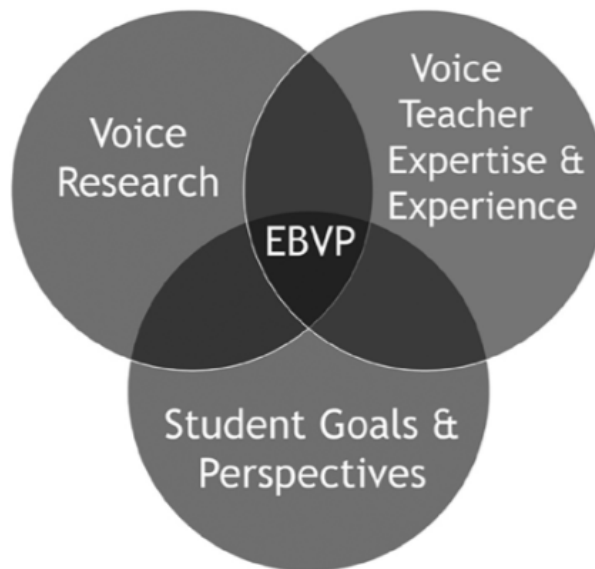
CONTEXT

The North American professional organisation for voice teachers, the National Association of Teachers of Singing, strongly promotes continuing education and provides a robust platform for emerging vocal pedagogy research in the *Journal of*

Singing and at their biannual conferences. The teaching paradigm that has generated the most interest in the past few years is evidence-based vocal pedagogy (EBVP). Considered a holistic framework it integrates research (Maxfield and Ragan, 2021), traditional pedagogy and teacher experience, with a collaborative student/teacher focus (Ragan, 2018), (Fig. 1). Emerging interest in evidence-based teaching is developing concurrently in discrete geographical pockets. A review in 2017 by Australians Crocco, Madill, and McCabe found no existing evidence-based frameworks for classical voice training, however, this trio has now proposed a motor learning framework (Crocco, McCabe, and Madill, 2020).

Fig. 1 Evidence-based voice pedagogy (EBVP)

(Ragan, 2018, p. 159)



PML literature intersects with all three aspects of Ragan's (2018) framework, from incorporating a research perspective, to best practices guiding student learning while incorporating teacher expertise. PML is the fusing of action and perception (Titze and Verdolini Abbott, 2012, p. 218). This approach places the focus squarely on how we teach not what we teach (Crocco and Meyer, 2021).

Being conversant in an EBVP approach is an asset in the highly competitive market for university voice teacher positions across North America. Obtaining such a position is a medium-term goal. A firm understanding of PML theory applied to voice will provide a solid foundation when faced with teaching constraints at a university.

LEARNING AND DEVELOPMENT AIMS

My immediate objective is to incorporate effective learning strategies so lesson time is used productively and students stay motivated and engaged. Developing AT/voice integration exercises with PML principles continues to expand my expertise. Ultimately, my goal is to make my students as self-reliant as possible based on their developmental level and technical abilities.

Eventually, I'd like to teach at a university. Since a teacher in this position must contend with time limitations alongside performance requirements, it is invaluable to know how to apply learning strategies to a student population. A logical extension of this objective is to design a motor learning module for inclusion in a voice pedagogy class. An additional objective is to publish a book on AT and singing. The exercises that I have developed specifically for AT/voice integration help to clarify my process and content in support of this goal.

METHODS AND RESOURCES

This literature review began with a couple of straightforward questions. How do we learn, and how can I help others to learn more effectively? As this review progressed another question emerged. How can I make the unlearning and relearning process more efficacious? An integrative literature review process to retrieve, analyse, critique and synthesis representative literature was used (Torraco, 2005, p. 356).

Literature was accessed through the university, my interstate library borrowing system, peer-reviewed industry journals, and my personal library. An initial title search using the terms *motor learning* and *singing* was submitted to the university library system yielding nine relevant articles. Article inclusion was limited to those pertinent to studio teaching. A similar search of the *Journal of Singing* archive was then undertaken adding an additional 32 articles. Due to the limited scope of the word search, the references from relevant articles were assessed for significant material that eluded the initial key word search. This reference review expanded the available source material beyond voice. Specifically, key interdisciplinary contributors from motor learning (Schmidt and Lee, 2005), psychiatry (Csikszentmihalyi, 2021; Bjork and Bjork, 2020; Doidge, 2015; Kandel, 2006; LeDoux, 2003) and neuroscience (Ericsson, 2020; Damasio, 1994), were identified. This representative list of multi-disciplinary sources was chosen for inclusion because they are published leaders in their field and were cited by vocal pedagogues. These expert voices add scientific rigour to meet the EBVP standard. Since little research has been conducted specifically on singers, generalisation from other areas of expertise, especially sport, was inevitable (Toner and Moran 2015; Wulf, 2013).

The second assessment drew on sources revealed in the expanded search and my personal library. Specifically, information related to expertise (Montero, 2016; Ericsson, 2020) **attention** (Wulf, 2013) and unlearning (Schmidt and Lee, 2005) became a focus. A gap in the literature linking PML, AT and unlearning revealed potential new areas of inquiry. A short review of AT/voice literature provided a framework for the practical explorations using PML theory to guide the process.

This review approach favoured recent publications while including as many diverse voices as practical. An internet search on dated sources was conducted to verify current author views when available. Some traditional sources were included to contextualise recent developments. While this literature review doesn't claim to assess all of the possible relevant information, it critically identifies, analyses, synthesises and reports key learning and development aims relevant to this independent study (Snyder, 2019, p. 337).

OUTCOMES

Immediate outcomes of this study include the design of new explorations, and more effective teaching strategies for my private studio. Longer term potential goals relate to specific PML guidance for university voice lesson implementation and the development of vocal pedagogy course content. The ultimate goal of publishing a book on AT/voice integration would incorporate some of the learning strategies derived from this study. These outcomes are expanded in the action plan below.

TIMESCALES AND REVIEW DATES

BMPF 7013 Activities	Feb. 2021	March 2021	April 2021	May 2021	June 2021
Week Starting	14 21 28	7 14 21 28	4 11 18 25	2 9 16 23 30	6 13 20
Literature review PML					
Initial tutor meeting - project approval		5/3/21			
Literature review AT procedures					
Second tutor meeting - check-in			6/4/21		
Document AT/Voice Integration exercises					
Compose draft: Portfolio					
Compose draft: Written Assignment					
Submit first draft to tutor				11/6/21	
Revisions					
Final paper due				25/6/2021	

LITERATURE REVIEW

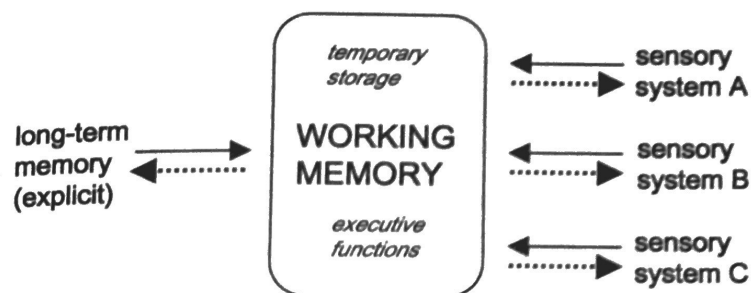
LEARNING

The process of learning, acquired through practice or experience, produces relatively permanent behavioural changes, and is inferred through skill transfer and retention

during performance (Schmidt and Lee, 2005, p. 302). Learning differs from genetically determined characteristics related to **ability** (Schmidt and Lee, 2005, p. 275). The PML process is underpinned by attention and memory (Helding, 2020). Attention can be viewed as a selective filter (Kandel, 2006, p. 311). When attention is focused on the execution of a task, dynamic cognitive processes called memory enable learning (Helding, 2020, p. 76). The theoretical constructs of memory are usually delineated into **working memory** (WM) and **long-term memory** (LTM), (Helding, 2020, p. 89). **Short-term memory**, often considered part of WM (Baddeley, Hitch and Allen, 2020), holds six or seven items for as long as a few minutes (Kandel, 2006, pp. 210, 206). As information is received it is temporarily stored and **encoded** in WM (Baddeley, Hitch, and Allen, 2020). Sensory information including vision, **audition**, and **proprioception**, is processed in WM (LeDoux, 2003, p. 179), (Fig. 2). During skill acquisition, data held in WM is influenced by previously processed information stored in the LTM (Schmidt and Lee, 2005). Memory is easily disrupted before consolidation, which can take several hours (Kandel, 2006, p. 211).

Fig. 2 Short-Term or Working Memory

Based on Squire and Kandel, cited in LeDoux, 2003, p. 179

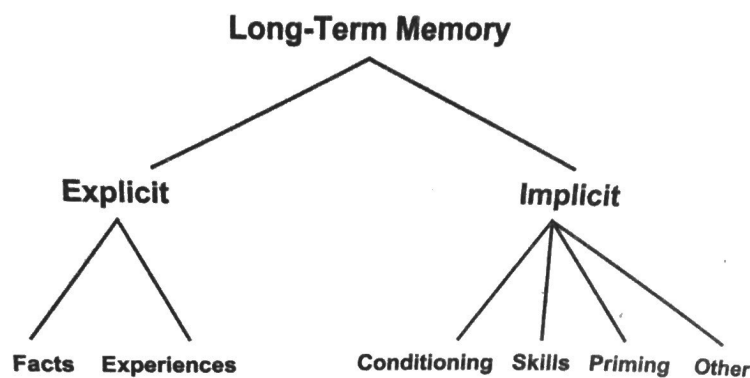


Research on expert musicians conclude that pertinent information is quickly accessed from an extended working memory due to **chunking** (McCarther, 2018a; Geeves et al. 2014; Feltovich, Pretula, and Ericsson, 2006). Chunking may be assisted through the use of rhythms (Baddeley, 1999, p. 36), an advantage that Racette and Peretz (2007) hypothesise may be exploited through rhythmically stressed language (p. 250). Repetition strengthens neuronal synapses allowing memories to be stored long term

(Kandel, 2006, p. 206; LeDoux, 2003, p. 80). There may be a memory advantage for voice over other instruments as sung melodies have been shown to elicit greater recall and emotional response (Weiss, Trehub and Schellenberg, 2012). LTM includes explicit **know that** knowledge such as melody, and language, and **implicit learning** or sensory **know how** knowledge like vocal technique (Verdolini, 2000), (Fig. 3).

Fig. 3 Long-Term Memory

Based on Squire and Kandel, cited in LeDoux, 2003, p. 102



LeDoux (2003) notes that **emotion** and **motivation** also affect memory (p. 174). Normal memory constraints may be bypassed during highly emotional events moving directly to LTM without repetition (Kandel, 2006, p. 264). Emotions, designated as **arousal** levels, are scientifically observable (Damasio, 2001). **Feelings** are psychological manifestations of emotions and are not measurable, but they can enhance or diminish learning (Helding, 2014; Damasio, 2001). Research into emotion in music is nascent (Juslin and Sloboda, 2010), although Helding (2020) states that intermediate arousal levels are beneficial for learning (p. 191). This may be understood in terms of Guadagnoli and Lee's **optimal challenge point** (2004) which seeks to balance skill level, task difficulty and appropriate feedback. Psychiatrists Robert and Elizabeth Bjork (2020) coined the term **desirable difficulties** to describe challenges that are relevant to the task, and can be solved by the learner (p. 477). Optimal challenges can lead to self-efficacy, as well as enhanced enjoyment and motivation (Abuhamdeh and Csikszentmihalyi, 2012, p. 264).

Motivation, the other element influencing memory, determines the degree to which learners will persist, and pay attention (Baddeley, 1999). High motivation has been linked to a nurturing environment (Gaunt et al. 2012; Clemmons, 2006). To increase self-efficacy and motivation Frey-Monell (2010) advocates for an atmosphere of joint problem solving between teacher and student. Setting goals with specific, challenging parameters and a documented implementation strategy have been shown to enhance motivation (Helding, 2019, p. 286). Goal setting guidelines are outlined in Appendix B. Helding (2019) notes that extrinsic rewards are not a primary motivator (p. 286). Conversely, Damasio (1999) indicates that reward and emotion are irrevocably intertwined (p. 55) indicating that reward plays some role in motivation. Music itself has been found to engage the neurochemical reward systems in the brain (Chanda and Levitin, 2013, p. 180). Early stages of motivation are fed by play (Howard-Jones et al. 2011), but to reach the automaticity of expert performance levels, a singer must engage in ***deliberate practice*** discussed below (Ericsson, Krampe, and Tesh-Römer, 1993). As automaticity is attained, intrinsic motivation increases (McCarther, 2018a). However, the desirability for complete automaticity at the expert level is disputed (Christensen, Sutton and Bicknell, 2019; Bergamin, 2017; Montero, 2016; Sutton et al. 2011). This is examined in part two.

PRACTICE

Consensus indicates that expertise is directly related to the ***power law of practice*** (Lehman and Gruber, 2006; Schmidt and Lee, 2005; Johansson, 2002). Simply put, while practice may not be a “*sufficient* condition for high achievement...it is certainly a *necessary* one” (Lehmann and Gruber, 2006, p. 458). Needless to say, practice is also essential for memory (Palmer, 2006). Studies show that it takes a minimum of ten years of intense training to obtain domain specific expertise (Ericsson, Krampe and Tesch-Römer, 1993, p. 393). Singers who aspire to sing expertly spend thousands of hours rehearsing independently and must learn to utilise their time efficiently. A fundamental goal in the university system is to empower students to become independent learners

(Frey-Monell, 2013). Providing the student with deliberate practice assistance, or **feedforward** guidance, can enhance learning (Helding, 2020, p. 130).

Deliberate practice is a highly structured, effortful activity to boost performance through constant improvement (Montero, 2016, p. 128; Ackerman, 2007; Sloboda, 2000). It only becomes feasible after the student has developed the skills for rehearsing reliability without supervision (Ericsson, 2020). Ericsson, Krampe and Tesch-Römer (1993) identify three **expert skill acquisition constraints** including resources, motivation and effort (pp. 368-369). Since universities provide resources, and motivation has been discussed, the issue of the required effort to implement deliberate practice strategies is considered next.

Studies indicate that effective practice lasts between one to two hours per day, and should not exceed four hours total (Ericsson, Krampe and Tesch-Römer, 1993, p. 270). A university student could incorporate additional cognitive practice strategies, including mental rehearsal, to enhance memory (Moran et al. 2012; Cremades, Hilliard, and Gapin, 2010; Brown, 1996, p. 120). Working on language acquisition and song texts, a vital developmental tool for classical singers, also enhances learning and performance without fatiguing the voice (Rainero, 2012, p. 212). Depending on the complexity of the music and student's expertise, deliberate practice strategies could include separating melody, rhythm and words in early learning stages (Bergan, 2010; Brown, 1996, p. 120). Racette and Peretz (2007) hypothesise that singing is a dual task, therefore, the perception and memory of words and music are processed independently. In a related finding they discovered that text recall was superior when initially learned separately from the music, and suggest that semantic predictability lends a memory advantage to text (p. 250). Shelton (2019) takes a purposeful approach to learning atonal music employing rhythm and pitch toolkits. Reducing music into its component parts like words, melody and rhythm seems like a common-sense approach to difficult music. However, it has been noted that skills performed in parallel, such as singing, dancing and acting, should be reintegrated promptly (Titze and Verdolini Abbott, 2012, p. 234).

Since memory is less easily disrupted after two hours (Kandel, 2006, p. 211), with even greater consolidation after six (Shadmehr and Holcomb, 1997), optimal learning conditions incorporate multiple practice sessions every day (Helding and Maxfield, 2019a). Lesson frequency can also be adapted to shorter more frequent lessons for novice students (Brown, 1996, p. 242). Students who collaborate with their teachers to develop practice schedules become more self-reliant (Maxfield, 2019). Optimal learning conditions for vocal tasks are executed in a ***blocked*** then ***random*** order (Nix, 2017, p. 217). Practice guidelines are summarised in Appendix C. Strategies to stimulate learning include adding practice variation or ***contextual interference***, distributing practice over longer periods, reducing ***feedback frequency***, and varying environments (Schmidt and Lee, 2005). Simply stated, learning is boosted by introducing practice variables with sensible scheduling tailored to meet specific student levels and goals (Lee et al. 2016; Pascua, Wulf and Lewthwaite, 2015; Keetch and Lee, 2007). When skill acquisition is the goal, singers must avoid practice conditions boosting performance over learning lest they risk misleading themselves as to their level of proficiency (Bjork, 1998, p. 438). Deliberate practice scheduling variables are found below.

Practice Scheduling (Adapted from Nix, 2017).

Type	Method and Advantages
<i>Massed</i>	Little or no rest between practice periods. Less total time with possible performance boosts, fatigue may become a factor.
<i>Distributed</i>	Space practice from 2 hrs. to 6 hrs. apart for memory consolidation. Highly recommended strategy, beneficial to learning.
<i>Self-Regulated</i>	Learner designed practice parameters. Produces highly motivated and self-reliant learners.

Performance is a primary assessment method in university programmes, therefore, repertoire is an important aspect of applied voice lessons. Fortunately, PML theory provides some guidance. While simple song assignments may be demotivating (Helding and Maxfield, 2019a; Stamer, 1999), a piece beyond the technical abilities of the singer is likely to frustrate them (Clemmons, 2006). However, perceived repertoire challenges depend somewhat on the student's attitude (McCarthy, 2018a). Fostering a collaborative environment could engender feelings of respect and trust (Frey-Monell, 2010). Collaboration could extend to some self-assigned repertoire allowing students to reliably assess their own abilities, with the added benefit of expanding the teacher's repertoire. Ralston's (1999) Repertoire Difficulty Index provides a framework to assess and assign appropriate repertoire (Appendix D).

FEEDBACK

Intrinsic and extrinsic perceptual feedback are both essential to the development of a self-reliant singer (Tillotson Bauer, 2013; Ohrenstein, 2003). Implicit or ***intrinsic feedback*** is kinesthetic or proprioceptive in nature and is discussed later. External or ***augmented feedback***, is explicit and can be verbal, aural, or visual (Bergan, 2010). ***Knowledge of results*** (KR) and ***knowledge of performance*** (KP) represent the two types of augmented feedback. More prescriptive in nature, KP provides the student with information about specific performance components such as corrections to posture (Nix, 2017; Bergan, 2010). The summary nature of KR may be most helpful when providing environmental information that cannot be ascertained by the performer, including acoustic balance (Helding and Maxfield, 2019a). Precise instruction has been shown to enhance learning (Eder and Dignath, 2017) but only to a point, beyond which no further gains occur (Maxfield, 2013; Salmoni, Schmidt and Walter, 1984). KR is most beneficial when it focuses on broad-spectrum correctness (Maas et al. 2008). Feedback that pulls awareness internally may negatively affect learning and performance (Wulf, 2013; Bergan, 2010). An exception to this may be novice singers who benefit from focusing on discrete internal movements (Helding, 2016; Maxfield, 2011). This is discussed more fully in part two.

Feedback frequency, summarised below, is easily implemented in voice studios. Generally speaking, less feedback allows advanced students to become more self-reliant, which is beneficial to learning (Maxfield, 2011; Winstein and Schmidt, 1990). Conversely, more frequent feedback may boost performance (Schmidt and Lee, 2005, p. 383; Salmoni, Schmidt and Walter, 1984) and help novices form reliable motor programs (Titze and Verdolini Abbott, 2012). Feedback can become a crutch if used too often (Helding, 2020, p. 136; Lee, White and Carnahan, 1990). According to **bandwidth theory**, too much feedback, or over-correction, inhibits learning and creates **errors** by forcing modification of a task that is essentially correct (Steinhauer and Grayhack, 2000). The process of discovery by which the learner corrects errors and discovers successes, called **surprises** (Gentile, 1972), leads to greater retention. The most effective strategy for advanced singers is **self-regulated feedback** (Wulf and Lewthwaite, 2016; Keetch and Lee, 2007). Self-directed learners are more likely to request feedback after successful task completion (Chiviacowsky and Wulf, 2007), which feeds confidence resulting in more successful performances (Maxfield, 2019). An effective teaching strategy incorporates positive feedback especially for novices (Helding and Maxfield, 2019b; Van Duijvenvoorde et al. 2008). Positive teacher intervention, including **social-comparative feedback**, has been shown to constructively affect performance (Lewthwaite and Wulf, 2010; Csikszentmihalyi, 1998).

