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Practical Evaluation of Orofacial Myofunctional Exercises:
Implications for Wind Instrument Learning

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ABSTRACT Performance on woodwind and brass instruments, henceforth 'wind instruments', crucially depends on the ability to control the orofacial muscles, in general, and so-called *embouchure*, in particular. In this study, students and teachers of wind instruments and professional speech and language therapists tested and evaluated a set of myofunctional exercises that were developed for the enhancement of articulatory motor control of tongue, lips, and jaw. The perceived functionality and feasibility of the exercises in music and speech domains were investigated as well as any similarities and differences in subjective evaluations after a short period of supervised practice. Functionality in terms of how well each exercise addresses aspects of articulation was found to be similar in both subject groups. Speech and language therapists rated the exercises significantly more applicable, appropriate, and useful as compared to wind instrumentalists, while their practical potential was acknowledged generally. Further studies are needed to explore the myofunctional approach to embouchure. Implications for intervention studies in wind instrument teaching and learning are discussed.

KEY WORDS: Wind instrument learning, speech and language therapy, embouchure, orofacial myofunctional exercises

Introduction

According to Curt Sachs (1940) both wind instruments and the human voice are *aerophones*. These are characterized by the conversion of "pneumatic energy, in the form of air pressure and velocity, into sound waves" (Fuks and Fadle, 2002. p. 319). To this end, both vocal and wind instrument sound production both entail the use of facial muscles that are involved, for example, in the movement patterns of lips, jaw, and tongue during articulation. Therefore, motor control of these structures is a key component of sound production for both vocal and wind instrument performance.

The present paper tries to evaluate the potential pedagogical value that could arise from applying so-called myofunctional exercises as developed in speech and language therapy to wind instrument teaching. Specifically, it asks whether representatives of mu-

sic domains perceive a set of pre-selected exercises as appropriate in practical teaching of wind instruments, whereas the speech and language therapists were asked to comment on the therapeutic value of these exercises in their profession.

Orofacial Myofunctional Therapy (OFT) was developed during the first half of the twentieth century (Garliner, 1989) as treatment for speech disorders. Such deficits are often associated with a lack of muscular control of the tongue, orthodontic problems (i.e. malocclusion), or dysphagia (inadequacy of the act of swallowing) (Bigenzahn, 1995) as well as with low-level auditory processing. Thus, the central elements of OFT are physical exercises for the mouth and face regions. Although there is controversy over the effectiveness of the of the OFT approach, there is at least initial evidence that OFT may reduce difficulties of speech expression by children and adults (Wirth, 1995, Habermann, 2003). In one of the first publications of OFT, Garliner (1989) suggested a therapy for the treatment of abnormal swallowing patterns, which was based on practising the movement components of the swallowing act. Nowadays, OFT indications typically include speech and language therapy, rehabilitation of neurological patients, behavioural disorders in children and as an accompanying treatment in orthodontic therapies (e.g., Adams, Struck, Tillmanns-Kraus, 1996; Burhop, Determann, Dirks, Schmülling, 1998; Clausnitzer, 2001, 2002; Garliner, 1989; Gil, Tillman-Karus, 2004; Hahn, 1988; Kittel, 2000; Struck, Mohls, 2002; Thiele, 1988,1992). OFT is internationally recognized as a well established and widely accepted form of speech and language therapy (Thiele, 1992; Castillo-Morales, 1998).

