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SING AND SEE

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ABSTRACT

In 1742 Tosi advocated that for the perfect singer to become a perfect instructor required acquisition of several additional skills, including the ability to 'communicate his sentiments with ease, and in a method adapted to the ability of the scholar'. This paper examines factors affecting the teacher's ability to communicate using a method adapted to the ability of the student. In a current study funded by the Australian Research Council we are examining the use of computer-assisted real-time visual feedback of acoustic characteristics of voice in the teaching of singing. Singing teaching is commonly based on a master-apprentice model, relying on good modelling and feedback. Most commonly, modelling is supplied by the teacher demonstrating the task and feedback by the teacher's verbal comments. In conventional singing training, interpretation of the teacher's feedback can be problematic. Recent research suggests real-time visual feedback enhances cognitive development and skills learning and may therefore be profitably employed in the teaching of singing. In this paper we examine pedagogical issues relating to use of computer-assisted visual feedback in the singing studio. These include student learning styles, the nature of visual and auditory imagery, and educational theories related to the self-regulated learner and the reflective practitioner.

INTRODUCTION

> It may seem to many that every perfect singer must also be a perfect instructor, but it is not so; for his qualifications (though ever so great) are insufficient if he cannot communicate his sentiments with ease and in a method adapted to the ability of the scholar (Tosi, trans. Galliard 1987).

So said the eminent teacher and writer Pier Francesco Tosi in 1742. This paper examines factors affecting the singing instructor's ability to communicate using a method adapted to the ability of the scholar.

Feedback which is both unambiguous and timely is central to the learning of all musical performance skills, but is of even more importance in the learning of singing, where the process is confused by the identification of the performer with the instrument. Kemp points out that "singers need to give a particularly introverted attention to themselves. They may also require a special kind of sensitivity that allows them to perceive the interrelationships between their body sensations and the desirable qualities of their vocal tone" (1996, p. 174). The history of singing pedagogy is littered with the bear-traps of metaphoric language; the frequent disparity between pupils' and teachers' life experiences renders allusive language as, at best, ambiguous.

Recent research suggests real-time visual feedback enhances cognitive development and skills learning (Welch, Howard & Rush, 1989; Howard, 1993; Nisbet, 1995; Weidenbach, 1998; Nair, 1999) and may therefore be profitably employed in the teaching of singing. If there is a way to present clear, instantaneous feedback which comes from an impartial machine, and cannot be misread as personal criticism or nagging, then the feedback information is more readily assimilated. In a current study funded by the Australian Research Council we are examining computer-assisted real-time visual feedback of acoustic characteristics of the singing voice and its use in enhancing singing teaching (Thorpe, Callaghan & van Doorn, 2001). We have developed a specialised computer system that displays acoustic characteristics of a student's voice during singing and are now investigating methods of presenting the acoustic information in meaningful visual displays and pedagogical approaches integrating the technology into the practice of singing teaching.

In this paper we examine pedagogical issues relating to the use of computer-assisted visual feedback in the singing studio. These include aspects of skill acquisition, student learning styles, the nature of visual and auditory feedback, and educational theories related to the self-regulated learner and the reflective practitioner.

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SKILL ACQUISITION

"Skill is goal-directed, well-organized behavior that is acquired through practice and performed with economy of effort" (Proctor & Dutta, 1995, p. 18). Fitts (1964) and Fitts and Posner (1967) identify three phases of complex skill acquisition: cognitive, associative and autonomous. In the process of learning to sing, learning the basics of vocal technique is part of the cognitive phase, in which the learner employs cognitive processes in understanding the nature of the task and how it should be performed, and attending to outside cues, such as the pitch to be matched, the appropriate vocal tone, the teacher's instructions, and feedback from a number of sources.

A common definition of feedback is the returning of a part of the output of any system—mechanical, electronic, or biological—as input, especially for correction or control purposes. Singing requires use of the whole person—a biological system—as a musical instrument, and teachers have long recognised that feedback is useful as input in managing this complex system. Essentially, musical performance skills are athletic skills and, as with learning the motor skills required for sporting prowess, feedback can profitably be used in perfecting movement routines and correcting faults.