Feedback Frequency (Adapted from Nix, 2017)

Concurrent	Frequently after stops or constant cuing during an activity
Applicable to novices for reinforcement of fundamentals, new tasks or error-free learning. Enhances specific short-term performance goals.	
Summary	After several trials
Builds error recognition, independence and self-correction through cognitive processing time. Results in greater consistency and adaptability.	
Fading	Decreases as skills improve and before performances
Feedback is phased out as error correction develops. Supports autonomy.	

Bandwidth	Provided when performance level is outside a criterion range
Novice students maintain motivation levels if correction is given less often. Intermediate students gain independence through observation and self-correction. Avoids over-correction and facilitates a flow in advanced students.	
Delayed	After an interval (3-5 second delay)
May be less beneficial for novices. Advanced students benefit from error detection, self-correction and adaptation.	
Self-regulated	Delivered only when requested
Novices may not have enough knowledge to self-regulate. Advanced students benefit from problem-solving, avoiding over-correction and unnecessary adaptation.	

PERCEPTION

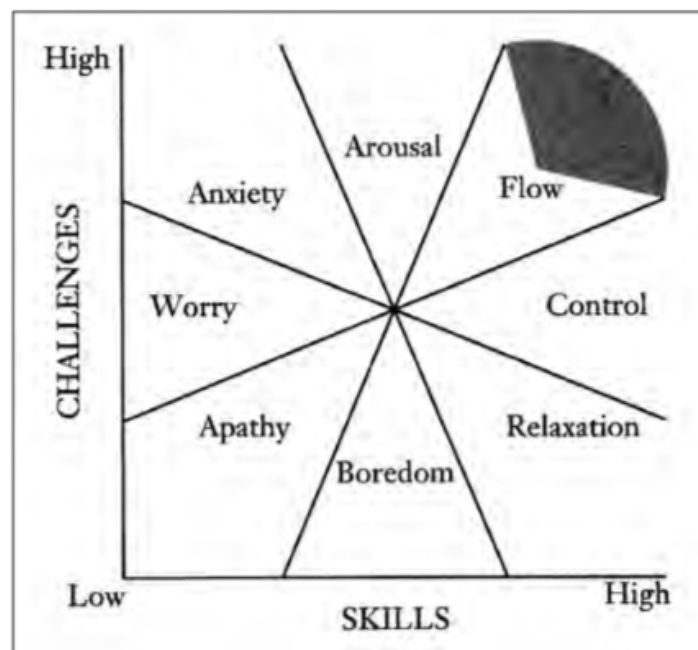
Intrinsic feedback relates to singers' perception. The **motor system** is complex and perhaps best described as a continuum regulated by both feedforward and feedback processes (Seidler, Noll and Thiers, 2004, p. 1775). These processes can be understood through Schmidt's **schema theory** (Titze and Verdolini Abbott, 2012, p. 225). Briefly, rapid movements such as singing coloratura is a **feedforward process** with minimal or no **sensory feedback**. It relies on internal **motor programmes** functioning like blueprints or **recall memory** for accuracy (Walden, 2014; Schmidt and Lee, 2005, p. 413). Conversely, slower tempos allow singers to evaluate correctness and respond to feedback in real time through **recognition memory** (Schmidt and Lee, 2005, p. 413). Both systems interact over time, with feedforward processes updating as errors are sensed through feedback (Lester-Smith, 2020, p. 3629). Although there are mechanoreceptors in the larynx (Sundberg, 1987), they are not well innervated for sensory feedback (Nafisi, 2013). Conversely, **exteroceptors** like hearing and vision have recognisable and distinct sensations (Proske and Gandevia, 2012). Accurate **audition** is essential for singers (Indik, 2006) as it is quickly integrated into motor behaviour (Sugiyama and, Liew, 2017; Altenmüller, 2008).

PERFORMANCE

It is important to remember that the goals of learning and performance are diametrically opposed (Helding, 2020, p. 101). We have seen that feedback frequency and type can be structured to boost either but not both. Temporary performance shifts can be depressed or elevated by emotion or motivational levels (Helding, 2008). Illness and fatigue can also have a profound effect on performance ability (Monjo, Terrier and Forestier, 2015). **Augmented intention**, or trying too hard, can also depress performance (Verdolini, 2002). Mornell and Wulf (2019) state that an external attentional focus on the sound of music rather than internal movements allows musicians to perform more reliably. This external focus may help singers attain a **flow** state discussed in part two (Helding and Maxfield, 2019b; Jensen, 2016; Abuhamdeh and Csikszentmihalyi, 2012, p. 264). McCarther (2018a) states that balancing perceived challenges with an appropriate skill level facilitates a flow state at every developmental stage (Fig. 4).

Fig. 4: Finding a Flow State

(Csikszentmihalyi, 1997, cited in McCarther, 2018a, p. 331)



CRITICAL REFLECTION

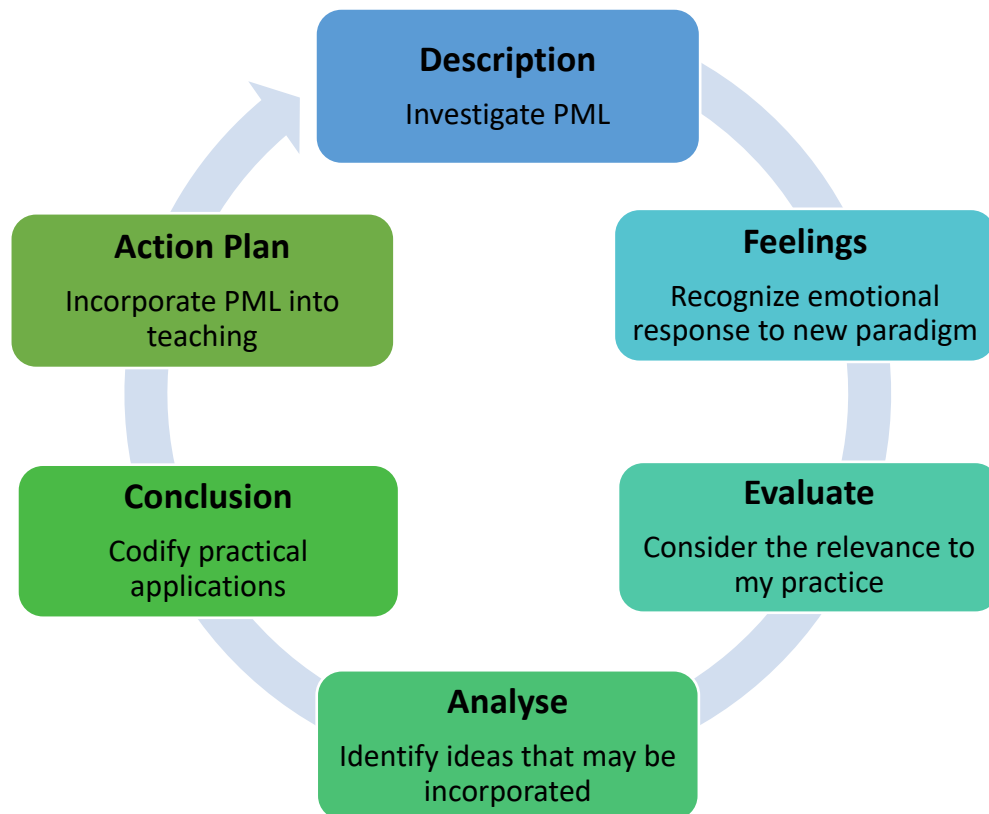
INTRODUCTION

My experience during this independent study is explored through Gibbs' reflective cycle below (University of Edinburgh Reflection Toolkit, 2019). This model reflects the iterative nature in both my singing and AT work. This investigation of PML theory has expanded my teaching and planning skill set by providing specific actionable guidance to teach more effectively. It also guides the parameters for AT/voice explorations in part two.

REFLECTION

Fig. 5, Gibbs Reflective Cycle

(University of Edinburgh Reflection Toolkit, 2019)



DESCRIPTION

My overarching goal for this assignment was to learn how to facilitate effective learning in others. Engaging with PML theory led me to incorporate learning variables in my voice studio relating to the frequency and type of augmented feedback. Additionally, this inquiry guided me to a greater understanding of the inverse of PML, or unlearning. Through this research I explored some conflicting issues between PML theories, and attempted to make sense of them within the context of my practice. Some theories tested my previously held beliefs and others were more congruent with my training and experience. In the end, I emerged with enough concrete information to structure more effective lessons and training, guide student practice, and give productive feedback.

FEELINGS

Throughout this process there was a sense of discovery as I read the literature in this emerging field. As both a teacher and performer I recognized the strengths in the varied approaches to learning versus performance and reflected on how I had met these demands previously. This process brought new urgency and relevance to this research in order to help others learn effectively. As a teacher I was able to reflect on the feedback strategies that I use, and adapt them for students' developmental skill level. Using positive social-comparative feedback was particularly motivating for my younger students.

Csikszentmihalyi's (2021) flow theory and addiction habit research (Brewer, 2021) both provided some context for expertise and unlearning in this study. Although they align with my areas of inquiry and elements from PML theory, they fall squarely into cognitive psychology without any motor or **explicit learning** theory component. I debated their brief inclusion but felt that both areas added context and would benefit from future study. The literature on **locus of attention** was carefully parsed due to length constraints, which made me focus on learning versus performance. Discrepancies related to singer application of attentional theory left me with unresolved feelings but

some tangible guidance. Reviewing information on touch in teaching led me to conclude that there is likely not enough substantial data to overcome existing reservations regarding the use of touch in school settings. Nevertheless, I remain an advocate for its effectiveness.

The AT/voice explorations prompted significant self-reflection. Although there are a number of books on AT and singing (Wragg; 2017; Murdock, 2015; Dimon, 2011; Weiss, 2009), only Heirich (2011) attempts to document meaningful exercises. I suspect this general reticence likely reflects my own reluctance to present exercises that may exacerbate underlying conditions. **End-gaining**, or rushing toward a goal without attention to the process, is a principle that most singers find challenging in my experience. Exercises are stimulating activities and are likely to trigger end-gaining. In an attempt to counter this, I found myself referring to these exercises more often as explorations. I later noticed that AT/voice teacher Heirich (2011) does the same. In the end, I must allow each student to direct their own learning.

EVALUATE

This review of PML theory provides precise parameters specifically related to feedback and practice strategies for university teaching. Approaches taken from PML can be applied to both teaching style and content in a vocal pedagogy course module. In addition, a number of ideas emerged for future publishing projects. These are explored in the action plan below.

The second assessment, focusing on my current AT/voice practice, challenged me to expand my view on the use of touch in teaching. PML principles were used in the development of my explorations and could guide singers when touch is not permitted. The locus of attention literature led me to consider the type of attentional focus AT practice demands in a new way. Reviewing material on conscious control, automaticity and expertise supplied an historical context to skill acquisition theory. However, more

clarifying were the emerging theories that ally with AT principles since they allow for a more flexible attentive state during performance.

ANALYSE

Understanding how we learn and the elements that can affect retention including motivation, emotion and goal setting revealed a number of elements that teachers should keep in mind.

- Motivation is essential for learning.
- Emotion can negatively or positively affect learning and performance.
- Deliberate practice is effortful.
- An attainable precise goal enhances learning.
- Skill develops with increased and level appropriate challenges.

The research related to feedback and practice also provided helpful general guidance.

- Practice up to two hours a day to progress and avoid injury or fatigue.
- Including alternate strategies like mental practice can boost learning.
- Distribute rehearsals two to six hours apart to increase memory retention.
- Musical elements can be separated, but should be reintegrated promptly.
- Frequency and type of feedback can be tailored for skill level and modified to boost learning or performance.

The second assessment yielded nine voice explorations based on four AT procedures. These were structured with guidance from PML theory studied throughout this independent study.

Voice Explorations	AT Procedures
• Autonomic breathing • Kinesthetic memory • Simple vocal task • Whispered phonation • Unvoiced SOVTE • Voiced SOVTE • Isolating pitch from volume • Isolating volume from pitch • Messa di voce	• Semi-supine • Monkey • Whispered “ah” • Hands on the back of a chair

CONCLUSION

Many of the ideas that I encountered in this review are directly applicable to the university voice studio setting. Some of these overarching PML principles include:

- Balance skill level with task difficulty to foster positive experiences and increase intrinsic motivation.
- Encourage self-efficacy through self-assigned repertoire, and clear goal setting.
- Deliberate practice is possible once the student attains some level of self-efficacy and skill, and is essential to attain advanced performance levels.
- Work with students to design individual practice protocols for effective learning.

In the second assignment strategies for unlearning and monitoring during performance, augmented my previous understanding of expertise and the effects of AT on performers. Strategies to interrupt automaticity and expand awareness supplemented my current approaches.

Throughout this process I regarded this literature review as an overview. Its purpose was to provide a broad foundation, first to meet a stated goal, and second to investigate specific areas of interest to meet the aims and needs of my current practice.

ACTION PLAN

Applied Voice Lessons	
Action	Implementation Strategy
Design typical lesson and hierarchy of skills	Create a lesson plan and identify key technical and performance skills to guide student development (Appendix E).
Design protocols to enhance learning	Codify PML principles to aid vocal technique development and efficient learning.
Design protocols to enhance performance	Codify PML performance principles to facilitate successful recital preparation.
Codify feedback types and strengths.	Codify feedback strategies by skill level.
Design student practice guidelines	Create a PML master framework to guide student practice in consultation with the teacher.
Compile repertoire resources	Identify repertoire resources to facilitate self-selected pieces to support student self-efficacy.
Pedagogy Course(s)	
Action	Implementation Strategy
Identify PML principles for inclusion in vocal pedagogy course	Create introductory (undergraduate) and advanced (graduate) modules outlining practical PML principles to enhance teaching strategies for aspiring pedagogues.

Other Applications	
Action	Implementation Strategy
AT/voice integration programme development	Codify an AT/voice programme integrating PML principles for online or in-person delivery.
Publish	Continue to develop a book on AT/voice integration with exercises based on PML theory. Continue to publish stand-alone AT/voice articles in industry journals including the AmSAT Journal and the new peer-reviewed Alexander Journal.

SUMMARY

This literature review revealed a number of adaptable learning and performance strategies that are compatible with an EBVP teaching approach. PML brings a flexible research-based foundation into the studio while allowing teacher experience and expertise to adapt those principles for the benefit of each particular student.

PART II: WRITTEN ASSIGNMENT

PERCEPTUAL-MOTOR LEARNING THEORY AND AT/VOICE INTEGRATION: HABIT, ATTENTION AND EXPERTISE

INTRODUCTION

The first assessment reviewed perceptual-motor learning (PML) principles for application in a university setting. The goal was to fortify my understanding of PML for efficient voice lesson application. The second assessment will synthesise and apply PML literature to my current independent studio focusing on the re-educative benefits of the Alexander Technique (AT) for singers. Unlearning strategies, as well as the effects of conscious control on motor function and expertise will be discussed. I will then parse principal literature on the ***locus of attention***. Since the primary focus of my current practice is to integrate AT and voice, the second part of this assessment will incorporate PML theory into AT/voice integration explorations I have developed.

THE ALEXANDER TECHNIQUE AND PERCEPTUAL-MOTOR LEARNING THEORY

MEANS WHEREBY

The impetus for Alexander (2001) to develop his technique emerged from his chronic hoarseness during oratory recitals. When recounting this struggle, he identified harmful alignment patterns related to his head, neck and back (HN&B) relationship the moment he began to speak (Alexander, 2001, p. 45). AT ***re-education*** is an iterative process aiming to reintegrate coordination through the release of unnecessary tension balanced with adequate tonus (Kleinman and Buckoke, 2013, p. 203). AT teachers seek to guide students' awareness to recognise inefficient habitual responses (Jones, 1976, p. 150; Kleinman and Buckoke, 2013, p. 52). Once a chronic habit has been identified the skill

must be consciously monitored and reassembled step-by-step in order to re-integrate new movement patterns (Alexander, 1923, p. 133). AT re-education calls this the **means whereby** (Alexander, 2001, p. 39). This process infers that unlearning must take place if changes to coordination are sought. In PML this interruption in automaticity is called **dechunking** (Geeves et al. 2014; Beilock and Carr, 2001).

UNLEARNING

In part one memory **persistence** was discussed in terms of its importance to the learning process. While early stages of memory storage are “dynamic and sensitive to disruption” (Kandel, 2006, p. 211), according to **Jost’s Law** older memories are extremely durable (Baddeley, 1999). Neurologists Richards and Frankland (2017) hypothesize that mental flexibility is the antecedent to forgetting. Doidge (2015) states that even though the brain is malleable, once a thought or action has become habitual through repetition, rigidity can mask underlying plasticity (p. 350). Unfortunately, unconscious, habitual or automatic actions are enduring and can easily overwhelm new motor patterns (Doidge, 2015, p. 351).

The inverse to persistence, although less researched, is **transience** or the ability to forget. Transience is perhaps most researched in terms of addiction (Klein and Brewer, 2021; Crossley, Ashby, and Maddox, 2013). Psychiatrist Brewer (2021) identifies a number of steps in his habit breaking guide that are AT compatible including recognition of triggers, conscious awareness and **inhibition**. However, it must be noted that breaking a behavioural habit differs from altering one’s habitual physical coordination. This line of inquiry exceeds the constraints of this paper, but would be an interesting future project.

Schmidt and Lee (2005) document a number of strategies to alter ingrained motor performance that essentially come down to a question of interference and memory decay. The dominant theories they highlight include **interference theory**, **trace-decay theory** and the **warm-up decrement** effect, which is attributed to a loss of either

memory or skill (pp. 443-448). **Interference**, a tool shown to help retention (Vidoni et al. 2010; Keetch and Lee, 2007), may also assist unlearning with novelty or **retroactive interference** playing a role in reversing ingrained habits (Richards and Frankland, 2017; Doidge, 2015). Fiorella (2020) reviewed the literature on habits in independent learning environments concluding that transience was aided by disruption, beneficial habit support and intrinsic rewards (p. 611). Patience is required when relearning a skill since temporal dynamics may also affect the rate of forgetting specific tasks (Richards and Frankland, 2017, p. 1080). Simply stated, skills that change more frequently have less stability and are more quickly interrupted than stable tasks (Kostrubiec et al. 2012). Activities including AT procedures or prescribed vocal exercises are often well-defined with arguably a high degree of predictability and stability. Therefore, slower changes may be the most effective when altering these behaviours. Alexander (1941) also advocated for gradual change to coordination (p. 82).

As previously stated memory decay and interference seem to dominate the unlearning strategies. Schmidt and Lee (2005) hypothesise that effective relearning tactics could exploit natural forgetting during the warm-up decrement. They suggest focusing on suitable arousal levels, incorporating rhythms and using appropriate feedback sources to aid transience (p. 451). An effective **biofeedback** strategy during warm-up could include AT kinesthetic touch. Interference strategies include contrast drills between desired and undesired movements (Toner, 2017, p. 14). Initially designed for athletics, these drills could be tailored to singers. Slowing down automatic movements in order to dechunk **motor programmes** and bring them into conscious awareness is another tactic interfering with automaticity (Maxfield, 2018; Beilock, et al. 2002). An athletic derived model (Carson and Collins, 2011, 2016) to interrupt inefficient habits while maintaining expert skill levels is adapted for singers in Appendix F. Holding and Maxfield (2019b) suggest that steady practice will help to strengthen retention efforts faster in the voice studio. A tailored practice regimen, discussed in the first assessment, could support the student's retraining efforts.