The complexity of facial and oral muscle coordination in speech production is likewise reflected in music performance by wind instrumentalists. Such musicians often refer to the act of tone production as *embouchure*. Embouchure was once defined "as the constellation of forces and positions in the lips, mouth region, and face that act on the wind instrument" (Porter, 1967, cited in Fuks & Fadle, 2002, p. 320). More recently, Biehlig (1980) has extended this definition to "all the coordinated factors related to every aspect of tone production - such as breath control, tension of the lips, pressure on the mouthpiece, and tonguing" (Biehlig, 1980, p.14-16). Wind instrumentalists influence many of the musically relevant sound parameters, i.e., pitch, timbre, articulation and dynamics, varying the amount of pressure they use on the mouthpiece via the embouchure (Mayer and Bertsch, 2005). Schlabach (1990) attributes the discrepancy between conceived and produced sound to a mismatch between movement intentions and the ability to control the embouchure. The morphology and function of the lips, especially their ability to roll in and out to form little packages of air through which the air passes, influence the pitch and timbre of wind instruments such as the French horn, trombone, or trumpet. A very common problem with this process, however, is the generation of involuntary noises arising from a deficient embouchure (Mayer & Bertsch, 2005). The 'ideal' embouchure would control perfectly the complex interaction between the musician's mouth region and the mouthpiece of wind instrument. Therefore, the internal configuration of the mouth, such as the active positioning of jaw and tongue, is important (Fuks and Fadle, 2002; Meidt, 1967).

Psychophysiological approaches to embouchure have identified a great number of variables involved (Farkas, 1956; Bertsch 1999). Bertsch (1999) distinguishes between organic and inorganic factors. Whereas inorganic factors, such as instrument, mouthpiece and room acoustics, can be sufficiently described by physical models, organic variables, relating to the individual performer, appear more elusive and more difficult to conceptualise. For example, a wide range of orofacial muscles contributes directly or indirectly to the

dynamics of tone production (cf. Weast, 1965). Bodily posture, the position of the arms holding the instrument and use of the respiratory system providing air supply are important too. In sum, the large range of possibilities for each player causes wide differences in the embouchure of individuals (Mayer and Bertsch, 2005).

Bertsch (1999) and his colleagues addressed embouchure in trumpet playing in a sequence of studies that were based on psychophysiological and physical considerations. They investigated the pressure of the arm on the mouthpiece (Mayer and Bertsch, 2005) as well as expert-novice differences in warming-up procedures and intonation (Bertsch, 1995; Bertsch and Maca, 2001) during trumpet performance. Their results confirmed a non-linear relationship between pitch and physical pressure on the lips during the performance of different notes on the trumpet. Moreover, stroboscopic (Copley and Strong, 1996) and cinefluorographic methods (Meidt, 1967) elicit some of the dynamics in tongue and lip movements of brass musicians while playing different pitches on various brass instruments. These preliminary findings point towards complex interactions particularly of lips, tongue and jaw in tone production on wind instruments.

In music education, the myofunctional approach has recently inspired a new approach to instrumental music teaching and learning, particularly with respect to wind instruments (Schade, 2000, 2004; Schade and Rapp, 2005). The rationale for this approach is that in the process of skill acquisition in wind instrument playing, certain aspects of articulation that would include controlled movement patterns of lips, tongue, and jaw, for example, are most important to sound production and control. However, to achieve these goals traditional wind instrument learning patterns often appear to be based on trial and error rather than being built up systematically. In one empirical study on embouchure in wind instrument teaching and performance, it was observed that the change of location of the tongue inside the mouth while singing or playing a wind instrument had a systematic effect on timbre and colour of tone (Smithers, Woram and Bowsher, 1988).

The rationale for the present study is that the motor control of tongue, lips and jaw might be enhanced and built up systematically by specifically selected myofunctional exercises. We therefore sought to investigate some aspects of the mutual relationship between articulation in speech production and wind-instrument performance, i.e., embouchure-building. To this end, a pre-selected set of myofunctional exercises was administered to experts in both music and speech domains. Specifically, participants were asked about the usefulness of exercises addressing lip, tongue and jaw movements, with respect to their fields of experience. Thus the study addressed similarities and differences in evaluations from both groups as well as the specificity of exercises for different aspects of articulation. Given the limitations of published data on brass and woodwind instrument learning, in general, and considering the novelty of a non-therapeutic myofunctional approach in instrumental education, in particular, it is important to take into account these evaluations before testing this new approach to wind instrument pedagogy via intervention studies.