Singing teaching is commonly based on a master-apprentice model, relying on good modelling and feedback (Callaghan, 2000). Modelling is usually supplied by the teacher demonstrating the task, or by using live or recorded performance. Feedback may come from either external or internal sources. Internal feedback may be tactile, kinaesthetic, proprioceptive, and auditory. External sources include the human response of auditors (teacher, family, fellow students, audience), and the feedback supplied by technology. Feedback which is specific, timely, and meaningful to the student is acknowledged as a pedagogic necessity (Ericsson, Krampe & Tesch-Römer, 1993; Chickering & Gamson, 1987). This involves the teacher making an assessment of the student's progress in relation to a goal or target, and also making an informed decision about the type, timing and frequency of feedback. Skill acquisition requires information about performance during training and attention to perceptual information. While providing frequent information about performance (knowledge of results) during training may improve performance at that time, less frequent feedback seems to enhance longer-term learning (Verdolini, 1997, 2001). The timing of feedback is also vital: Havighurst (1952) refers to a "teachable moment", the optimal moment at which learning of a particular task is possible, making achievement of succeeding tasks possible.

While teachers commonly use verbal feedback, unless the feedback is specific, the time spent talking has little effect on student learning (Juslin & Laukka, 2000). When audio recordings became widely available they were employed to enrich students' reflection on their performance. For centuries, mirrors have been used in singing studios to provide visual feedback and in recent years some teachers have incorporated video photography into their pedagogic process (Edwards, 1997). Teachers have also made use of visual hand signals to supplement verbal instructions (Choksy, 1974; Cousins & Persellin, 1999). Our experience (Callaghan, Thorpe & van Doorn, 1999) and that of other researchers (Welch, 1985;. Nisbet, 1995) suggests that the use of computer-generated visual feedback can provide information to supplement the verbal and kinaesthetic feedback and modelling behaviour traditionally provided by the teacher. Well-designed computer-generated visual feedback is particularly suited to providing information on performance in relation to a target. It may also better match the learning style of many students than other types of feedback.

STUDENT LEARNING STYLES

The work of Howard Gardner (1983, 1993) and collaborators (Kolb, 1984; Lazear, 1991) has investigated individual differences in profiles of intelligences and how these are linked to ways of learning. While people are attracted to domains related to their particular intelligences, success in a specific domain requires proficiency in a set of intelligences. For example, people with musical intelligence may be attracted to the domain of music, but for success in this domain they require proficiency in a set of seven intelligences. For a singer, these would include:

Verbal/Linguistic - Understanding order and meaning of words, memory and recall, story-telling;
Logical/Mathematical - Abstract pattern recognition, discerning relationships and connections;
Musical/Rhythmic - Appreciating the structure of music, schemes or frames in the mind for hearing music, sensitivity to sounds, recognition, creation and reproduction of melody and rhythm, sensing characteristic qualities of tone;

Visual/Spatial - Active imagination, forming mental images;
Bodily/Kinaesthetic - Control of "voluntary" movements, control of "pre-programmed" movements, the mind-body connection, expanding awareness through the body, communication through gesture;
Social/Interpersonal - Effective verbal/non-verbal communication, sensitivity to others' moods, temperaments, motivations and feelings;
Solidarity/Intra-personal - Concentration of the mind, mindfulness, metacognition (thinking and learning about knowing what you know), awareness and expression of different feelings.

Cognitive research in the last 20 years has brought wide recognition of the diversity of effective learning styles. It is implicit in the breadth of teaching approaches which are now industry standard at all educational levels. Chalk and talk is now seen as only one of a number of equally fine pedagogic pathways. For similar sound reasons, "sing it [or play it] the way I do" can only be one of a music teacher's many tools.

VISUAL FEEDBACK

It has been hypothesised that imagery plays a significant part in the learning, planning, and execution of motor skills (Marks, 1992). Research in psychology and sports coaching suggests that for the bulk of the population this imagery is visual. Thus, visual feedback may complement other types of feedback to achieve a better fit with the individual intelligence profile and ways of learning of many students to enhance their acquisition of singing skills.

Traditional methods for learning to sing have relied heavily on auditory imagery. Many students in our very visually-oriented society are more visually than aurally aware, and that visual awareness is part of the bodily-kinaesthetic intelligence which plays such an important part in singing. In talking about acting students, Barton (1997) claims that, at the introductory levels, the vast majority (often up to 80 percent) are visual learners; at more advanced levels more have become kinaesthetic or auditory learners.

Visual feedback can help to clarify concepts, set goals, and provide knowledge of results in order to enhance students' learning.