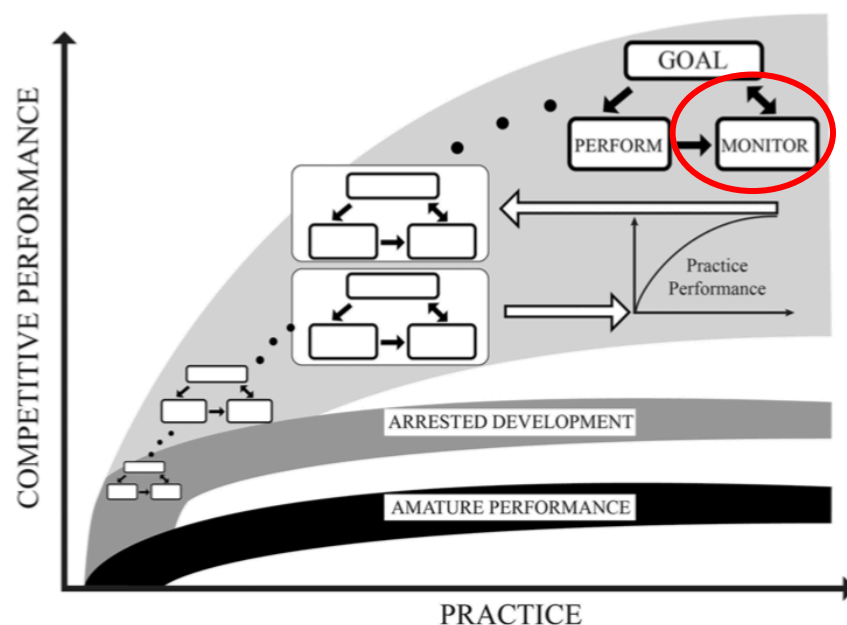
Slowing down, dechunking, interference, contrast drills and conscious monitoring are all strategies that may disrupt automaticity and provide awareness of undesirable habits (McCarthy, 2018b; Indik, 2006). This awareness, or conscious control during activity, is discussed next.

CONSCIOUS CONTROL, EXPERTISE AND THE ROLE OF AUTOMATICITY

Expert performance is characterised by the appearance of smooth, effortless, and automatic movements (Jacobs, 2018; Ericsson, 2006). Expertise is relevant to my practice. It reflects the emerging and professional singers I teach, and my own professional performance background. As previously noted, traditional motor performance research specifies that optimal performance is interrupted when automaticity is brought under conscious control. However, Ericsson (2006) cautions experts to be wary of relying on automaticity (p. 685). In 2020 Ericsson reiterated that the motor programmes guiding performance are a product of practice and experience but they are continually refined through monitoring (Fig. 6). Monitoring, or conscious awareness, and its effects on expert performance will be examined in this section.

Fig. 6: Three performance trajectories based on practice and experience

(Ericsson, 2020, p. 8)



Early skill development models assumed that automaticity was the ultimate objective. Fitts and Posner's (1967) widely cited three-stage model identify cognitive, associative and autonomous stages of learning. Later Dreyfus and Dreyfus (1980) expanded this model into five stages including a level of mastery signifying an automatically functioning expert absorbed in a task (p. 14). This description is reminiscent of what Csikszentmihalyi (2021) calls **flow**. Although flow theory has much in common with PML including balancing task difficulty with skill level, goal setting, feedback, locus of attention and intrinsic motivation (Beard and Csikszentmihalyi, 2015, p. 353), a thorough discussion of this topic is beyond the scope of this paper.

What flow theory and these early motor acquisition models fail to differentiate is everyday automatic expertise, from elite expertise relying on spontaneous or adaptive skills (Christensen, Sutton and Bicknell, 2019; Bergamin, 2017). Recent theories challenge the equivalency of automaticity and expertise. **AIR theory** hypothesises that experts develop flexible attention to draw on a repertoire of adaptive motor patterns to meet shifting physiological states, or environmental demands (Sutton et al. 2011, p. 96). This has been further developed into **MESH theory**, a hierarchical attentional control framework balancing the benefits of automatic efficiency and spontaneous flexibility (Christensen, Sutton, and McIlwain, 2016). These emerging models help to explain shifts in strategic focus that musicians employ called **performance cues** (Ginsborg, Chaffin and Nicholson, 2006). Toner, Montero and Moran (2014) propose two additional circumstances requiring explicit task focus including alteration of habitual movement, central to AT re-education, as well as slowing down during pre-performance planning (p. 1129). Originally designed for athletes, there are nevertheless a number of pre-performance routines applicable to singers from warm-ups to rehearsing tasks that exceed normal singing performance parameters including falls, jumps, or combat staging.

Explicit task focus, or monitoring, has also been identified as **cognition-in-action** by philosopher and dancer Montero (2016), who rejects the argument that augmented attention implicates interference (pp. 237-238). Her principle echoes AT student

Dewey's phrase "thinking in activity" (Alexander, 2001, p. 32), and the AT principle **constructive conscious control** (Alexander, 1923). This attentional quality has been described in AT as "an efficient alarm system" (Carrington and Carey, 2001, p. 124), continually monitoring the periphery of attention (Carrington, 1994, pp. 86-87). Clearly AT aligns with attentional theories advocating for some monitoring whether retraining, responding to performance conditions, or mitigating the effects of illness and fatigue (Toner and Moran, 2015). Naturally, this attentional focus does not aim to control every process at once. Such a high cognitive demand would overwhelm the system as illustrated in **degrees of freedom problem** (Schmidt and Lee, 2005, p. 176).

AT seeks to bring an intentional focus to inefficient proceduralised movements to facilitate change. Inevitably this is disruptive to performance (Titze and Verdolini Abbott, 2012, p. 228). This enhanced attention, or **consciousness**, necessitates a switch to slower semantic or linguistic processing (Crocco et al. 2020, p. 574). Using **representational gestures** (Toner, 2017, p. 17), lowers cognitive demand and accelerates processing. Singers may benefit from this approach through movements that are easily seen such as jaw, tongue and lip movements, or postural shifts. The point is to link new actions to perception (Toner, 2017, p. 18). **Cuing**, the use of abbreviated phrases or words to represent complicated functions, is a related concept shortening cognitive processing time and may explain the rapidity of motor adjustments (Miyake et al. 2004).

LOCUS OF ATTENTION

Our complex attentional network includes both nervous system and cognitive functions (Helding, 2020, pp, 77, 215). The **autonomic nervous system** is not consciously controlled nor does it have a direct effect on phonation (Webb and Adler, 2008, p. 50). Therefore, this inquiry focuses on attentional switch, or the ability to selectively engage with both automatic and conscious attention assuming sufficient volition and motivation (Helding, 2020, p. 77; Webb and Adler, 2008, p. 224). This selective attention corresponds to the monitoring function of various theories discussed previously. My

working theory is that the feedforward and feedback processes employed during different singing tasks direct the prevailing attentional focus at any given time. Some tasks, like rapid scales, require preplanning and likely benefit from an external focus. However, singing also benefits from sensory feedback allowing for virtually instantaneous adaptations requiring balance between an expanded focus and a more proximal attentional awareness.

The optimal place to focus attention for the most effective learning and performance outcome is highly debated in PML. Schmidt and Lee (2005) indicate that attentional focus has been discussed for over a hundred years (pp. 114-115). Their synthesis of early empirical theories suggests that an external focus benefits well-learned skills while less proficient skills require a more internal focus (Schmidt and Lee, 2005). This is disputed by Wulf (University of Nevada, Las Vegas, 2021), who has arguably the highest profile among contemporary researchers focusing on attentional focus in motor performance. Wulf (2013), who predominately researches athletics, consistently cites the ***constrained action hypothesis*** affirming that an internal focus impedes performance (Wulf, McNevin and Shea, 2001). This is supported by the conclusions in Mornell and Wulf's (2019) pianist study where enhanced musical expression while performing a familiar piece was attributed to an external attentional focus. Unfortunately, this study measured performance not learning. Recently, Singh and Wulf (2020) argued that external foci should be viewed on a continuum with experts benefiting from a more distal focus than novices. Their conclusion seems predisposed to confirmation bias because what had been previously viewed as an internal focus is parsed in this study as simply a lesser degree of external focus. Ultimately, an attentional continuum perspective may prove the most reasonable due to the myriad of influences and disparate ways attention is analysed in PML and performance. Currently, it remains an atypical way of describing attentional focus.

Shusterman (2011) also questions Wulf's dogmatic assertion regarding the preeminence of external focus asking if the attentional quality is "calmly observant or anxiously flustered" (p. 319). In other words, if attention is undermined by emotion, such

as the fear of failing, it is compromised and conclusions may be misleading. There are few studies related to locus of attention for teaching singers. Maxfield (2011) posits, based on his thesis research, that novice singers or new skills benefit from a more internal focus. This conflicts with the results of a pianist study, which found that an external focus was the most beneficial for novices (Duke, Cash and Allen, 2011). Unfortunately, there is simply not enough evidence to quantify the motor or cognitive equivalence between moving fingers and the **complex motor skill** of singing.

AT does not fit neatly into the traditional **internal/external locus of attention** paradigm represented in PML. While conscious control and breaking down skills during re-education seems to imply a more internal focus, AT eschews the roadblocking internal focus techniques for unlearning espoused by Doidge such as closing one's eyes (Alexander, 1946, pp. 215-216; Holding, 2020, p. 131). During AT lessons the student is invited to see something outside of themselves with open eyes (Davies and Barlow, 2002, P. 155). Alexander (1941) viewed internally focused attention, or concentration, as mental tension (p. 82). An AT attentional focus balances between selective attention and expansive consciousness (Drake, 1991, p. 29). Dimon (2015a) equates this ideal field of consciousness to a calm but alert mental state (p. 123).

To summarise, an external locus of attention may benefit more advanced singers and performance conditions over learning. Conversely, there is some evidence to suggest that an internal focus may benefit inexperienced singers, new skill acquisition or habit disruption. Research into expertise shows us that some form of flexible monitoring may explain the ability to attend to particular moments during performance without interrupting perceived automaticity. An AT attentional focus is perhaps best understood as the ability to switch between an internal focus when required, while maintaining an overall external focus (De Alcantara, 2013, p. 201).

AT/VOICE INTEGRATION

TOUCH

Traditional AT lessons include light touch, an augmented feedback strategy related to the **guidance hypothesis** (McCarther 2018b; Indik, 2006). Guiding students toward a preferred behaviour through **errorless learning** (Schmidt and Lee, 2005, p. 359), may benefit novices and new skill acquisition (Schmidt and Lee, 2005, p. 360). Touch is considered an effective learning strategy (Titze and Verdolini Abbott, 2021). Jones (1976) notes that verbal instruction is not as effective as kinesthetic learning when studying AT (p. 157). Kandel (2006) argues that touch activates the sensory neurons, which engage action potentials to produce specific behaviours (pp. 200-201). Schmidt and Lee (2005) suggest that guidance may be most effective when commingled with embodied practice (p. 360), which represents the activities in my practice.

While touch may be effective for some students, its use in lessons is controversial for a couple of reasons. The first is that some **errorful learning** can be beneficial (Kalyuga, Rikers, and Paas, 2012; Winstein, Pohl and Lewthwaite, 1994). Specifically, expanded choices within a consistent environment boost retention (Lee et al. 2016). Guidance may boost performance, but if relied upon it can depress learning (Bergan, 2010; Salmoni, Schmidt and Walter, 1984). The second challenge relates to legal and ethical considerations due to potential misunderstandings or the imbalanced power dynamic between teacher and student (Helding, 2020, p. 137). Strategies to circumvent touch like **modelling** for the student or providing written instructions may be unavoidable in some settings (Helding, 2020, p. 138), but they are not ideal for my private practice where students expect kinesthetic feedback. Needless to say, there are several things to consider including the teaching environment, overall frequency of guidance, and the goals and perspectives of the student. The following explorations may mitigate the use of touch.

PML GUIDELINES FOR EXPLORATIONS

A number of AT/voice integration explorations incorporating PML principles were developed during this independent study. These exercises explore procedural learning, which must be experienced (Crossley, Ashby and Maddox, 2013). These can be self-directed. It is assumed that the student will incorporate deliberate practice strategies from PML theory previously discussed.

Exploration Practice Strategies

- **Vary** practice time, length, location
- **Distribute** attentive practice into short periods throughout the day
- **Randomise** the order and/or tasks

The simplicity of the proposed tasks reflects the necessity of breaking down skills to interrupt automaticity and bring them under conscious control. As previously noted flexible instructions rather than rigid directions are provided to support self-efficacy and motivation. These guidelines can be altered to meet appropriate developmental and skill levels. It is expected that novice students will require more specific guidance designed by their teacher. A simple, trouble-free vocal task corresponding to the following parameters will be used in these explorations.

Simple Vocal Task

- Very short exercise or excerpt
- Comfortable and easy vocal range
- Sung at a relatively soft dynamic

Independent work is enhanced through the use of augmented feedback from a video camera or a mirror to monitor the HN&B relationship as well as overall alignment.

EXPLORATIONS

The following AT/voice exercises or explorations are based on four AT procedures. The entire process is initially hierarchical and ultimately iterative. The purpose is to identify and release tension and then to reintegrate proper tonus. Progress will depend on the coordination of the individual and should not be rushed. Attention to the process is encouraged and end-gaining should be avoided. It is assumed that the student has previous experience with the corresponding AT procedure before embarking on these integrated explorations (Appendices G-J). No position should be held. Movement is encouraged if the student becomes rigid. Remember shorter, distributed and varied explorations are recommended.

Semi-Supine

The semi-supine procedure aids in chronic tension release (Liebowitz and Connington, 2000, p. 129; MacDonnell, 2000, p. 18). This procedure gives full support to the body taking advantage of gravity. This is mentally active work (Davies and Barlow, 2002, p. 234). The full AT procedure preceding this exploration is found in Appendix G.

Fig. 7: Semi-Supine Procedure



(Dimon, 2015a, p. 145)

Full directions for the following two explorations are found in Appendix K.

Exploration #1: Respiratory awareness through the autonomic breath

The function of an **autonomic breath** is to engage natural respiration. Simply, expel existing air from the lungs without first inhaling and allow the air to rebound back in (Wolf, 2013, pp. 27-28). This procedure is particularly helpful to bring awareness to respiration using the kinesthetic feedback from the floor (McAllister-Viel, 2021).

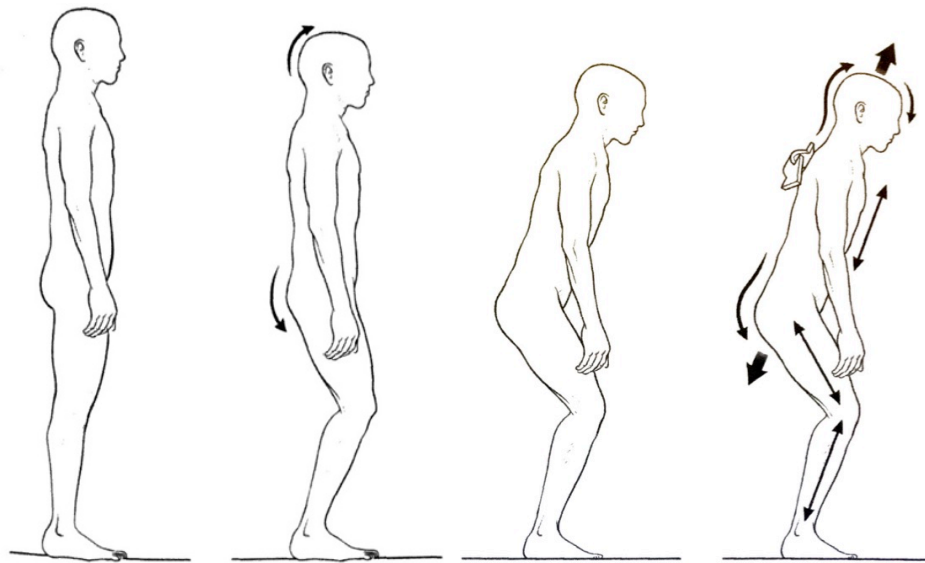
Exploration #2: Kinesthetic memory

The mental practice of thinking through a piece of music while in the semi-supine position helps to identify tensions that may be camouflaged by other intrinsic feedback during singing. This can be incorporated into regular practice to extend sessions without fatiguing the voice (Helding, 2020, p. 130). **Subvocalisation** during **kinesthetic memory** subtly engages singing muscles and enhances learning (Pruitt, Halpern, and Pfordresher, 2019). A combination of both kinesthetic imagery and active motor training yields better musical performance results (Lotze, 2013, p. 4). Three sessions of 15-20 minutes per week can be effective (Ladda, Lebon, and Lotze, 2021).

Monkey

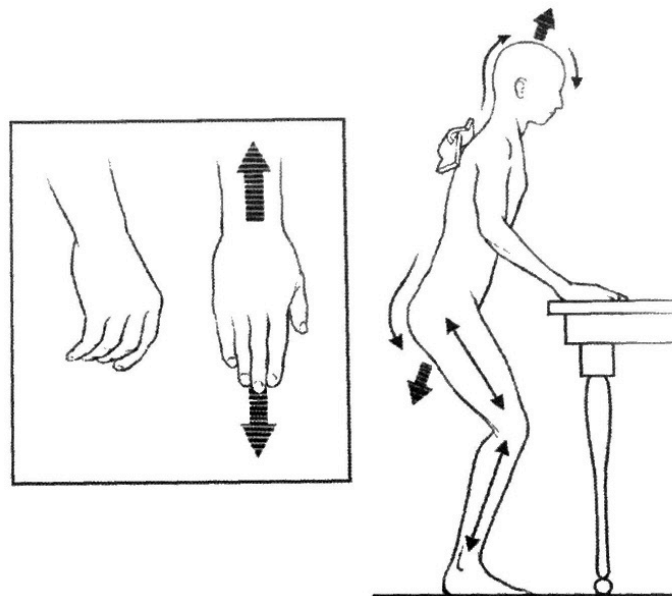
This **position of mechanical advantage** starts to re-integrate the deep extensor muscles of the spine and postural tonus (Dimon, 2015a, pp. 220-221). One could argue that monkey is the foundation for all AT movement due to its active postural restoration. Some vocal pedagogues view AT as an ineffectual technique of relaxation or collapse (King cited in Blades, 2017, p. 7). However, the active and dynamic nature of monkey demonstrates how this misrepresents AT principles, which Alexander (1946) attributes to adequate tension (pp. 26-27). Singing requires sufficient tonus in the right places (De Alcantara, 2002, p. 239; Engelhart, 1989, p. 134). While in a monkey, attention to the HN&B relationship and release in the legs is paramount. (Fig. 8). Monkey variations include forward inclined sitting, and using feedback from hands on a surface (Dimon, 2015c, pp. 14-15), (Fig. 9). Innovation and variation are encouraged as this procedure can be exhausting. Be patient. This AT procedure is described in Appendix H.

Fig. 8: Going into Monkey



Dimon, 2015a, p. 85

Fig. 9: Monkey with hands like feet



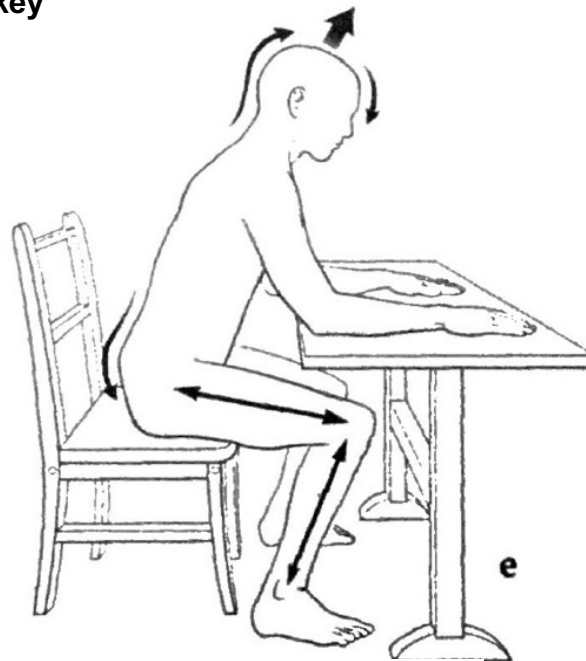
Dimon, 2015c, p. 15

Full directions for the following two explorations are found in Appendix L.

Exploration #3: Autonomic breathing in an upright position

This is a continuation of the autonomic breath first explored in the semi-supine. Exhale any existing air in the lungs and allow the inhalation to rebound in naturally. It may be helpful to isolate the movements of going into monkey by sitting and inclining forward from the hips in order to work on the HN&B alignment before standing and re-introducing the legs (Fig. 10). The seated monkey can be performed with or without a table. Direct yourself up and back from the surface if using your hands and forearms for feedback.

Fig. 10 Seated Monkey



Dimon, 2015a, p. 231

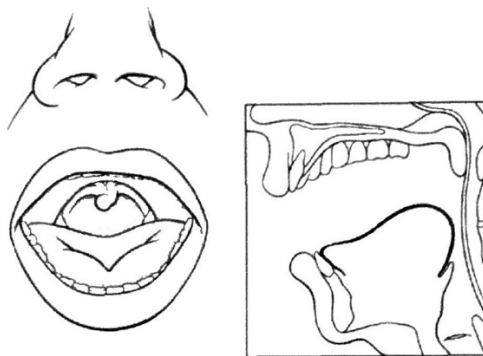
Exploration #4: Simple vocal task

In order to identify harmful phonation habits this exploration uses a very simple vocal task in the lower to middle register that is trouble-free for the singer and can be sung softly. It can be as simple as one note. Building on an autonomic breath, the stimulus of phonation is introduced. Alexander (2001) called phonation onset the “critical moment” (p. 45). Notice what happens to the head balance in this moment.