Method

Participants

Twenty participants each from the domains of wind instrument performance and speech and language therapy (total N = 40) were selected. The group of musicians included five professional music teachers and fifteen graduate students, who were recruited from the

Universities of Music in Karlsruhe and Mannheim, as well at the Institute of Music Education, Johann Wolfgang Goethe-University Frankfurt/Main, Germany. The youngest participant was aged 19 years, the oldest one 49 years. There were 14 female and 6 male participants with a mean age of 26 years 6 months. The music teachers had an average of 12 years 5 months of professional experience, while the participating students were enrolled, on average, in their sixth term of study (ranging from first to 12th term). All musicians were fluent speakers of German and actively played at least one type of wind/brass instrument, distributed as follows: French horn (6), trumpet (3), flute (3), clarinet (4), trombone (2), saxophone (1) and recorder (1).

The group of speech and language therapists consisted of 20 female participants working as professional speech and language therapists (mean age: 33 years 6 months, with an age range of 22 to 62 years). Their professional experience in applied Orofacial Myofunctional Therapy ranged from six months to 32 years, with an average of 8 years 5 months. Seventeen of these participants played an instrument, 14 of them a wind instrument. None of the participants in this study received payment. The survey was carried out between March 16 and April 27, 2005.

Questionnaire

A questionnaire of ten pages was used. The first page informed the participant about the aim of the study and asked participants to give their informed consent after reading the entire questionnaire. Demographic data were then obtained from the questions on the second page. The main body of the questionnaire addressing the evaluation of the myofunctional exercises comprised a total of eight pages, one for each exercise. Pictorial and verbal explanations introduced each exercise to the subjects and were used for supplementary instruction and orientation to the interactive component of the study with the first author of this study (see *Procedure* for details, below). The eight exercises were specifically selected to address tongue (3 exercises), lips (3 exercises), jaw (one exercise), and facial muscles (one exercise). Each exercise was explained via a brief verbal description and photographs. In addition, each exercise was demonstrated to the participants by the first author. To enable the precise reproduction of each exercise, participants were given photographs depicting the intended movement (see Figure 1). Table 1 summarizes the names of each exercise and its associated orofacial region.

Fourteen items were presented, reflecting subjective perceptions, for the evaluation of each exercise. Each item requested a series of ratings on five-point Likert-type rating scales. Scales represented the amount of agreement with a given statement between "1 = agree" and "5 = disagree". The first set of six items referred to the anatomical regions to which the exercise were thought to be directed, namely *lips*, *tongue*, and *jaw*. Additional items asked participants to indicate the perceived degree of stress *(1=very stressful to 5= not stressful), comfort (1=very comfortable to 5= very uncomfortable)* and *ease of coordination (1=very easy to 5=very difficult).*

The second set of seven items referred to the implied pedagogical and professional relevance of each exercise:

- This exercise is useful for my regular professional work.
- This exercise is appropriate for use with children.
- This exercise helps to improve perception of the anatomical region of mouth, tongue, lips and jaw.
- This exercise has an effect on the blood-flow at this region.

- This exercise has effects on lip-/jaw-/tongue-muscles.
- This exercise effects movement of lip / jaw / tongue.
- This exercise requires concentration while performing.'