AUDITORY FEEDBACK

Music is an art in which sounds are structured in time. In teaching, musicians have therefore relied heavily on auditory imagery, auditory feedback, and verbal feedback on the musical sound. Musical intelligence, like linguistic intelligence, is closely tied to the auditory-oral tract. Because of the task-specific and culture-specific demands of singing competency, it is the example *par excellence* of auditory-oral musical intelligence, which Gardner (1993) defines as the ability to discern meaning and importance in sets of pitches rhythmically arranged and also to produce such metrically arranged pitch sequences as a means of communicating with others. For these reasons singing teaching has traditionally relied heavily on auditory and oral feedback. The process of hearing, perceiving, and remembering sound forms a loop with the production of sound. In speaking and singing, the sounds being produced by the vocal mechanism are constantly being fed through this loop—the phonological loop—dictating what is produced by the vocal apparatus. Auditory feedback, transmitted from the ear through the brain stem to the cerebral cortex, is thus used as a control, allowing the singer to match the sound produced with the sound intended.

Essential to singing is both audition (hearing) and audiation (mental hearing, or auditory imagery). "Audiation" is Gordon's (1993) term for the ability to hear and comprehend musical sound that is no longer present, or that may never have been present. The ear is the organ essential to this process, not only in providing auditory input, but in its control of symmetry and balance.

It seems, however, that visual feedback, in contributing to the learning of the motor skills of sound production, may well contribute to the process of perceiving, remembering and reproducing sound that constitutes the phonological loop. Welch, Howard and Rush, for example, found that school students in their experiment using real-time visual feedback in the development of vocal pitch accuracy in singing "were able to extract meaning from the visual display and combine this with proprioceptive feedback from the voice mechanism to modify and develop their vocal pitch behaviours" (1989, p. 156).

THE SELF-REGULATED LEARNER

Self-regulated learning is an open-ended process involving the learner in a cycle of forethought, performance or volitional control, and self-reflection (Zimmerman, 1998). Research on visual and movement imagery by Isaac and Marks (1994) supports the theory that mental imagery plays a key role in forethought and volitional control. Chiviacowsky and Wulf (2002) found that allowing learners of a simple, sequenced, motor task the opportunity to decide when to receive feedback was more beneficial than externally controlling the timing of feedback, hypothesising that this enhanced the perception of self-control, which in turn enhanced learning. Likewise, Cumming and Hall (2002) in investigating the development of imagery skills in competitive athletes found that when athletes were engaged in imagery for their sport they also enjoyed being challenged and felt that they were improving and becoming competent.

Woody (2001) applied the research on expert performance to music education, identifying the development of expert performance on three component skills: goal imaging, motor production, and self-monitoring. Visual feedback may contribute to all three of these components. Computer-assisted visual feedback may thus be used as part of a self-regulatory cycle to develop students' perception of self-efficacy or control over the learning process. It has the advantage of being private, unbiased, uncritical; the focus is entirely on the singer and the sound produced.

THE REFLECTIVE PRACTITIONER

Expert teaching relies on two types of knowledge: content knowledge (knowledge of the subject matter to be taught) and pedagogical knowledge (knowledge of how to teach) (Shulman, 1987). In a qualitative research project evaluating the voice pedagogy of singing teachers in Australian tertiary institutions, Callaghan (1998) found that most singing pedagogy in Australian tertiary institutions is practised with incomplete content knowledge, i.e. knowledge of vocal physiology and acoustics. One way to incorporate a knowledge of acoustics into a traditional master-apprentice approach is to supply computer-assisted visual feedback.

Shulman (1987) puts content knowledge and pedagogical knowledge together as "pedagogical content knowledge", the capacity of a teacher to transform the content knowledge he or she possesses into forms that are pedagogically powerful yet adaptive to the variations in ability and background presented by the student, thus echoing Tosi's observation of 245 years earlier. This capacity requires teachers to reflect on their praxis: "Through reflection, [they] can surface and criticize the tacit understandings that have grown up around the repetitive experiences of a specialized practice, and can make new sense of the situations of uncertainty or uniqueness" (Schön, 1983, p. 61).

Whenever teachers' rituals are interrupted by the need to incorporate new technologies, the reflective examination of praxis which the disruption demands will often yield salutary results. Early findings of our ongoing research project indicate that aspects of its protocol are encouraging teachers to become reflective practitioners: they need to understand exactly what vocal features the software analyses and how one feature may co-occur with other features; they need to reflect on how to utilise the feedback in lessons in the way most appropriate for each student subject; they need to assist the student to interpret the feedback and make appropriate physical adjustments to achieve the target result. In addition, the protocol requires them to answer interview questions on the application of the feedback in the studio. Meeting these demands of the protocol helps to clarify the teacher's understandings, thus facilitating the ability "to communicate … sentiments with ease, and in a method adapted to the ability of the scholar".

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