The Whispered “Ah”

The ***whispered “ah”*** /a/ is the only explicit exercise that Alexander used (Heirich, 2011, p. 87). A first-hand account is recounted by Jones’ (1976, pp. 21-22) and elucidated in Appendix I. The whispered /a/ has been said to benefit respiration (Heirich, 2011, p. 85; Kleinman and Buckoke, 2013, p. 10), vocalisation (Dimon, 2015b; Murdock, 2009; Jones, 1976, p. 2), and even regulation of the central nervous system (De Alcantara, 2013, p. 139). It has been reported that Alexander responded to questions regarding the purpose of the whispered /a/ by saying, “I ask you to tell me what it isn’t good for!” (Carrington and Carey, 2001, p. 36). Alexander was initially known as the “breathing man” (Carrington, 1994, p. 64). He specifically extolled the virtues of the whispered /a/ for training a controlled or extended exhalation, which is fundamental to singing (Alexander, 1946, p. 338). The use of whispering in voice work is controversial primarily due to two possible detrimental effects. The first is drying of the vocal folds especially when coupled with oral inhalation, and the second is excess pharyngeal constriction easily introduced when whispering too loudly (Titze and Verdolini Abbott, 2012, p. 264). Few vocal pedagogues actively use whispered exercises although Bozeman’s (2021) use of the chiaroscuro whisper is a new development (pp. 132-135). Brown (1996), a former Julliard teacher, also used whispering in his vowel explorations (pp. 103-106).

Fig. 10: The whispered /a/



(Dimon, 2015b, p. 31)

Full directions for the following two explorations are found in Appendix M.

Exploration #5: Whispered /a/ into unvoiced semi-occluded vocal tract (SOVT) articulation

The following 3 unvoiced SOVT consonants are suitable to incorporate into the whispered /a/.

/f/ (fan) /s/ (san) /ʃ/ (shaow)

This is an exploration of a simple shift between the whispered /a/ and the unvoiced SOVT consonants identified above. SOVT exercises have been shown to facilitate efficient phonation (Titze, 2018). When shifting between the whispered /a/ and unvoiced consonants, it is helpful to notice extraneous articulatory tension in the tongue, lips and jaw, without the strong stimulus of phonation.

Exploration #6: Whispered /a/ into paired unvoiced/voiced SOVT phonation

The following unvoiced and voiced SOVT consonant pairs are recommended for this exercise.

/f/ (fan) to /v/ (van) /s/ (san) to /z/ (zan) /ʃ/ (shaow) to /ʒ/ (jaudge)

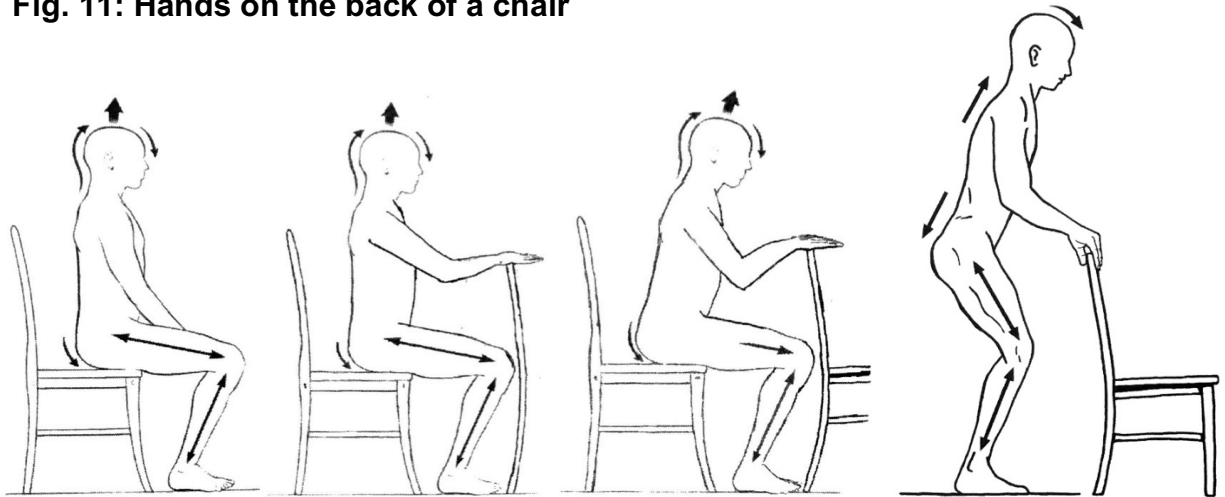
This flexible and adaptable exercise builds on the previous exploration adding voice through the whispered /a/ using consonant pairs. The student may notice that the stronger stimulus of phonation reveals habits that may have eluded previous observations. The HN&B should be monitored for excessive tensions and changes in alignment.

Hands on the Back of a Chair

Hands on the back of a chair (HotBoaC) was the only procedure Alexander (1923) documented in detail (pp. 111-115). Building on the monkey procedure, this active procedure is very helpful for singers investigating the appropriate tonus needed for breath management through torso ***tensegrity*** (Dimon, 2015c, pp. 32-33). This procedure is more advanced due to its heightened activity and tends to invite end-

gaining rather than attention to the process. HotBoaC can be done seated or standing (Fig. 11). The details for this AT procedure are very specific, and may take time to master. AT instructions are found in Appendix J.

Fig. 11: Hands on the back of a chair



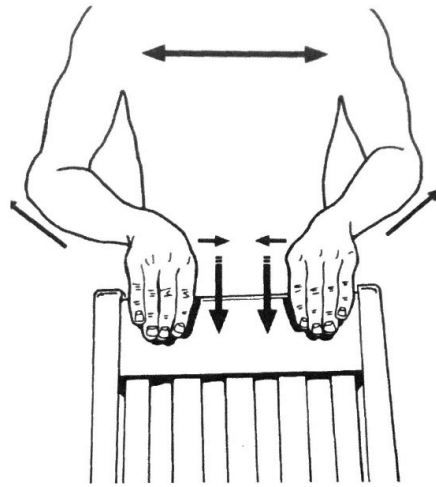
Dimon, 2015c, pp. 18, 35

Full directions for the following three explorations are found in Appendix N.

Exploration #7: Simple vocal task, changing frequency

This exploration turns again to the simple vocal task previously defined. If in doubt a single note is recommended. A gentle pull in the forearms engages degrees of antagonistic action throughout the whole torso (Dimon, 2015c, p.18). The singer is advised to release wide across the shoulders during this moderate pull to avoid excessive engagement of the biceps and pectorals. Notice the alignment of both the HN&B and the hands and wrists (Fig. 12). If tugged too hard the hands and wrists will lose their initial orientation and change the quality of antagonistic action in the torso (Dimon, 2015c, p. 26). Stop or re-engage if you begin to end-gain or become fatigued. The student may notice that greater antagonistic action is helpful at higher frequencies depending on the task. Be mindful to change the pitch independent of the volume.

Fig. 12 Hands and Wrists (HotBoaC)



(Dimon, 2015c, p. 26)

Exploration #8: Simple vocal task, changing amplitude

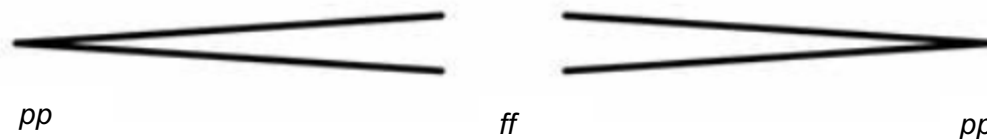
Building on the previous exploration using a simple vocal task, begin to play with volume changes. The student may notice that higher amplitudes demand greater antagonistic action accessed through the forearm pull. Be mindful to change the volume independent of the pitch, and continue to monitor alignment.

Exploration #9: Messa di voce

Messa di voce (MdV) is a traditional single pitch classical vocal exercise exploring the complete range of dynamics (Fig. 13). Lamperti (1905) believed that the MdV should be attempted only by advanced singers (p. 21). Many pedagogues believe that MdV is not for beginners, although Stark (1999) notes that some voice teachers pre-dating Lamperti thought that MdV was one of the first exercises that must be mastered (p. 99). The HotBoaC procedure can be used to bring awareness to the regulation of antagonistic action based on the specific pitch, volume and vowel combination. Ideally, both dynamic phases should be equal in length and the execution should last 8-10 seconds in total. However, the duration should not be forced as attention to the process

is critical. Along with dynamic range and pitch, this exercise explores the effort required at the end of the respiratory cycle (Hixon, 2006, p. 86). Enhanced effort is engaged through a gentle pull in the forearms as previously described.

Fig 13: Messa di voce



(Choice of a single vowel and pitch): 8-10 seconds duration

IMPACT ON LEARNING

This study yielded practical guidelines for studio teaching as well as the design of AT/voice integration explorations. PML theories relevant to learning, practice, feedback and performance applied to university voice lessons were summarised in part one. Those principles contributed to the second assessment exploring the link between AT and PML including unlearning injurious habits, conscious control of actions, and flexible attention. Throughout this study the supremacy of automaticity was challenged, and strategies to interrupt undesirable habits were discovered including:

- Slowing down actions to separate them into their component parts and bring them into awareness.
- Contrast drills between less and more desirable sounds.
- Introducing new tasks for interference.

In addition, commonalities between contemporary expertise theories (Montero, 2016; Ericsson, 2020) and AT were explored. Simply stated, both adopt a similar flexible attentional focus viewpoint in order to monitor performance or environmental conditions,

avoid injury or re-educate inefficient actions. This is a promising area for future investigation.

APPLICATION TO PRACTICE

Beyond the studio teaching applications previously mentioned, the most concrete contribution to my practice are the explorations I designed using PML theory and AT procedures as a guide. This initially hierarchical process becomes iterative as familiarity with the procedures grows and student coordination improves. These exercises investigate principal areas of pedagogical concern for my practice including posture, respiration, articulation, phonation and breath management. This independent study yielded the following exercises:

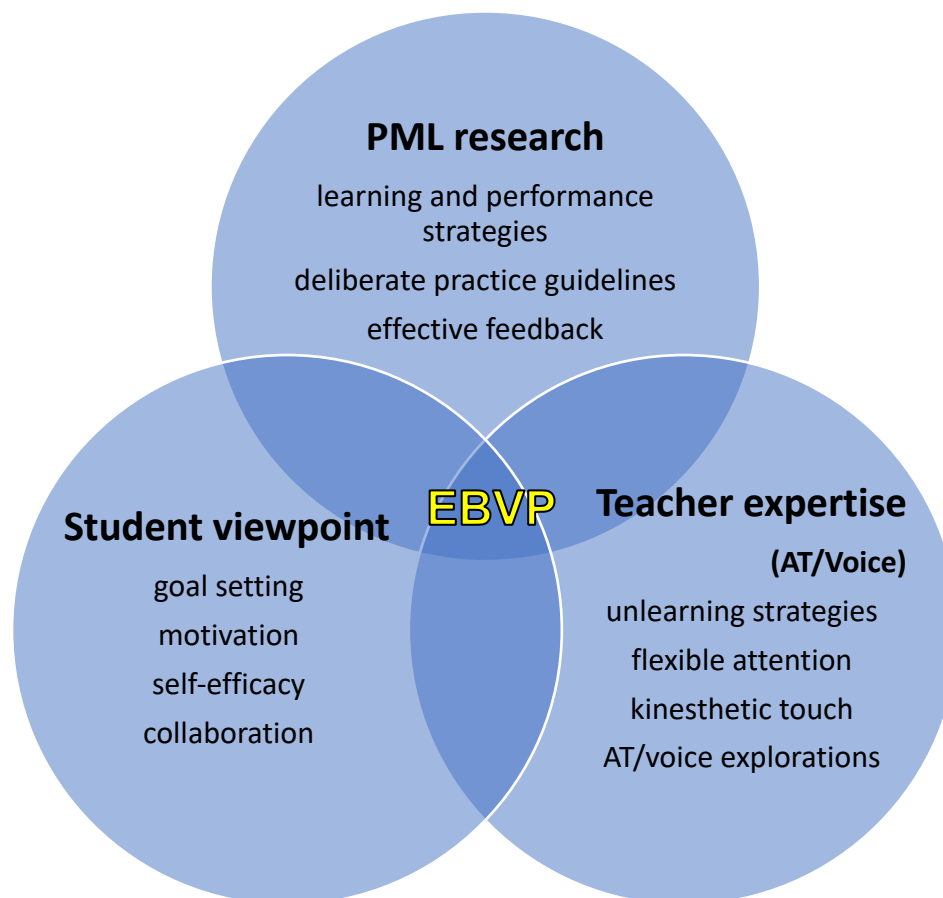
1. Autonomic breathing (natural respiration pattern).
2. Kinesthetic memory (awareness of chronic tensions related to specific music).
3. Simple vocal task (postural integration and alignment during phonation).
4. Whispered /a/ (assessing head balance and vocal tensions).
5. Unvoiced SOVT /f/ /s/ and /ʃ/ (investigating articulation).
6. Voiced SOVT /v/ /z/ and /ʒ/ (investigating phonation).
7. Isolating pitch from volume (breath management adjustments during frequency).
8. Isolating volume from pitch (breath management adjustments during amplitude).
9. Messa di voce (integrating flexible support).

CONCLUSION

The context for this independent study centred around the emerging EBVP teaching framework in voice pedagogy (Fig. 14). This investigation into PML theory immediately provided a rich foundation for both the research and student perspective elements in the paradigm. The third element, my expertise and experience as an AT/voice teacher, was nurtured during this process through the expansion and development of effective

teaching strategies and practical exercises. These exercises are immediately applicable to my AT/voice bipartite practice and can be delivered both online and in person.

Fig. 14: EBVP Outcomes from PML Independent Study



Finally, this investigation provided a greater understanding of the correlations between AT and PML theory. This link represents a gap in the literature, presenting future research and publishing opportunities. Overall, this independent study afforded a stronger theoretical basis for the development of both individual and group instruction bolstered by practical training explorations.

REFERENCES

- Abuhamdeh, S. and Mihaly Csikszentmihalyi, M. (2012) 'Attentional Involvement and Intrinsic Motivation' *Motivation and Emotion*, 36(3), pp. 257–267.
- Ackerman, P.L. (2007) 'New Developments in Understanding Skilled Performance' *Current Directions in Psychological Science*, 16(5), pp. 235–239.
- Alexander, F.M. (1923) *Constructive Conscious Control of the Individual*. New York: E.P. Dalton and Company. Available at: <https://archive.org/details/in.ernet.dli.2015.506893> (Accessed: 15th April, 2021).
- Alexander, F.M. (1941) *The Universal Constant in Living*. New York: E.P. Dutton & Co., Inc. Available at: <https://archive.org/details/in.ernet.dli.2015.166036/page/n7/mode/2up> (Accessed: 15th April, 2021).
- Alexander, F.M. (1946) *Man's Supreme Inheritance*. Revised edn. London: Methuen & Co, Ltd. Available at: <https://archive.org/details/manssupremeinher01alex/page/n7/mode/2up> (Accessed: 15th April, 2021).
- Alexander, F.M. (2001) *The Use of the Self*. Reissue. London: Orion Books Ltd.
- Alexander, F.M. (2015) *Articles and Lectures*. 2nd edn. Fischer, J.M.O. (ed.) London: Mouritz.
- Altenmüller, E. (2008) 'Neurology of Musical Performance' *Clinical Medicine*, 8(4), pp. 410–413.
- Baddeley, A.D. (1999) *Essentials of Human Memory*, Hove, England: Psychology Press.

Baddeley, A., Hitch, G. and Allen, R. (2020) 'A Multicomponent Model of Working Memory', in Logie, R., Camos, V. and Cowan, N. (eds.) *Working Memory: The State of the Science*, Oxford: Oxford University Press.

Beard, K.A. and Csikszentmihalyi, M. (2015) 'Theoretically Speaking: An Interview with Mihaly Csikszentmihalyi on Flow Theory Development and Its Usefulness in Addressing Contemporary Challenges in Education' *Educational Psychology Review*, 27(2), pp. 353–364.

Beilock, S.L. et al. (2002) 'When Paying Attention Becomes Counterproductive' *Journal of Experimental Psychology: Applied*, 8(1), pp. 6–16.

Beilock, S.L. and Carr, T.H. (2001) 'On the Fragility of Skilled Performance' *Journal of Experimental Psychology. General*, 130(4), pp. 701–725.

Bergamin, J.A. (2017) 'Being-in-the-flow: Expert Coping as Beyond Both Thought and Automaticity' *Phenomenology and the Cognitive Sciences*, 16(3), pp. 403–424.

Bergan, C. (2010) 'Motor Learning Principles and Voice Pedagogy: Theory and Practice. *Journal of Singing*, 66(4), pp. 457–468.

Bjork, R. (1998) 'Assessing Our Own Competence: Heuristics and Illusions', in Gopher, D. and Koriath, A. (eds.) *Attention and Performance XVII*. Cambridge, MA: MIT Press, Available at:
https://www.researchgate.net/publication/232585318_Assessing_our_own_competence_Heuristics_and_illusions (Accessed: 27th September, 2019).

Bjork, R.A. and Bjork, E.L. (2020) 'Desirable Difficulties in Theory and Practice' *Journal of Applied Research in Memory and Cognition*, 9(4), pp. 475–479.

Blades, E.L. (2017) *A Spectrum of Voices: Prominent American Voice Teachers Discuss the Teaching of Singing*. 2nd edn. Lanham, MD: The Scarecrow Press, Inc.

Bozeman, K. (2021) *Kinesthetic Voice Pedagogy*, Gahanna, OH: Inside View Press.

- Brewer, J.A. (2021) 'A Simple Way to Break a Bad Habit: A Step-by-Step Guide' *drjud.com*. Available at: <https://drjud.com/mapmyhabit/> (Accessed: 4th May, 2021).
- Brown, O.L. (1996) *Discover Your Voice: How to Develop Healthy Voice Habits*. San Diego, CA: Singular Publishing Group, Inc.
- Carrington, W. (1994) *Thinking Aloud: Talks on Teaching the Alexander Technique*. Sontag, J. (ed.) Berkley, CA: Mornum Time Press.
- Carrington, W. and Carey, S. (2001) *Personally Speaking: Walter Carrington on the F. M. Alexander Technique in discussion with Sean Carey*. Mouritz.
- Carson, H.J. and Collins, D. (2011) 'Refining and Regaining Skills in Fixation/Diversification Stage Performers: The Five-A Model' *International Review of Sport and Exercise Psychology* 4(2), pp. 146-167 DOI: 10.1080/1750984X.2011.613682.
- Carson, H.J. and Collins, D. (2016) 'Implementing the Five-A Model of Technical Refinement: Key Roles of the Sport Psychologist' *Journal of Applied Sport Psychology*, 28(4), pp. 392–410.
- Chanda, M.L. and Levitin, D.J. (2013) 'The Neurochemistry of Music' *Trends in Cognitive Sciences*, 17(4), pp. 179–193.
- Chiviacowsky, S. and Wulf, G. (2007) 'Feedback After Good Trials Enhances Learning' *Research Quarterly for Exercise & Sport*, 78(2), pp. 40–48.
- Christensen, W., Sutton, J. and Bicknell, K. (2019) 'Memory systems and the control of skilled action; *Philosophical Psychology*, 32(5), pp. 692–718.
- Christensen, W., Sutton, J. and Mcllwain, D.J.F. (2016) 'Cognition in Skilled Action: Meshed Control and the Varieties of Skill Experience' *Mind & Language*, 31(1), pp. 37–66.

Clemmons, J. (2006) 'The Private Studio: Rapport and Motivation in the Applied Studio' *Journal of Singing*, 63(2), pp. 205–210.

Cremades, J.G., Hilliard, R.M. and Gapin, J.I. (2010) 'The Effects of Physical Practice on a Novel Mental Imagery Task as Measured by Electroencephalography (EEG)' *Journal of Imagery Research in Sport & Physical Activity*, 5(1), pp. 1–22.

Crocco, L., Madill, C.J. and McCabe, P. (2017) 'Evidence-Based Frameworks for Teaching and Learning in Classical Singing Training: a Systematic Review' *Journal of Voice*, 31, pp. 130.e7- 130.17. <https://doi.org/10.1016/j.jvoice.2015.12.001>.

Crocco, L., McCabe, P. and Madill, C. (2020) 'Principles of Motor Learning in Classical Singing Teaching' *Journal of Voice*, 34(4), pp. 567–581.

Crocco, L. and Meyer, D. (2021) 'Motor Learning and Teaching Singing: An Overview' *Journal of Singing*, 77(5), pp. 693–702.

Crossley, M.J., Ashby, F.G. and Maddox, W.T. (2013) 'Erasing the Engram: The Unlearning of Procedural Skills' *Journal of Experimental Psychology, General*, 142(3), pp. 710–736.

Csikszentmihalyi, M. (1998) 'Chapter 3: Creativity and Genius: A Systems Perspective', In Steptoe, A. (ed.) *Genius and the Mind*. Oxford University Press. DOI: 10.1093/acprof:oso/9780198523734.001.0001.

Csikszentmihalyi, M. (2021) 'Mihaly Csikszentmihalyi' *Wikipedia*. Available at: https://en.wikipedia.org/wiki/Mihaly_Csikszentmihalyi (Accessed 25th May, 2021).

Csikszentmihalyi, M., Abuhamdeh, S. and Nakamura, J. (2005) 'FLOW', in Elliot, A.J. and Dweck, C.S. (Eds.), *Handbook of Competence and Motivation*. Guilford Publications.

Damasio, A.R. (1994) *Descartes' Error: Emotion, Reason, and the Human Brain*. New York: G.P. Putnam's Sons.

Damasio, A.R. (1999) *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*. Harcourt Brace & Company.

Damasio, A. (2001) 'Fundamental Feelings' *Nature*, 413(6858), p. 781.

Davies, T.A. and Barlow, M. (2002) *An Examined Life: Marjorie Barlow and the Alexander Technique*. Berkeley, CA: Mornum Time Press.

De Alcantara, P. (2002) 'An Alexander Teacher Reads *The Free Voice*, His Mouth Agape', in Bybee, A. and Ford, J.E. (eds) *The Modern Singing Master*. Lanham, MD: Scarecrow Press, Inc.

De Alcantara, P. (2013) *Indirect Procedures*. 2nd edn. Oxford: Oxford University Press.

Dimon, T. and Brown, G. D. (2011) *Your Body, Your Voice*. Berkeley, CA: North Atlantic Books.

Dimon, T. (2015a) *Neurodynamics: The Art of Mindfulness in Action*. Berkeley: North Atlantic Books.

Dimon, T. (2015b) *Breathing and the Voice: A Practical Guide to the Whispered "ah"*. Revised edn. Day Street Press.

Dimon, T. (2015c) *The Use of Hands in Teaching*. Day Street Press.

Doidge, N. (2015) 'Hypnosis, Neuroplasticity, and the Plastic Paradox' *The American Journal of Clinical Hypnosis*, 57(3), pp. 349–354.

Drake, J. (1991) *Body Know-How: A Practical Guide to the Use of the Alexander Technique in Everyday Life*. London: Thorsons.

Dreyfus, S.E. and Dreyfus, H.L. (1980) 'A Five-Stage Model of the Mental Activities involved in Directed Skill Acquisition' *Operations Research Center*, University of

California, Berkley: Air Force Office of Scientific Research, pp. 1-18. Available at: <https://apps.dtic.mil/dtic/tr/fulltext/u2/a084551.pdf> (Accessed 28th April, 2021).

Duke, R.A. Cash, C.D. and Allen, S.E. (2011) 'Focus of Attention Affects Performance of Motor Skills in Music' *Journal of Research in Music Education*, 59(1), pp. 44–56.

Eder, A.B. and Dignath, D. (2017) 'Influence of Verbal Instructions on Effect-Based Action Control' *Psychological Research*, 81(2), pp. 355–366.

Engelhart, R.J. (1989) An Electromyographic Study of Preparatory Set in Singing as Influenced by the Alexander Technique. PhD Ohio State University Dissertation.

Ericsson, K.A. (2006) 'The Influence of Experience and Deliberate Practice on the Development of Superior Expert Performance', in Ericsson et al. (eds.) *The Cambridge Handbook of Expertise and Expert Performance*. New York: Cambridge University Press.

Ericsson, K.A. (2020) 'Towards a Science of the Acquisition of Expert Performance in Sports: Clarifying the Differences Between Deliberate Practice and Other Types of Practice' *Journal of Sports Sciences*, 38(2), pp. 1-32.

Ericsson, K.A., Krampe, R.T. and Tesh-Römer, C. (1993) 'The Role of Deliberate Practice in the Acquisition of Expert Performance' *Psychological Review*, 100(3), pp. 363-406.

Feltovich, P.J., Preitula, M.J. and Ericsson, K.A. (2006) 'Studies of Expertise from Psychological Perspectives', in Ericsson, K.A. et al. (eds.) *The Cambridge Handbook of Expertise and Expert Performance*. New York: Cambridge University Press.

Fiorella, L. (2020) 'The Science of Habit and Its Implications for Student Learning and Well-Being' *Educational Psychology Review*, 32(3), pp. 603–625.

Fitts, P.M. and Posner, M.I. (1967) *Human Performance*. Belmont, CA: Wadsworth Publish Company Inc.

Frey-Monell, R. (2010) 'Motivation in the Applied Voice Studio: An Overview' *Journal of Singing*, 67(2), pp. 147–153.

Frey-Monell, R. (2013) 'Developing the Art of Learning: The Applied Vocal Self-Assessment Tool' *Journal of Singing*, 70(2), pp. 221–227.

Gaunt, H. et al. (2012) 'Supporting Conservatoire Students towards Professional Integration: One-to-One Tuition and the Potential of Mentoring' *Music Education Research*, 14(1), pp. 25–43.

Geeves, A. et al. (2014) 'To Think or Not to Think: The Apparent Paradox of Expert Skill in Music Performance' *Educational Philosophy and Theory*, 46(6), pp. 674–691.

Gentile, A. M. (1972) 'A Working Model of Skill Acquisition with Application to Teaching' *Quest* (00336297), 17(1), pp. 3–24.

Ginsborg, J., Chaffin, R. and Nicholson, G. (2006) 'Shared Performance Cues in Singing and Conducting: A Content Analysis of Talk During Practice' *Psychology of Music*, 34, pp. 167-194.

Guadagnoli, M. and Lee, T. (2004) 'Challenge Point: A Framework for Conceptualizing the Effects of Various Practice Conditions in Motor Learning' *Journal of Motor Behavior*, 36(2), pp. 212–24.

Heirich, J.R. (2011) *Voice and the Alexander Technique: Active Explorations for Speaking and Singing*. 2nd edn. Morum Time Press.

Helding, L. (2008) 'Voice Science and Vocal Art, Part Two: Motor Learning Theory' *Journal of Singing*, 64(4), pp. 417–429.

Helding, L. (2014) 'Teaching Voice with the Brain in Mind' *Journal of Singing*, 70(3), pp. 349–355.

Helding, L. (2016) 'Mindful Voice: Motor Learning and Voice Training, Part II. Locus of Attention: Internal or External? That is the Question' *Journal of Singing*, 72(5), pp. 621-627.

Helding, L. (2019) 'Brain' in McCoy, S. (ed.) *Your Voice and Inside View*. 3rd edn. Gahanna, OH: Inside View Press.

Helding, L. (2020) *The Musician's Mind: Teaching, Learning, and Performance in the Age of Brain Science*. Lanham, MD: The Rowman & Littlefield Publishing Group, Inc.

Helding, L. and Maxfield, L. (2019a) 'How Cognitive Science Informs Voice Teaching' *NATS Chat* [Webinar]. Available at: <https://www.youtube.com/watch?v=betY2pPv54c> (Accessed: 10th September, 2019).

Helding, L. and Maxfield, L. (2019b) 'Motor Learning Part II: Focus? Locus? Hocus-pocus' *NATS Chat* [Webinar]. Available at: <https://www.youtube.com/watch?v=BljKrcUS77A> (Accessed: 13th November, 2019).

Helding, L., Maxfield, L. and Bozman, K. (2020) 'Defining Evidence-Based Voice Pedagogy EBVP A New Framework' *NATS Chat* [Webinar]. Available at: <https://www.youtube.com/watch?v=fruzgBq8aP4> (Accessed: 14th December, 2021).

Hixon, T.J. (2006) *Respiratory Function in Singing: A Primer for Singers and Singing Teachers*. Plural Publishing Inc.

Howard-Jones, P. et al. (2011) 'Toward a Science of Learning Games' *Mind, Brain, and Education*, 5(1), pp. 33–41.

Indik, L. (2006) 'Memory and the Skill of Singing' *Journal of Singing*, 62(3), pp. 251–258.

Jacobs, E. et al. (2018) 'Unravelling Motor Learning Processes in Theater Performers' *Motor Control*, 22(2), pp. 134–149.

Jensen, K. (2016) 'The Significance and Pedagogic Applications of the Vocal Breakthrough. Part Two: The Role of Attention' *Journal of Singing*, 72(3), pp. 355–362.

Johansson, B.B. (2002) 'Music, Age, Performance, and Excellence: A Neuroscientific Approach' *Psychomusicology: A Journal of Research in Music Cognition*, 18(1-2), pp. 46–59.

Jones, F.P. (1976) *Body Awareness in Action: A Study of the Alexander Technique*. New York, NY: Schocken Books Inc.

Juslin, P.N. and Sloboda, J.A. (2010) 'Chapter 33: The Past, Present, and Future of Music and Emotion Research', in Juslin, P.N. (ed.) *Handbook of Music and Emotion: Theory, Research, Applications*. Oxford University Press.

Kalyuga, S., Rikers, R. and Paas, F. (2012) 'Educational Implications of Expertise Reversal Effects in Learning and Performance of Complex Cognitive and Sensorimotor Skills' *Educational Psychology Review*, 24(2), pp. 313–337.

Kandel, E.R. (2006) *In Search of Memory*. New York, London: W.W. Norton & Company Ltd.

Keetch, K.M. and Lee, T.D. (2007) 'The Effect of Self-Regulated and Experimenter-Imposed Practice Schedules on Motor Learning for Tasks of Varying Difficulty' *Research Quarterly for Exercise and Sport*, 78(5), pp. 476–486.

Klein, E. and Brewer, J. (2021) 'That Anxiety You're Feeling? It's a Habit You Can Unlearn' *The Ezra Klein Show [podcast]*. 20 April. Available at: <https://www.nytimes.com/2021/04/20/opinion/ezra-klein-podcast-judson-brewer.html?showTranscript=1> (Accessed: 27th April, 2021).

Kleinman, J. and Buckoke, P. (2013) *The Alexander Technique for Musicians*. Bloomsbury Methuen Drama.

Kostrubiec, V. et al. (2012) 'Beyond the Blank Slate: Routes to Learning New Coordination Patterns Depend on the Intrinsic Dynamics of the Learner—Experimental Evidence and Theoretical Model' *Frontiers in Human Neuroscience*, 6(222), pp. 1-14.

Ladda, A.M., Lebon, F. and Lotze, M. (2021) 'Using Motor Imagery Practice for Improving Motor Performance – A Review' *Brain and Cognition*, 150, p. 105705.

Lamperti, G.B. (1905) *The Technics of Bel Canto*. New York: G. Schirmer. Available at: <https://archive.org/details/technicsofbelcan00lamp/page/n5/mode/2up> (Accessed: 14th April, 2021).

Ledoux, J. (2003) *Synaptic Self: How Our Brains Become Who We Are*. New York: Penguin.

Lee, T.D. et al. (2016) 'On the Role of Error in Motor Learning' *Journal of Motor Behavior*, 48(2), pp. 99–116.

Lee, T.D., White, M.A. and Carnahan, H. (1990) 'On the Role of Knowledge of Results in Motor Learning: Exploring the Guidance Hypothesis,' *Journal of Motor Behavior* 22, pp. 191-208.

Lehmann, A.C. and Gruber, H. (2006) 'Music', in Ericsson, K.A. et al. (eds.) *The Cambridge Handbook of Expertise and Expert Performance*. New York: Cambridge University Press.

Leibowitz, J. and Connington, B. (1990) *The Alexander Technique*. New York: Harper & Row, Publishers.

Lester-Smith, R.A. (2020) 'The Relation of Articulatory and Vocal Auditory--Motor Control in Typical Speakers' *Journal of Speech, Language & Hearing Research*, 63(11), pp. 3628-3643.

Lewthwaite, R. and Wulf, G. (2010) 'Social-Comparative Feedback Affects Motor Skill Learning' *Quarterly Journal of Experimental Psychology*, 63(4), pp. 738–749.

Lotze, M. (2013) 'Kinesthetic Imagery of Musical Performance' *Frontiers in Human Neuroscience*, 7(280), pp. 1-9.

Maas, E. et al. (2008) 'Principles of Motor Learning in Treatment of Motor Speech Disorders' *American Journal of Speech-Language Pathology*, 17(3), pp. 277–298.

MacDonnell, M. (2000) *Alexander Technique: For Health and Well-Being*. Southwater Publishing.

Maxfield, L.M. (2011) *Application of Principles from Motor-Learning Theory to the Studio Voice Lesson: Effects of Feedback Frequency on Retention of Classical Singing Technique*. Unpublished PhD thesis. University of Iowa.

Maxfield, L. (2013) 'Improve your Students' Learning by Improving Your Feedback' *Journal of Singing*, 69(4), pp. 471–478.

Maxfield, L. (2018) 'Mindful Voice: How to Do More than Just Practice Slowly' *Journal of Singing*, 75(10), pp. 69-75.

Maxfield, L. (2019) 'Mindful Voice: Incorporating Motivation into Your Model of Motor Learning' *Journal of Singing*, 75(5), pp. 583-587.

Maxfield, L. and Ragan, K. (2021) 'Evidence-Based Voice Pedagogy (EBVP), Part 1: Voice Research Component' *Journal of Singing*, 77(4), pp. 543–547.

McAllister-Viel, T. (2021) '(Re)considering the Role of Touch in “Re-educating” Actors' Body/Voice', in Kapadocha, C. (ed.) *Somatic Voices in Performance Research and Beyond*. Routledge.

McCarther, S. (2018a) 'Getting in the Zone, Part 1: Flow and Finding a State of Peak Performance' *Journal of Singing*, 74(3), pp. 329–335.

McCarther, S. (2018b) 'Getting in the Zone, Part 2: Attention and Setting Goals' *Journal of Singing*, 74(4), pp. 443–448.

Miyake, A. et al. (2004) 'Inner Speech as a Retrieval Aid for Task Goals: The Effects of Cue Type and Articulatory Suppression in the Random Task Cuing Paradigm' *Acta Psychologica*, 115(2-3), pp. 123–142.

Monjo, F. Terrier, R. and Forestier, N. (2015) 'Muscle Fatigue as an Investigative Tool in Motor Control: A Review with New Insights on Internal Models and Posture-Movement Coordination' *Human Movement Science*, 44, pp. 225–234.

Montero, B.G. (2016) *Thought in Action : Expertise and the Conscious Mind*. 1st edn. Oxford: Oxford University Press.

Moran, A. et al. (2012) 'Re-imagining Motor Imagery: Building Bridges between Cognitive Neuroscience and Sport Psychology' *British Journal of Psychology*, 103(2), pp. 224–248.

Mornell, A. and Wulf, G. (2019) 'Adopting an External Focus of Attention Enhances Musical Performance' *Journal of Research in Music Education*, 66(4), pp. 375–391.

Moss Erickson, H. (2021) 'Mobile Apps and Biofeedback in Voice Pedagogy' *Journal of Singing*, 77(4), pp. 485-500.

Murdock, R. (2015) *Born to Sing*. Berkeley, CA: Mornum Time Press.

Nafisi, J.S.A. (2013) 'Gesture and Body-Movement as Teaching and Learning Tools in the Classical Voice Lesson: A Survey into Current Practice' *British Journal of Music Education*, 30(3), pp. 347–367.

Nix, J. (2017) 'Best Practices: Using Exercise Physiology and Motor Learning Principles in the Teaching Studio and the Practice Room' *Journal of Singing*, 74(2), pp. 215–220.

Ohrenstein, D. (2003) 'Insights into Training Aural and Kinesthetic Awareness' *Journal of Singing*, 60(1), pp. 29–35.

Palmer, C. (2006) 'The Nature of Memory for Music Performance Skills', in Altenmüller, E., Wiesendanger, M. and Kesselring, J. (eds.) *Music, Motor Control and the Brain*. Oxford University Press.

Pascua, L.A.M, Wulf, G. and Lewthwaite, R. (2015) 'Additive Benefits of External Focus and Enhanced Performance Expectancy for Motor Learning' *Journal of Sports Sciences*, 33(1), pp. 58–66.

Proske, U. and Gandevia, S.C. (2012) 'The Proprioceptive Senses: Their Roles in Signaling Body Shape, Body Position and Movement, and Muscle Force' *Physiological Reviews*, 92(4), pp. 1651–16597.

Pruitt, T.A., Halpern, A.R. and Pfordresher, P.Q. (2019) 'Covert Singing in Anticipatory Auditory Imagery' *Psychophysiology*, 56(e13297), pp. 1-12.

Racette, A. and Peretz, I. (2007) 'Learning Lyrics: To Sing or Not to Sing?' *Memory & Cognition*, 35(2), pp. 242–253.

Ragan, K. (2018) 'Defining Evidence-Based Voice Pedagogy: A New Framework' *Journal of Singing*, 75(2), pp. 157-160.

Rainero, R. (2012) 'Practicing Vocal Music Efficiently and Effectively: Applying "Deliberate Practice" to a New Piece of Music' *Journal of Singing*, 69(2), pp. 203–215.

Ralston, J. (1999) 'The Development of an Instrument to Grade the Difficulty of Vocal Solo Repertoire' *Journal of Research in Music Education*, 47(2), pp. 163–173.

Richards, B.A. and Frankland, P.W. (2017) 'The Persistence and Transience of Memory' *Neuron*, 94(6), pp. 1071–1084.

Salmoni, A.W., Schmidt, R.A. and Walter, C.B. (1984) 'Knowledge of Results and Motor Learning: A Review and Critical Reappraisal' *Psychological Bulletin*, 95(3), pp. 355-386.

- Schmidt, R.A., and Lee, T.D. (2005) *Motor Control and Learning: A Behavioral Emphasis*. 4th edn. Champaign, IL: Human Kinetics.
- Seidler, R.D, Noll, D.C and Thiers, G. (2004) 'Feedforward and Feedback Processes in Motor Control' *NeuroImage*, 22(4), pp.1775–1783.
- Shadmehr, R. and Holcomb, H.H. (1997) 'Neural Correlates of Motor Memory Consolidation' *Science*, 277(5327), pp. 821–826.
- Shelton, L. (2019) 'The Art and the Skills of Learning (New) Music: Lucy Shelton's Practice Guide' *The Journal of Singing* 75(4), pp. 477-487.
- Shusterman, R. (2011) 'Soma, Self and Society: Somaesthetics as Pragmatist Meliorism' *Metaphilosophy*, 42(3), pp. 314–328.
- Singh, H. and Wulf, G. (2020) 'The Distance Effect and Level of Expertise: Is the Optimal External Focus Different for Low-Skilled and High-Skilled Performers?' *Human Movement Science*, 73, p.102663.
- Sloboda, J.A. (2000) 'Individual Differences in Music Performance' *Trends in Cognitive Sciences*, 4(10), pp. 397–403.
- Snyder, H. (2019) 'Literature Review as a Research Methodology: An Overview and Guidelines' *Journal of Business Research*, 104, pp. 333–339.
- Stamer, R.A. (1999) 'Motivation in the Choral Rehearsal' *Music Educators Journal*, 85(5), pp. 26–30.
- Stark, J. (1999) *Bel Canto*. Toronto: University of Toronto Press.
- Steinhauer, K. and Preston Grayhack, J. (2000) 'The Role of Knowledge of Results in Performance and Learning of a Voice Motor Task,' *Journal of Voice* 14(2), pp. 137–145.

Sugiyama, T. and, Liew, S.L. (2017) 'The Effects of Sensory Manipulations on Motor Behavior: From Basic Science to Clinical Rehabilitation' *Journal of Motor Behavior*, 49(1), pp. 67–78.

Sundberg, J. (1987) *The Science of the Singing Voice*. DeKalb, IL: The Northern Illinois University Press.

Sutton, J. et al. (2011) 'Applying Intelligence to the Reflexes: Embodied Skills and Habits between Dreyfus and Descartes' *Journal of the British Society for Phenomenology*, 42(1), pp. 78–103.

Tillotson Bauer, K. (2013) *The Essentials of Beautiful Singing: A Three-Step Kinesthetic Approach*. Lanham, MD: Scarecrow Press, Inc.

Titze, I. (2018) 'Major Benefits of Semi-Occluded Vocal Tract Exercises' *Journal of Singing*, 74(3), pp. 311–312.

Titze, I. and Verdolini Abbott, K. (2012) *Vocology: The Science and Practice of Voice Habilitation*. Salt Lake City, UT: National Center for Voice and Speech.

Titze, I. and Verdolini Abbott, K. (2021) 'Legends in our Field: Ingo Titze and Kittie Verdolini Abbott' *NATS Chat* [Webinar]. 13 April. Available at: <https://www.youtube.com/watch?v=gqDX0tvBh-4> (Accessed: 13th April, 2021).

Toner, J. (2017) 'Habitual Reflexivity and Skilled Action' *Body & Society*, 23(4), pp. 3–26. doi:10.1177/1357034x17736371.

Toner, J., Montero, B.G. and Moran, A. (2014) 'Considering the Role of Cognitive Control in Expert Performance' *Phenomenology and the Cognitive Sciences*, 14(4), pp. 1127–1144.

Toner, J. and Moran, A. (2015) 'Enhancing Performance Proficiency at the Expert Level: Considering the Role of "Somaesthetic Awareness"' *Psychology of Sport & Exercise*, 16, pp. 110–118.

Torraco, R.J. (2005) 'Writing Integrative Literature Reviews: Guidelines and Examples' *Human Resource Development Review*, 4, pp. 356-367.

University of Edinburgh Reflection Toolkit (2019) 'Gibbs' Reflective Cycle' Available at: <https://www.ed.ac.uk/reflection/reflectors-toolkit/reflecting-on-experience/gibbs-reflective-cycle> (Accessed: 11th May, 2021).

University of Nevada, Las Vegas (2021) *Gabriele Wulf Publications* Available at: <http://gwulf.faculty.unlv.edu/publications-2/> (Accessed: 12th June, 2021).

Van Duijvenvoorde, A.C.K. et al. (2008) 'Evaluating the Negative or Valuing the Positive? Neural Mechanisms Supporting Feedback-Based Learning Across Development' *Journal of Neuroscience*, 28(38), pp. 9495-9503.

Verdolini, K. (2000) 'Principles of Skill Acquisition Applied to Voice Training', in Acker, B. and Hampton, M.E. (eds.) *The Vocal Vision: Views on Voice by 24 Leading Teachers, Coaches and Directors*, Applause Books.

Verdolini, K. (2002) 'On the Voice: Learning Science Applied to Voice Training: The Value of Being "In the Moment"' *The Choral Journal*, 42(7), pp. 47-51.

Vidoni, E.D. et al. (2010) 'Role of the Primary Somatosensory Cortex in Motor Learning: An rTMS Study' *Neurobiology of Learning and Memory*, 93(4), pp. 532–539.

Walden, P. (2014) 'Practice & Feedback Schedules: Lessons from Established Principles of Motor Learning' *Voiceprints*, 12, pp. 5–6.

Webb, W.G. and Adler, R.K. (2008) *Neurology for the Speech-Language Pathologist*. 5th edn. St. Louis, MO: Mosby Elsevier.

Weiss, M. (2009) *The Alexander Technique and the Art of Teaching Voice: Singing and Speaking with an Energetic, Free and Beautiful Voice*. VDM Verlag.

Weiss, M.W., Trehub, S.E. and Schellenberg, E.G. (2012) 'Something in the Way She Sings: Enhanced Memory for Vocal Melodies' *Psychological Science*, 23(10), pp. 1074–1079.

Winstein, C.J., Pohl, P.S. and Lewthwaite, R. (1994) 'Effects of Physical Guidance and Knowledge of Results on Motor Learning: Support for the Guidance Hypothesis' *Research Quarterly for Exercise and Sport*, 65(4), pp. 316–323.

Winstein, C.J. and Schmidt, R.A. (1990) 'Reduced Frequency of Knowledge of Results Enhances Motor Skill Learning' *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 16(4), pp. 677-791.

Wolf, J. (2013) *The Art of Breathing*. Jessica Wolf Publisher.

Wragg, G. (2017) *Towards Vocal Freedom: Alexander Technique and the Use of the Singing Voice*. Williamson, M. ed. London: Mourtiz.

Wulf, G. (2013) 'Attentional Focus and Motor Learning: A Review of 15 Years' *International Review of Sport and Exercise Psychology*, 6(1), pp. 77-104.
<http://dx.doi.org/10.1080/1750984X.2012.723728>.

Wulf, G., McNevin, N. and Shea, C.H. (2001) 'The Automaticity of Complex Motor Skill Learning as a Function of Attentional Focus' *Quarterly Journal of Experimental Psychology*, 54(4), pp. 1143–1155.

APPENDICES

APPENDIX A: GLOSSARY

This glossary serves as a reference to this paper and an introduction to perceptual-motor learning theory and the Alexander Technique. Sources are noted.

Ability: Typically regarded as genetically determined or developed during growth and maturation abilities are therefore largely unmodifiable by practice. These traits represent the 'equipment' a person has at their disposal and may be used interchangeably with the word's capability and aptitude. The variety of abilities include, body configuration, emotional or personality characteristics as well as motor abilities including speed, and manual dexterity (Schmidt and Lee, 2005).

AIR Theory (Applying Intelligence to the Reflexes): This is a multi-dimensional framework that suggests experts have access to their reflexes through acquired adaptive patterns enabling dynamic potential movement sequences (Sutton et al., 2011).

Anxiety: Often viewed as the emotional and cognitive impact of arousal such as nervousness or tension. Usually measured at the behavioural or cognitive level (Schmidt and Lee, 2005).

Arousal: A multidimensional construct with a physiological basis. Levels are usually assessed through respiratory, cardiovascular, biochemical and neurophysiological levels (Schmidt and Lee, 2005).

Attention: is limited and selective. When a combined need for resources exceeds attentional capacity available, then tasks will interfere with each other and performance may be affected. Attention can be allocated either intentionally or incidentally to different inputs or tasks. Intentional selection occurs through the purposeful attention to one source of information. Involuntary attention usually results from an external stimulus.

- Focus: selective attention to appropriate stimuli
- Shift: appropriate flexibility in response to new information
- Sustain: ability to maintain alert state and attention to task (Schmidt and Lee, 2005).

Audition: Refers to the sense of hearing or sound received through feedback (Collins Dictionary). **NB:** *This is unlike the similarly named **audiation** which refers to the ability to hear or imagine music that is not present.*

Augmented Feedback: External information about the task that augments the inherent feedback. It may be presented in the form of verbal, visual, auditory or kinesthetic information provided to the subject during the acquisition stage of perceptual or motor learning task and may be presented as *knowledge of results* (KR) or *knowledge of performance* (KP) (Bergan, 2010, p. 461; Schmidt and Lee, 2005).

Augmented Intention: Trying too hard, which can interfere with automaticity by focusing internally and depress performance (Verdolini, 2002; Helding, 2008).

Autonomic Breath: This refers to a reflexive rebounding of the air into the respiratory system without effort or instruction to “take a breath”. This approach tends to avoid unnecessary tension on the inhalation and interference with the natural breath cycle (Wolf, 2013).

Autonomic Nervous System: This system is distributed throughout the central and parasympathetic nervous systems and cannot be consciously controlled. It innervates involuntary structures such as the heart and digestion. It affects singing **indirectly** through hormones, reflexes, and blood pressure (Webb and Adler, 2008).

Bandwidth Theory (Feedback): Refers to an adaptable KR feedback strategy that is provided only when a performance is outside the boundaries of correctness. The tolerance limit can be altered rewarding and correcting *relatively* good and bad performances. Research suggests that learning is facilitated by a larger bandwidth (Schmidt and Lee, 2005).

Biofeedback: Refers to feedback about kinetic measures of unconscious processes with the goal of learning to voluntarily control them (Schmidt and Lee, 2005).

Blocked Practice: In this format tasks are trained sequentially within a session. Each specific task is trained completely before practice on remaining tasks begins (Bergan, 2010).

Catastrophe Hypothesis: Performance is enhanced by physiological arousal and cognitive anxiety only to a certain point. If and when anxiety extends beyond this point there will be an abrupt catastrophic impact on performance (Schmidt and Lee, 2005).

Chunking: Perceptual or memory structures that bond more elementary units into larger organisations extending working or short-term memory (Feltovich, Pretula and Ericsson, 2006).

Cognition-in-action principle: Optimal or near optimal expert performance frequently involves some of the following conscious mental processes: self-reflective thinking, planning, predicting, deliberation, attention to or monitoring of their actions, conceptualizing their actions, controlling their movements, trying, effort, having a sense of the self, and acting for a reason. These mental processes do not necessarily or even generally interfere with expert performance and should not generally be avoided by experts (Montero, 2016).

Complex Motor Skill: Consist of discrete component movements that are tied together into a complete unit or temporally ordered sequence. Singing is considered a complex skill (Lawther cited in Ohrenstein, 2003).

Concurrent Feedback: Refers to information about a performance given to participants during the execution of an action. Also called constant or continuous feedback. (Schmidt and Lee, 2005).

Constructive Conscious Control: Refers to a conscious approach to developing a framework of how to make changes to everyday activities. The goal is to recognise

habit, and incorporate the primary control through inhibition and direction (Alexander, 1923).

Contextual Interference: An adaptable learning strategy referring to the interference during practice that may enhance learning. This includes altering either the order in which multiple items are practised or the similarity of tasks practised close together. Similar tasks cause higher interference than different tasks (Battig framework, 1979, cited in Schmidt and Lee, 2005).

Consciousness: The concept of limited consciousness is closely related to, but not identical with the concept of short-term memory (STM), holding and manipulating limited amounts of information. It is as if the system can grasp fleeting ideas which would otherwise slip into oblivion, hold them, relate them, and manipulate them for its own purposes (Baddeley, 1999).

Constrained Action Hypothesis: When attention is focused inward automaticity may be impeded, while an external focus allows the motor system to more naturally self-organise (Wulf, McNevin, and Shea, 2001).

Cuing: (Easterbrook's 1959 hypothesis) refers to cues taken in from an environment that support future performance. With optimal arousal levels a combination of attention to relevant cues and minimal inclusion of irrelevant cues occurs. This is also known as the inverted-U relation. Cuing for singers may refer to the use of inner verbal orders in the form of abbreviated phrases or words to represent more complicated functions. These cues shorten processing time during task execution (Schmidt and Lee, 2005).

Dechunking: Uncouples previously combined automated processes through conscious awareness and slowing down actions in order to adjust coordination. This likely results in suboptimal performance while changes are being made (Geeves et al. 2014).

Delayed feedback: Feedback given after an interval. May not be as beneficial for novice learners. Allows more advanced students time to process feedback on their own and correct errors (Schmidt and Lee, 2005).

Degrees of Freedom Problem: There are too many variables or *degrees of freedom* in each movement to be consciously controlled by the Central Nervous System (Schmidt and Lee, 2005).

Deliberate Practice: Activities that have been specially designed to improve the current level of performance. The effort required is not inherently enjoyable, but is motivated by performance improvement. Individuals should attempt to maximise the amount of time they spend on deliberate practice to reach expert performance. (Ericsson, Krampe and Tesch-Romer, 1993).

Desirable Difficulties: Describes practice conditions that cause the learner to fully engage in the task at hand and put substantial cognitive effort into the learning process. This increased cognitive engagement facilitates learning (Bjork, 1994).

Directions (AKA Orders): Alexander used a prescribed set of what he called orders. Neck free – head forward and up – back lengthening and widening. These directions have been described as, thinking without doing. To give directions, is to think in a particular way about a potential movement of the body. In early stages of implementation, it helps to direct thoughts to facilitate muscle release (Alexander, 1923).

Distributed Practice: Rehearsals are spaced with periods of rest. Shorter rehearsals scheduled more often are shown to be more effective than massed practice (Baddeley, 1999).

Emotion: A patterned collection of chemical and neural responses that is produced by the brain when it detects the presence of an emotional charged stimulus either an object or situation (Damasio, 2001).

Encode (Memory): The processing of component information fundamental to learning, and the ability to manipulate material in working memory (STM) and transfer into LTM (Schmidt and Lee, 2005).

End-gaining: Refers to a focus on a goal rather than the process by which you attain it (Alexander, 1941).

Errors: There are thought to be at least two distinct types of motor system errors, each use feedback differently. Program selection errors are due to an intentional decision about what to do. In rapid movements these errors are hard to fix as they require a new motor program to be selected, but alterations may be made during slower movements. Program execution errors refer to unexpected disruptions and may not require a new motor program selection if compensation for environmental factors can be made (Schmidt and Lee, 2005).

Errorful Learning: Refers to an acquisition phase in which individuals are allowed to make errors, because it is through the execution of these errors that the individual defines and refines the production and retention of the target behaviour (Bergan, 2010).

Errorless Learning: Refers to an acquisition phase that discourages any errors from being made, in order to strengthen the perceptual trace that ultimately leads to retention. This approach may benefit novice learners (Bergan, 2010).

Expert Skill Acquisition Constraints: Identifies 3 constraints to expert skill acquisition. Resource: Deliberate practice requires available time and energy for the individual as well as access to teachers, training material, and training facilities. Motivation: Engagement in deliberate practice is not inherently motivating. Performers consider it instrumental in achieving further improvements in performance. Effort: Deliberate practice is an effortful activity that can be sustained only for a limited time each day during extended periods without leading to exhaustion (Ericsson, Krampe and Tesch-Romer, 1993).

Explicit Learning (Declarative): A process that depends on the active use of attention to feed memory (Baddeley, 1999).

Explicit Memory: Fact recall. Also known as conscious or declarative memory. A critical feature of this system is the capability to transfer new, short-term memories into long-term ones (Vidoni and Boyd, 2007; Kandel, 2006).

External Locus of Attention: Involves eliciting a desired vocal response by asking the student to focus on the desired result of a movement, not the movement itself (Helding 2008).

Exteroceptors: Provides identifiable information through our senses about the character and movement of objects in the environment. Includes, proprioception, vision and audition (Schmidt and Lee, 2005).

Fading (Feedback): Refers to the process of eliminating feedback over time as the learner becomes more independent. Related to bandwidth (Schmidt and Lee, 2005).

Feedback Frequency: Can be modified to enhance either learning or performance tasks. Styles include concurrent, summary, fading, bandwidth, delayed, and self-regulated (Schmidt and Lee, 2005).

Feedforward Process: The motor system sends a signal ahead of the movement that prepares the system for the motor command as well as the receipt of sensory information (Schmidt and Lee, 2005).

Feelings: Psychological manifestations of emotions, and as such are not observable, but are inferred or self-reported. Feelings can enhance learning (Damasio, 2001).

Flow Theory: Csikszentmihalyi's model consists of nine elements including challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration on the task at hand, sense of control, loss of self-consciousness, transformation of time, and an autotelic experience (Beard and Csikszentmihalyi, 2015).

Guidance Hypothesis: Augmented feedback used to direct someone toward a preferred behaviour by preventing **errors**. It is predicted that the guiding properties are beneficial for learning when used to reduce error, but detrimental when relied upon.

Strategies can include verbal instruction, audio or visual modelling, biofeedback, or even manual manipulation (Bergan, 2010; Salmoni, Schmidt and Walter, 1984).

Hands on the back of a chair: This procedure is described in detail in *Constructive Conscious Control of the Individual*. Its purpose is to bring on antagonistic action. This dynamic procedure is useful for singers to integrate an active support. It can be used sitting, or while standing in a monkey position (Alexander, 1923).

Implicit Learning (Procedural): This learning is demonstrated by *doing* which appears to bypass conscious awareness. It is also referred to as priming, conditioning, or non-associative learning (Baddeley, 1999).

Inhibition: This refers to a suspension of activity, as well as a temporary withholding, or suppression of an automatic response so that reasoned guidance (conscious control) can intervene. It's employed to avoid a negative habit and expand awareness (Alexander, 1941).

Interference Theory: Memory is actively degraded by interference either proactively or retroactively (Schmidt and Lee, 2005).

Internal Locus of Attention: Infers a proximal focus or attentional focus on parts and specific movements rather than on the outcome, like the resulting music (Schmidt and Lee, 2005).

Interoceptors: Implicit, automatic receptors in our internal organs such as hunger pangs (Schmidt and Lee, 2005).

Intrinsic Feedback: Information gained through various sensory channels during or resulting from a movement inherent to the individual (Schmidt and Lee, 2005).

Jost's Law: Forgetting is initially fast and subsequently levels off - if two memory traces are equally strong at a given time, then the older of the two will be more durable and forgotten less rapidly. Some believe that memory traces become tougher as they age, resisting further decay (Baddeley, 1999).

Know How: Body intelligence related to physical activity and craft. It is implicit, procedural, or tacit knowledge (Verdolini, 2000).

Know That: Cognitive knowledge or product of the mind. It is explicit, declarative or propositional knowledge (Verdolini, 2000).

Knowledge of Performance (KP): Explicit augmented feedback regarding the actual components of the performance itself. It can include biofeedback and body processes about which the subject is unaware. It can be concurrent or summary feedback (Schmidt and Lee, 2005).

Knowledge of Results (KR): Explicit augmented feedback that is verbalised (or verbalisable) post movement, summary information about the outcome of the movement in the environment (Schmidt and Lee, 2005).

Locus of Attention: Refers to where an individual directs their attention at a given time. Focus is split between external and internal (Schmidt and Lee, 2005).

Long-Term Memory (LTM): Refers to more durable encoding and storage systems. Information is held in LTM as a result of practice. There appear to be a number of parallel systems that are capable of implicit memory, whereby a subject can't recall the learning experience, but can demonstrate learning through a change in behaviour (Baddeley, 1999).

Massed Practice: Rehearsal periods are scheduled very close together with little to no rest which doesn't enhance learning but may boost performance if fatigue doesn't become a factor. This is the opposite of spaced practice (Schmidt and Lee, 2005).

Memory: Memory does not comprise a single unitary system, but rather an array of interacting systems, each capable of encoding or registering information, storing it, and making it available by retrieval. Without this capability for information storage, we could not perceive adequately, learn from our past, understand the present, or plan for the future. (Baddeley, 1999; Schmidt and Lee, 2005).

Kinesthetic Memory (Mental Imagery): Mental imagery, also referred to as covert rehearsal, takes place when a skill is rehearsed without any associated physical overt actions. It has been shown to lend some benefits in skill transfer (Schmidt and Lee, 2005).

MESH Theory: A theory of skilled action proposing that cognitive processes make an important contribution to almost all skilled action. Cognitive control is focused on strategic aspects of performance, and plays a greater role as difficulty increases. *Mesh* theorises that controlled and automatic processes are closely integrated in skilled action, and that cognitive control directly influences motor execution in many cases (Christensen, Sutton and McIlwain, 2016).

Modelling: A cognitive strategy for information processing, can include in person modelling by teacher, video or recording of student or expert(s). Direction should be given regarding what to look for during complex tasks for more naïve learners so they are not overwhelmed and can identify the skill to be learned (Schmidt and Lee, 2005; Holding, 2020).

Monkey: A position somewhere between standing and sitting or squatting that keeps the full stature in the torso. This coordinated state is equally balanced on two feet with the hips, knees and ankles released in order to bend. It is considered a position of mechanical advantage for many tasks (Davies and Barlow, 2002).

Motivation: A force that energises and directs behaviour considered central to learning. Motivation determines the degree to which the learner will persist, and pay attention in deliberate practice (Schmidt and Lee, 2005; Baddeley, 1999).

Motor Learning: A process, which is inferred rather than directly observed, leading to permanent changes in skill acquisition as the result of exposure or practice (Schmidt and Lee, 2005).

Motor Programme: Theoretical structure that acts as a single unit, a temporary organisation imposed on the system (Schmidt and Lee, 2005).

Motor System: There are at least two levels in a motor system. The executive level selects, organises and initiates complex pattern of muscular activities and the effector level controls or produces patterns as they unfold (Schmidt and Lee, 2005).

Optimal Challenge-Point: An hypothesis extending the desirable difficulties concept by suggesting that the difficulty in practice conditions is a function of the relationship between nominal task difficulty and functional task difficulty. Nominal task difficulty refers to the constant level of difficulty of a given task, independent of the performer's skill level. Functional task difficulty refers to the level of difficulty of a given task relative to the performer's skill level or performance situation. As a learner's skill level advances, the nominal task difficulty must increase to offset the decrease in functional task difficulty (Guadagnoli & Lee, 2004).

Over-learning: Refers to a hypothetical performance ceiling or limit, which when reached will not result in any further improvement (Schmidt and Lee, 2005).

Perceptual Motor Learning: The intricate interaction of perception and action leads us to conceptualise all problems in terms of "perceptual-motor learning" rather than just "motor learning" (Titze and Verdolini Abbott, 2012).

Perceptual narrowing: Refers to the narrowing of attentional focus with increased arousal levels. There is a progressive elimination of input from more peripheral environmental aspects (Schmidt and Lee, 2005, p. 120).

Performance Cues: Performance cues are established by thinking of particular features in the music to serve as landmarks to guide their performances. Basic performance cues yield details of technique, such as taking a breath or sustaining a note. Interpretive performance cues denote critical phrasings, dynamic emphases, changes in dynamic level, and tempo. Expressive performance cues identify musical feelings to be conveyed to the audience (Ginsborg, Chaffin and Nicholson, 2006).

Persistence (Memory): Refers to the strength and stability of the encoding process that allows memory recall (Richards and Frankland, 2017).

Point of No Return: Represents the point at which conscious control of a movement has been transferred to a motor program, beyond which attempts to modify the action will be largely unsuccessful (Schmidt and Lee, 2005).

Position of Mechanical Advantage: There is no 'one' position, although the Monkey procedure is generally thought to be 'the one'. Alexander describes this as any position, that may or may not be 'normal', that leads to a lengthening in stature. Where the muscles are lengthening and the head, neck and back relationship can be maintained (Alexander, 1923).

Power Law of Practice: All other things being equal, more practice equals more learning. The rate of improvement at any point tends to be linearly related to the amount left to improve. Improvements can continue for years although the gains may be very small (Schmidt and Lee, 2005).

Proactive Interference: Refers to an old response suddenly breaking through a new motor pattern. It is as if the old trace, having been displaced and suppressed by the new one, strikes back, often when least expected (Baddeley, 1999).

Proprioception: Refers to the muscle, tendon and joint sense, related to the automatic maintenance of posture and the knowledge of the position of the skeletal musculature of the body. The unconscious monitoring of movement and effort through sensors in the musculature that bypasses cognition permitting rapid adjustments in response to changing conditions (Ohrenstein, 2003; Proske and Gandevia, 2012; Schmidt and Lee, 2005).

Random Feedback: In random practice format, tasks are trained in no predetermined or patterned order (Bergan, 2010).

Recall Memory: Refers to the memory responsible for the production of the movement (Schmidt and Lee, 2005).

Recognition Memory: Refers to the sensory system responsible for movement evaluation (Schmidt and Lee, 2005).

Re-education: This is a gradual restoration of a natural coordination that has been previously experienced, but over time and due to mis-use was lost. It is not the process of adding something, but restoring it (Alexander, 1941).

Representational Gestures: Refers to the use of gestures that depict semantic content, either literally or metaphorically. These simulated actions activating sensory, premotor, and motor areas of the brain in action-appropriate ways (Toner, 2017, p. 17).

Retroactive Interference: Refers to new material superseding the old. In general, this type of interference increases as the amount of new learning increases, and is most dramatic when it is interfering with a relatively weak older memory trace (Baddeley, 1999).

Schema Theory: An information-processing theory stating that we learn skill by learning rules about body function, forming a relationship between how muscles are activated, what they do, and how they feel. Augmented feedback (KR) is an essential part of this theory (Schmidt and Lee, 2005).

Self-Regulated Feedback: Refers to feedback that is given only when requested by the student. This has been shown to be an effective learning strategy (Schmidt and Lee, 2005).

Self-Regulated Practice: Refers to practice sessions that are set by the learner. This is an effective strategy for highly motivated learners (Schmidt and Lee, 2005).

Semi-Supine (Constructive Rest, Lie Down): A procedure used to restore coordinated use or a neutral state as well as recharge our batteries. This active procedure involves the student giving directions in order to link up the mind and body while lying on your back with knees raised toward the ceiling and feet are on the floor.

The head is supported with enough books to support the head so it's not pulled back and down, and the neck in the front is not crushed (Davies and Barlow, 2002).

Sensory Feedback: Afferent in nature, this motor control feedback can occur prior to, during or following a movement. Prior afferent feedback from the proprioceptors is critical for action selection in a variable environment. Feedback during a movement acts as a monitoring function and can initiate reflective corrections if necessary. The Central Nervous System (CNS) evaluates extensive feedback after a movement regarding movement adjustments, error reduction, or level of effort (Schmidt and Lee, 2005).

Short-Term Memory (See also Working Memory): Short-term or working memory refers to the temporary storage of material necessary for performing a range of complex tasks such as comprehension, reasoning, and long-term learning. Information that is essential for a brief period of time is temporarily stored, then becomes irrelevant. It is the storage system for information delivered either from STSS or LTM (Baddeley, 1999).

Social-Comparative Feedback: Perceived self-efficacy and positive social comparative feedback improves performance (Lewthwaite and Wulf, 2010).

Subvocalisation: Refers to auditory imagery that engages motor planning related to subtle muscle movements that are related to vocal production, and which is used to prepare vocal motor responses (Pruitt, Halpern and Pfordresher, 2019).

Summary Feedback: Refers to a feedback strategy delivering KR or KP at the end of a performance. Also referred to as terminal feedback (Schmidt and Lee, 2005).

Surprises: Refers to a phrase coined by Gentile to describe a better than expected outcome, based on predictions (Gentile, 1972).

Tensegrity: A tensegrity model distributes tension throughout the muscle tissue of the entire system, so no one muscle carries the entire burden. This type of structure is stable and resilient but more flexible than a compression structure (Dimon, 2015a).

Trace-Decay Theory: This passive theory of disuse states that memories are neurological traces in the central nervous system that tend to weaken over time. If material is not practiced it decays over time (Schmidt and Lee, 2005).

Transience (Memory): Refers to destabilised synapses that promotes forgetting or the interruption of memory recall. Memories naturally decay over time (Richards and Frankland, 2017).

Unlearning: Erasing the memory traces that encode the behaviour (Crossley, Ashby, and Maddox, 2013).

Warm-up decrement: Refers to the gradual loss of warm-up effects during a period of inactivity. There are 2 active theories addressing this phenomenon. *Forgetting* refers to the loss of skill memory during a rest period. *Set hypothesis*, refers to being in a proper state of internal tuning. This is not related to memory but preparation levels necessary for the execution of a skilled task. Warm-up effects last approximately 30 min. and are generally most effective immediately before performance (Schmidt and Lee, 2005).

Whispered 'Ah': This procedure was likely derived from singing exercises of the day. In AT it is used as a device for demonstrating the role of inhibition in breathing and voice production (Jones, 1976).

Working Memory (see also Short-Term Memory): Part of STM where information from STSS is stored for processing. Information from LTM (motor programs) can be retrieved for processing and integration with environmental information from STSS. Effortful and limited-capacity conscious processing (controlled processing) takes place (Schmidt and Lee, 2005).

APPENDIX B: STUDENT GOAL SETTING

Goals must be valued by the student to be the most effective. The following form can be filled in, or re-evaluated at the beginning of each term to identify those goals. Tasks should be challenging, but with a likelihood of success if the student remains motivated and attentive. Guidance from the teacher depends on the motivation and skill level of each singer. The following parameters should be addressed in this process:

- Goals must be specific
- Goals must be realistic and realizable
- Both short and long-term goals
- Must answer the question “how”
- Can include learning and performance goals

(To be filled in by the student)

Name of Student:	
Specific goals for the year/term	<i>Guidelines:</i> <i>Practice goals</i> <i>Technical goals</i> <i>Language goals</i> <i>Memorisation goals</i> <i>Repertoire goals</i> <i>Artistic goals</i> <i>Performance goals</i>
Short-term goals	<i>List specific short-term goals and reassess as needed.</i>
Long-term goals	<i>List specific long-term goals and reassess as needed.</i>
Specific implementation strategies	<i>Practice strategies, schedules and deadlines to meet learning and performance goals (recitals, masterclasses, etc.).</i> <i>Use reflection journal to assess efficacy of strategies.</i>
Identify goal challenges and strategies	<i>Goals should be realistic and realizable with adequate student motivation and volition.</i>

(Adapted from Holding, 2020, pp. 82-84)

APPENDIX C: LEARNING AND PERFORMANCE GUIDELINES

Practice Order	
Blocked	Vocal tasks are practiced in discrete blocks.
<i>Learning</i>	<i>Performance</i>
Practice one discrete task at a time to establish skills (motor programmes).	Blocked scheduling is often used for large scale performances. Pacing is important to avoid fatigue.
Serial	Vocal tasks are rehearsed in a repeated sequential order.
<i>Learning</i>	<i>Performance</i>
Some practice variability is added, but practice order is maintained (ABC, etc.).	Helpful for performance preparation when tasks must be performed in a specific order. e.g. recitals, song cycles, entire roles.
Random	Vocal tasks are mixed in a non-sequential fashion.
<i>Learning</i>	<i>Performance</i>
This approach supports long term learning and retention goals.	May not be as helpful close to performances. Although some variability may promote ability to adapt during performances.
Practice Behaviour	
Constant	Exact same behavior or movement is practiced in the same context.
<i>Learning</i>	<i>Performance</i>
Drills with little variation (repetition) benefits new skill acquisition.	May benefit novice learners and difficult tasks.
Variable	Variations of a given behavior or context are practiced.
<i>Learning</i>	<i>Performance</i>
Exercise variation enhances learning after basic skill level is established.	Introduce practice in various environments, and times of day to enhance performance flexibility.

(Adapted from Nix, 2017, p. 217)

APPENDIX D: RALSTON REPERTOIRE DIFFICULTY INDEX

THE RALSTON REPERTOIRE DIFFICULTY INDEX (RRDI) (Ralston, 1999)

RANGE

Easy	Range is limited to a major tenth.
Moderate	Range is up to one octave plus a fifth with moderate register changes.
Difficult	Range is extended to two octaves and beyond with difficult register changes.

TESSITURA

Easy	Tessitura lies well within the comfortable range for high soprano.
Moderate	Tessitura is moderately high or low but reasonable for high soprano.
Difficult	Tessitura is high or low and may be difficult to sustain.

RHYTHM

Easy	Rhythm is uncomplicated and symmetrical.
Moderate	Rhythm has moderate complexity (alternating meters).
Difficult	Rhythm is complex (compound meters, alternating meters).

PHRASES

Easy	Phrases are short (2–3 measures).
Moderate	Phrases are up to 3–5 measures long.
Difficult	Phrases are long and require strong breath control.

MELODIC LINE

Easy	Melodic line is simple, diatonic with conjunct intervals and is syllabic.
Moderate	Melodic line may include disjunct and difficult intervals and may include melismas.
Difficult	Melodic line is chromatic with leaps of more than an octave.

HARMONIC FOUNDATIONS

Easy	Harmonic foundations include triadic accompaniment with few dissonances.
Moderate	Harmonic foundations include consonant to moderately dissonant accompaniment that may or may not be related to the voice part.
Difficult	Harmonic foundations include dissonance and clear delineation between melody and accompaniment.

PRONUNCIATION

Easy	Pronunciation of consonants and vowels, individually or in combination, is relatively simple with regard to tempo, vocal placement, and repetition.
Moderate	Pronunciation of consonants and vowels, individually or in combination, is moderately complex with regard to tempo, vocal placement, and repetition.
Difficult	Pronunciation of consonants and vowels, individually or in combination, is difficult with regard to tempo, vocal placement, and repetition.

APPENDIX E: KEY TECHNICAL AND ARTISTIC PRINCIPALS FOR CLASSICAL VOICE TRAINING

These fundamental technical and artistic principles can be used to design an individual student learning framework and progressive lesson structure for classical singing lessons.

This process, beginning with dynamic posture, is initially hierarchical and ultimately iterative depending on student skills and performance needs.



(Adapted from Miller, 1986; Brown, 1996, p. 118)

APPENDIX F: STRATEGIES FOR BREAKING HABITS AND EXPERT SKILL MAINTENANCE

Stage	Direct teaching practices	Indirect teaching practices
Analysis	Identify singer requirements and reason for refinement or change. Ensure singer's intention to change or adapt.	
	• Analysis performance to provide the premise for changes • Singer must be engaged. Carefully consider alternatives that they offer. • Performance adaptations should fit within singer's existing technique. Drastic change is possible only if there is time to learn.	• Use of performance and studio videos, audio recordings and reflection journals
Awareness	Bring conscious awareness to skill to free from automaticity. Encourage monitoring for adaptable performances.	
	• Apply unlearning/ interference motor learning principles to interrupt habit(s). • Employ deliberate practice methods to integrate new techniques or styles.	• Study non-habitual aspects of skill, e.g. new roles, new languages (part practice). • incorporate kinesthetic memory exercise.
Adjustment	Modify the erroneous technique. Incorporate new skills.	
	• Let the singer solve problems to facilitate new motor program formation. • Use self-regulated and 'best attempt' positive feedback. • Start to integrate parts back into the whole.	• Evaluate video or audio recordings of new behaviour • Work on monkey to strengthen postural tonus. • Work on whispered /a/ for onset
(Re)Automation	Internalize and reintegrate the change to automatic control.	
	• Incorporate positive challenges by increasing levels of desirable difficulties.	• Use of multiple modalities in rehearsal including biofeedback, visual feedback to verify changes.
Assurance	Increase confidence in automaticity during high-pressure conditions.	
	• Performance simulations—make sure that new skills integrated	• Leave a sufficient gap before next change

Adapted from the Five-A Model: Carson and Collins (2011, 2016)

APPENDIX G: SEMI-SUPINE, AT PROCEDURE



(Dimon, 2015, p. 145)

Preparation

- Lie down on the floor with a carpet or yoga mat with your knees bent
- Put a pile of soft covered books 2-4 inches (5-10 cm) high under your head.
- There should be enough books under your head so that your head isn't pulled back and down and not so many that your chin crowds your neck. Height may change over time.

Primary Mental Directions (Give these mental directions sequentially and simultaneously). Directions are fundamental to all procedures.

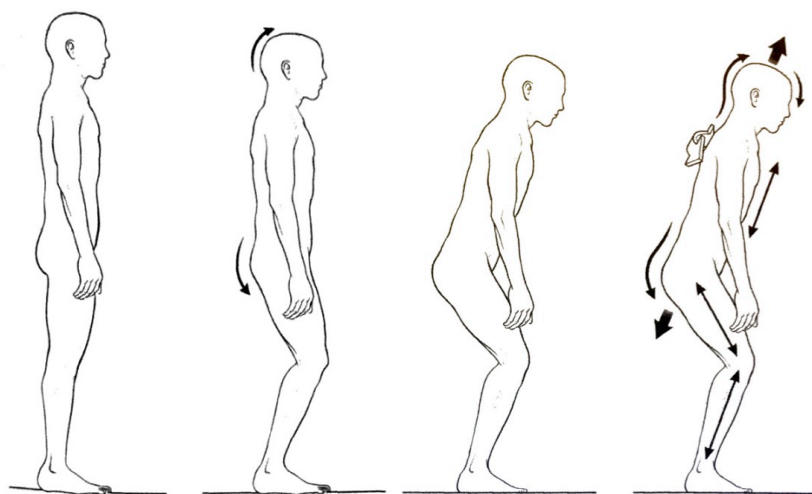
- Allow your neck to be free...
- To let your head go forward and up...
- To let your back lengthen and widen...

Secondary Mental Directions (Add these mental directions to primary directions as student gains experience and as needed)

- Let your knees go forward and away.
- Let your elbows lengthen.
- Shoulders free and opening out.
- Allow your feet to soften and widen.

Frequent (2-3 times per day) but short (10 min.) periods are recommended to begin. Introduce longer periods when possible.

APPENDIX H: MONKEY, AT PROCEDURE



(Dimon, 2015a, p. 85)

Directions

- Release knees forward to go into a vertical monkey.
- Bend at the hip while maintaining the integrity of the head, neck and back
- Notice if your legs are tightening and release what you can.
- If you become tense or start to hold come out of this position and reengage.

Variations

Seated Monkey

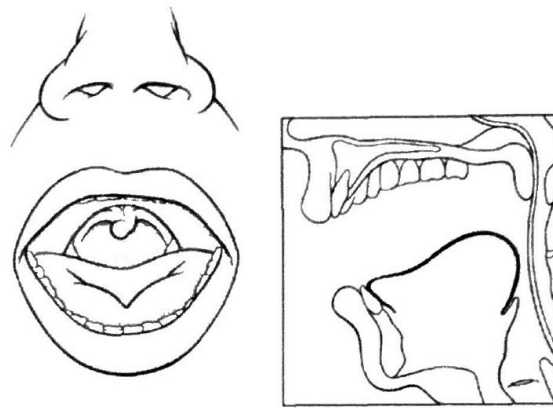
- While balanced on your sit bones bend forward at the hip, maintaining the integrity of the head, neck and back. (This is often a better starting point as leg joints tend to be very tight).
- Give your mental directions (see semi-supine procedure).

Incorporating Hands

- While in the monkey (seated or standing) extend your hands and place them on a surface about elbow height in front of you.
- Use feedback from your actively extended hands to come up and back while maintaining the necessary muscular balance.
- “Hands like feet” - The hands should be active, not too tense and not collapsed.

Note: It can be helpful to check the monkey visually in the beginning using a mirror or video. Perception and reality often diverge especially when it comes to head balance.

APPENDIX I: WHISPERED “AH”, AT PROCEDURE



(Dimon, 2015b, p. 31)

Preparation

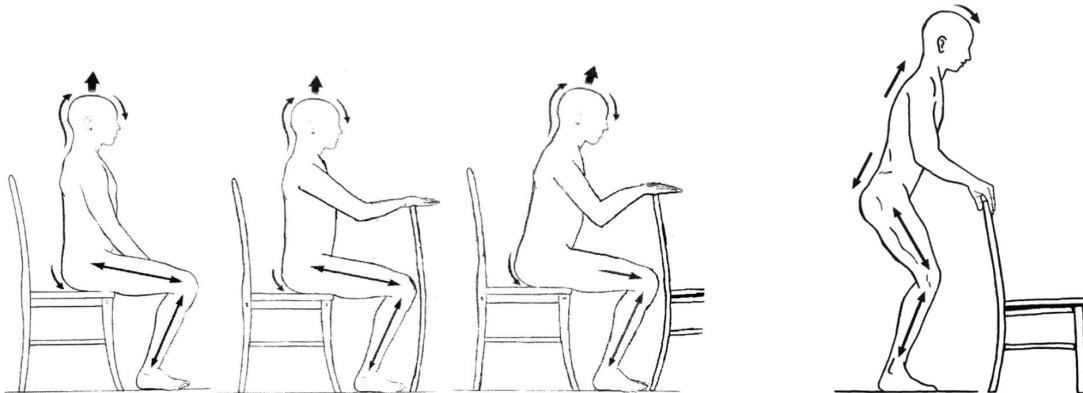
- Allow your neck to be free.
- Brighten your eyes and smile inside. (Think of something funny).
- Gently bring your teeth into the bite position with your tongue resting lightly against the bottom front teeth.
- Releasing at the temporomandibular joint and allow the jaw to slide forward until your top teeth rest on your lower teeth. The tongue moves easily with the bottom jaw.
- Open the jaw to the full extent you can manage without forcing.

Execution

- With the jaw open exhale without taking a breath, whispering the vowel “ah” without voice.
- Close the mouth allowing the breath to rebound in through the nose for the inhalation.
- After each breath check your sitting or standing balance and the freedom of your neck.
- Repeat.

This can be done in the semi-supine position, while seated or standing. Note that if doing this while lying down the larynx is not in the most mechanically advantageous position. Adding hands on the back of a chair will increase the intensity of the procedure. Some singers find it helpful to think of simply letting the jaw hang rather than actively moving it forward.

APPENDIX J: HANDS ON THE BACK OF A CHAIR, AT PROCEDURE

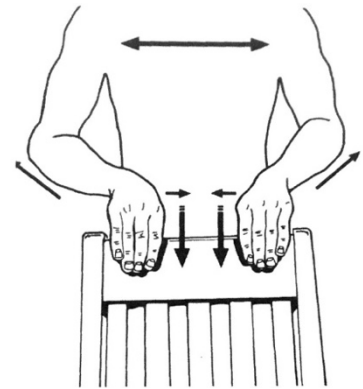


(Dimon, 2015c, pp. 18, 35)

Directions

Seated

- Begin in a seated monkey with a chair in front of you.
- Give your directions (neck, head, back) and release into length.
- Bending at the elbow, allow your fingers to lead your hands (like feet) to the top (or rail) of the chair.
- With your palms on the chair, angle the inside of your wrists slightly toward the center, so that your fingers are pointing directly ahead.
- Bend your fingers extending straight down in front of the chair and counter this movement with your thumbs at the back of the chair. Check your hand/wrist alignment, your knuckles should now be forward facing.
- Grasp the chair and gently pull with your forearms to widen across your torso.
- Notice the engagement of the antagonistic action in your entire torso and play with the amount of tension you introduce.



Dimon, 2015c, p. 36

Standing

- Stand behind a chair with a high rail and follow the directions for going into a monkey.
- Give your directions (neck, head, back) and release into length.
- Continue to follow the HotBoaC directions from above being mindful of head, neck and back alignment, hand and wrist position, and leg tension at all times.
- Come out of the position if you become aware of holding or tension.
- Do not work too long in this position especially in the beginning stages.

APPENDIX K: SEMI-SUPINE EXPLORATIONS



(Dimon, 2015a, p. 145)

Exploration #1: Respiratory awareness through the autonomic breath

This procedure is helpful for tension release and to bring awareness to respiration.

Directions:

- While in the semi-supine position with AT directions established, expel the air in your system through your mouth. (Do not take a preparatory breath, exhale only what is already present).
- Close your mouth and allow the air to rebound in through your nose.
- Continue to breath easily, always inhaling through your nose.
- Notice your ability to expand fully (360°).
- Notice the feedback from the floor during an easy respiration.
- Without putting the air anywhere, notice the possibilities to expand your back.
- Now, notice what happens when you “TAKE” a breath – does that introduce tension?

Exploration #2: Kinesthetic memory

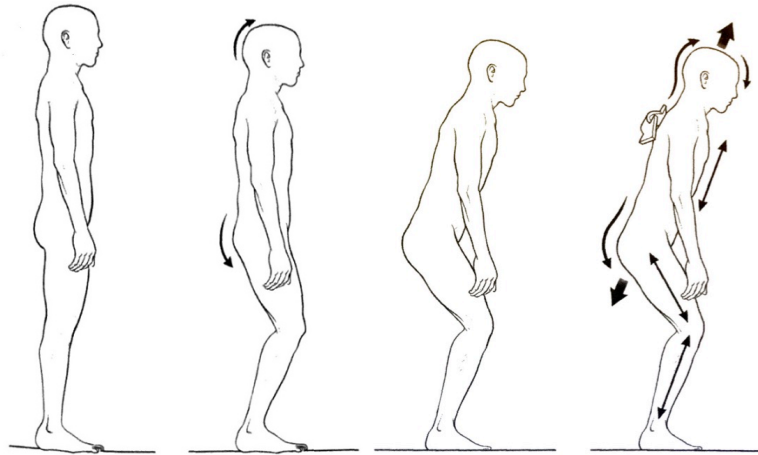
This procedure or mental practice is useful to notice tensions that may be camouflaged by other intrinsic feedback during singing, and for practice without fatiguing the voice.

Directions:

- Make sure you are breathing autonomically.
- Imagine that you are singing something specific. (Approach this from a first-person perspective. Don't merely watch yourself from afar.)
- As you are thinking through your music notice if and where you begin to tighten.
- Is this tension efficient and necessary?
- Isolate and dechunk these moments by stopping and inhibiting the excessive tension when you tighten.
- Try singing these sections with less preparatory tension.
- Sing the entire music selection or piece normally and notice if your awareness of your tensional or postural habits has altered.

APPENDIX L: MONKEY EXPLORATIONS

Going into Monkey



Dimon, 2015a, p. 85

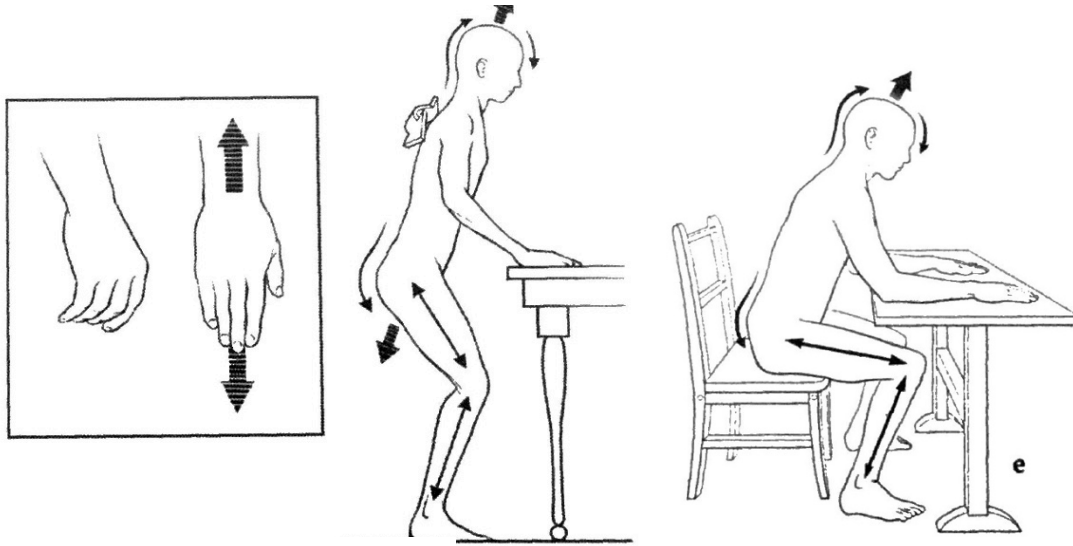
Exploration #1: Autonomic breathing in an upright position

This is an extension of the autonomic breath first explored in the semi-supine procedure. It may be helpful to isolate these movements by sitting and inclining forward from the hips in order to work on the head, neck and back alignment before standing and re-introducing the legs. Come out of this position if you begin to hold or tense, especially in the legs.

Directions:

- While in a monkey position take several autonomic breaths as described above.
- Do this a number of times, noticing any differences in the upright position.
- Notice if you begin to hold your breath, stiffen to hold this position.
- If this happens come back to it later, or try a variation (below).

Monkey Variations



Dimon, 2015c, p. 15

Dimon, 2015a, p. 231

Exploration #2: Simple vocal task

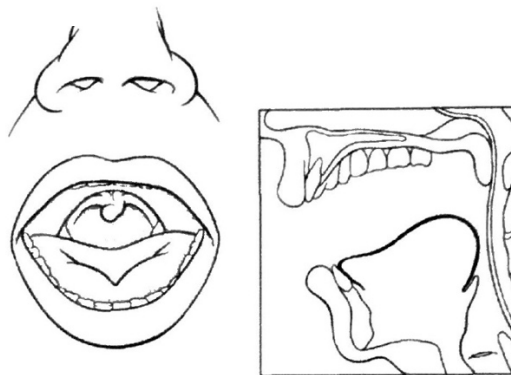
This exploration uses a very simple vocal task in the lower to middle register that is easy for the singer and can be sung softly. The specific task is up to the student or teacher. It can be as simple as one note.

Directions:

- While in the monkey position of your choice, make sure you are breathing autonomically. Exhale before allowing the air to rebound in.
- When you decide to sing notice how the breath and tonus in the system changes.
- Are you able to maintain the alignment of your head, neck and back during onset?
- How much pre-phonatory tension was introduced?
- Did you notice any changes to HN&B alignment, especially head balance?
- Come out of the monkey and sing the same task while standing (or sitting) straight and notice any differences.
- Mindfully alternate between standing (or sitting) and monkey a few times.
- Notice any changes to your habitual standing posture and tonus as you contrast it with the monkey.

APPENDIX M: THE WHISPERED “AH” EXPLORATIONS

The Whispered /a/



(Dimon, 2015b, p. 31)

Exploration #1: Whispered /a/ and unvoiced semi-occluded vocal tract exercises (SOVTE)

The following 3 unvoiced consonants are suitable to incorporate into the whispered /a/:

/f/ (fan) /s/ (sun) /ʃ/ (show)

Shifting between the whispered /a/ and an unvoiced SOVT consonants /f/, /s/ or /ʃ/ may be organized in a number of ways and adapted for your needs.

Directions:

- Begin slowly with one sound per breath
 - (whispered /a/, *breathe*, unvoiced SOVTE consonant during the next exhalation).
- Combine the whispered /a/, with an unvoiced SOVTE consonant
 - (whispered /a/ into an unvoiced SOVTE consonant, *breathe*).
- Move from one unvoiced SOVTE consonant to another interspersed with the whispered /a/.
 - (/f/ to /s/ to /ʃ/ in any combination with the whispered /a/).

Exploration #2: Whispered /a/ and paired voiced/unvoiced SOVTE

This exercise builds on the previous exploration. When adding phonation or sound to the whispered /a/, the stimulus increases. It is likely that an individual's habit will become more prominent in this critical moment of phonation (Alexander, 2001, p. 45). Pay particular attention the head, neck and back alignment and any new excessive or injurious tensions. Remember habitual tensions are familiar and are therefore likely to feel 'right'. This exploration may be organized in a number of ways and adapted to the student's needs.

The following unvoiced and voiced consonant pairs are recommended for this exercise.

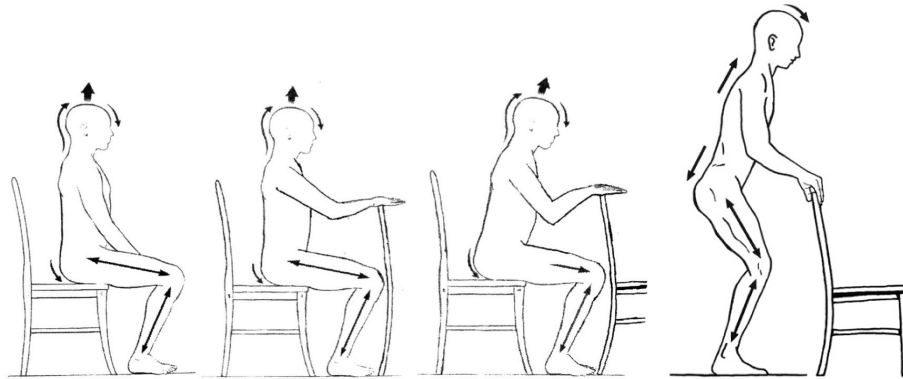
/f/ (fan) to /v/ (van) /s/ (sun) to /z/ (zoo) /ʃ/ (show) to /ʒ/ (judge)

Shifting between the whispered /a/ and these paired SOVT consonants may be organized in a number of ways and adapted for your needs.

Directions:

- Choose a note on a relatively low pitch and soft volume.
- Combine the whispered /a/, with a SOVTE pair on one pitch. Begin slowly to notice changes just before and during phonation onset.
 - (whispered /a/, *breathe*, paired SOVTE, *breathe*).
- Continue to play with phrase lengths and adapt the exercise.
 - (whispered /a/ into an unvoiced and voiced SOVTE pair, *breathe*)
 - (/hɑ-f-v/; /hɑ-s-z/; /hɑ-ʃ-ʒ/).
- Move between voiced and unvoiced pairs in varying lengths and combinations, on one pitch without the whispered /a/.
 - (/f-v/; /s-z/; /ʃ-ʒ/).
- Vary the pitches of the voiced consonants as desired through this exploration.
- Further possible explorations in this iterative process.
 - When voicing is comfortable and easy add gentle small pitch glides on the voiced consonant, with and without its initial unvoiced pair.

APPENDIX N: HANDS ON THE BACK OF A CHAIR (HotBoaC) EXPLORATIONS



Dimon, 2015c, pp. 18, 35

Experience with the full HotBoaC procedure is important before embarking on these procedures. Monitor for alignment to avoid end-gaining.

Exploration #1: Simple vocal task, changing frequency

This exploration turns again to a simple vocal task sung at a relatively low pitch and soft dynamic. If in doubt a single note is recommended. A gentle pull in the forearms engages the antagonistic action throughout the whole torso, both front and back. The singer is advised to release wide across the shoulders while gently pulling to avoid excessive pull in the front or back. Pay close attention to the hands and wrists. If pulled too hard they will lose their initial orientation. Stop and re-engage if you begin to end-gain or become fatigued.

Directions:

- While engaged in the HotBoaC procedure take an autonomic breath.
- Sing a single note in an easy and relatively low part of your range.
- Increase your pitch (not volume) through ascending glides while playing with the pull in your arms. Glide ranges can be as simple as a second, or third and expanded from there.
- Next increase your pitch (not volume) through ascending leaps while still playing with the pull in your arms. Leap ranges can be tailored to the singer, narrow leaps usually benefit more novice singers. Excerpted leaps from repertoire can also be used.
- Notice if it is helpful to introduce greater antagonistic action, through a forearm pull, at higher frequencies.

Exploration #2: Simple vocal task, changing amplitude

The next exploration builds on the previous one using a single note on a relatively low pitch and soft dynamic. Antagonistic action will again be explored.

Directions:

- While engaged in the HotBoaC procedure take an autonomic breath.
- Sing a single note in an easy, but fairly low part of your range.
- Crescendo (do not change pitch) while playing with the amount of pull in your arms.
- Notice if it is helpful to introduce greater antagonistic action at higher amplitudes.
- Continue to monitor your HN&B alignment.

Exploration #3: Messa di voce (MdV)

The MdV exercise in conjunction with HotBoaC can help to bring awareness to the amount of antagonistic action required to regulate the controlled exhalation during a complete range of dynamics. Note that this can change based on the specific pitch, volume and vowel combination. Awareness of efficient and appropriate effort at the end of the exhalation is also highlighted. Increase duration gradually. The process is more important than total duration.



(Choice of a single vowel and pitch): Ultimately, 8-10 seconds duration.

Directions:

- While engaged in the HotBoaC procedure take an autonomic breath.
- Beginning with a note in the middle of your range sing a MdV.
- Play with the amount of pull in your arms as the volume increases and decreases. Notice the effort required at the end of the controlled exhalation when respiration is less efficient.
- More advanced singers can play with the MdV throughout their entire range. Novice singers will likely benefit from limiting this exercise to where the singer phonates most easily. Usually their lower and middle ranges.
- Notice the support requirements as the pitch and volume increases.
- Notice if greater antagonistic action is required at the end of exhalation phase.

APPENDIX O: BIBLIOGRAPHY

- Aggett, C. (2010) 'Reflective Journaling in the Singing Studio', in Harrison, S.D. (ed.) *Perspectives on teaching singing: Australian vocal pedagogues sing their stories*. Bowen Hills, Qld: Australian Academic Press.
- Bullock, E. (2019) 'Designing Opera Rehearsals to Optimize Learning and Retention' *Journal of Singing*, 75(4), pp. 463-466.
- Cleveland, T.F. (1989) 'Multisensory Feedback Systems in the Teaching of Voice: A Student Case Study' *Journal of Singing* 46(1), pp. 26-28.
- Haas, A. (2018) 'Creativity through Silence: Exploring the Use of Meditation in Musical Performance' *Journal of Singing*, 74(5), pp. 563-570.
- Helding, L. (2007) 'Voice Science and Vocal Art, Part One: In Search of Common Ground' *Journal of Singing*, 64(2), pp. 141-150.
- Helding, L. (2009) 'The Missing Brain' *Journal of Singing*, 66(1), pp. 79-84.
- Helding, L. (2009) 'Howard Gardner's Theory of Multiple Intelligences' *Journal of Singing*, 66(2), pp. 193-199.
- Helding, L. (2010) 'Gardner's Theory of Multiple Intelligences: Musical Intelligence' *Journal of Singing*, 66(3), pp. 325-330.
- Helding, L. (2010) 'The Mind's Mirrors' *Journal of Singing*, 66(5), pp. 585-589.
- Helding, L. (2010) 'Master Class Syndrome' *Journal of Singing*, 67(1), pp. 73-78.
- Helding, L. (2010) 'Break a Leg! The Ironic Effect, Choking, and Other Mind Games' *Journal of Singing*, 67(2), pp. 207-212.
- Helding, L. (2011) 'Creativity in Crisis?' *Journal of Singing*, 67(1), pp. 597-604.
- Helding, L. (2012) 'Choosing Attention' *Journal of Singing*, 68(3), pp. 321-327.

- Helding, L. (2012) 'Tiger Teaching' *Journal of Singing*, 68(5), pp. 569-577.
- Helding, L. (2013) 'Memory, Hither Come' *Journal of Singing*, 69(3), pp. 337-344.
- Helding, L. (2014) 'Singing with Your Whole Brain: The Right Brain/Left- Brain Dichotomy' *Journal of Singing*, 71(1), pp. 83-88.
- Helding, L. (2014) 'Singing with Your Whole Brain: The Mind-Body Problem' *Journal of Singing*, 71(2) pp. 227-232.
- Helding, L. (2015) 'Motor Learning and Voice Training: Locus of Attention' *Journal of Singing*, 72 (1), pp. 87-91.
- Helding, L. (2015) 'The Clinician's Illusion' *Journal of Singing*, 71(3), pp. 353-357.
- Jensen, K. (2015) 'The Significance and Pedagogic Applications of the Vocal Breakthrough. Part 1: Conditions and Stages' *Journal of Singing*, 72(2), pp. 219-224.
- Manternach, B. (2020) 'The Independent Teacher: Voice Lessons as Observed Practice' *Journal of Singing*, 77(1), pp. 85-89.
- Manternach, B. (2021) 'The Independent Teacher: Driver's Education: A "Motor" Learning Analogy' *Journal of Singing*, 77(4), pp. 537-541.
- Maxfield, L. (2015) 'Healthy Voices, Healthy Singers' *Journal of Singing*, 71(4), pp. 507-512.
- Maxfield, L. (2018) 'Toward an Understanding of Attention and Awareness' *Journal of Singing*, 75(2), pp. 197–201.
- McCoy, S. (2016) 'Voice Pedagogy: What Comes Next?' *Journal of Singing*, 72(4), pp. 455-457.
- McLeod, C. (2020) 'Causal Learning: Addressing Barriers in Learning to Sing' *Journal of Singing*, 76(3), pp. 327-332.

Meyer, D. and Holding, L. (2021) 'Voice Pedagogy: Practical Science in the Studio: "No-Tech" Strategies' *Journal of Singing*, 77(3), pp. 359-367.

Nafisi, J.S.A. (2014) 'Gestures and body-movements in the teaching of singing: a survey into current practice in Australia and Germany' *Australian Journal of Music Education*, 22(1), pp. 77–94.

Nix, J. (1998) "'Dear Diary..." Body Monitoring Techniques for Singers' *Journal of Singing*, 54(4), pp. 25–27.

Ohrenstein, D. (1999) 'Physical Tension, Awareness Techniques, and Singing' *Journal of Singing*, 56(1), pp. 23-26.

Swanson, C.D. (2005) 'Learning Styles and the Voice Student' *Journal of Singing*, 62(2), pp. 203–209.

Tillotson Bauer, K. (2016) 'The Role of Kinesthesia in a Pedagogy for Singing' *Journal of Singing*, 73(2), pp. 129-137.

Treinkman, M. (2019) 'Lifting the Curse of Knowledge in Voice Pedagogy' *Journal of Singing*, 75(3), pp. 337-344.

Treinkman, M. (2021) 'Focus of Attention Research: A Review and Update for Teachers of Singing' *Journal of Singing*, 77(3), pp. 407-419.

Wulf, G. and Lewthwaite, R., (2016) 'Optimizing Performance Through Intrinsic Motivation and Attention for Learning: The OPTIMAL Theory of Motor Learning' *Psychonomic Bulletin & Review*, 23(5), pp. 1382–1414.