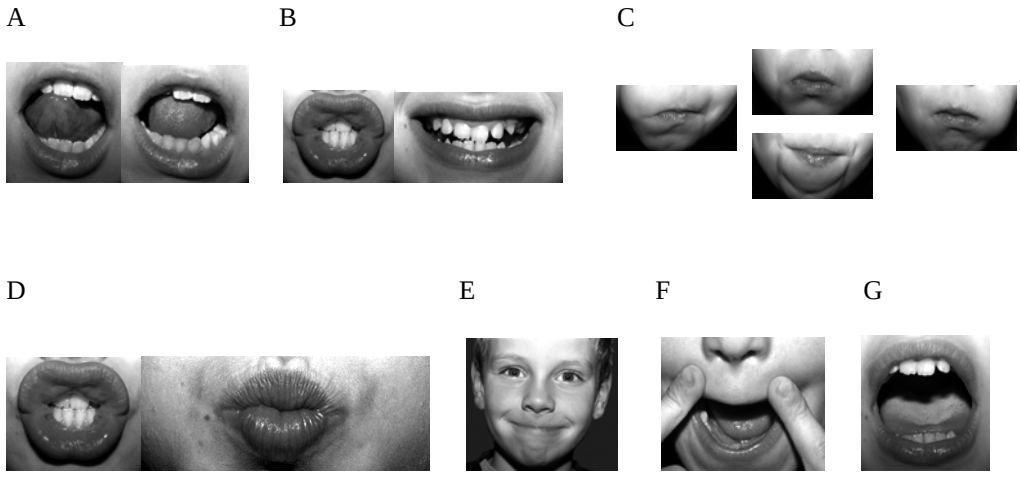

Figure 1 A - G: Example photographs representing orofacial positions as intendend in myofunctional exercises, orginal exerpts from questionnaire. A) 'counting teeth', B) 'wind mouth and showing the teeth', C) 'circulating candy and monkey mouth', D) 'fishmouth', E) 'clownface', F) 'upper lip fight', G) 'talking without tongue', see text for details. (Photographs by Claudia Schade. Copyrights by Rapp-Verlag, Badenweiler. Reprinted with permission).

Table 1: Numbers and names of exercises and the intended orofacial region.

Exercise No.	Description	Intended region	Figure
1	counting teeth	tongue	1 A
2	wind mouth and showing teeth	lips	1 B
3	circulating candy and monkey mouth	tongue	1 C
4	tapping with finger on jaw joints	jaw	-
5	fish mouth	lips	1 D
6	clown face	facial muscles	1 E
7	upper lip fight	lips	1 F
8	talking without using tongue	tongue	1 G

Scales represented the amount of agreement with a given item between "1 = agree" and "5 = disagree" (1=*correct to 5= incorrect).* Finally, the participants were asked the following open-ended question: "How useful might this exercise be for your work? [Von welchem Nutzen könnte diese Übung für Ihre Arbeit sein?]"

The last page of the questionnaire requested subjects to rate their overall impressions concerning each of the exercises on six-point scales. Items were:

- How much fun was it to perform the exercise?
- How useful would you consider the exercise for your professional work?

Finally, feedback on the quality of the questionnaire (and procedure) was collected by

means of seven further questions at the end of page 10, namely:

- Did you find the questionnaire clearly arranged?
- Did you fully understand the questions?
- Were you able to concentrate?
- Are you interested in the topic?
- Would you like to know more about (other) myofunctional exercises?
- Did you perceive the use of the little mirror as helpful for the exercises?
- Would you feel ready to participate again in a similar survey?

Options for answering these questions requested responses using three-point Likert-type rating scales: 'yes', 'no' and 'I don't know'.

Procedure

Sessions in which the participants learned to use the exercises and completed the questionnaires took place individually or in groups of up to three people. The locations for the research, usually practice rooms, offices, or other facilities of the Department of Music Education at the Goethe-University, were carefully selected to allow participants and researcher to work without external disturbances. The participants were given general instructions by the researcher about the aims of the study.

Table 2: Instructions given to participant groups for each exercise.

Ex.	Instructions
1	"1. Look into your mirror and open your mouth. 2. Tap with your tongue at each of your upper teeth, one after the other, just as though you are counting them with the tip of your tongue. 3. T.A.P (= tongue at place): when you have finished the exercise, rest your tongue at the place behind the line of your upper teeth, but without touching them."
2	"1. Start the exercise with T.A.P. 2. Your teeth should be in occlusion. 3. Shape your mouth round, letting your teeth show. Then stretch your mouth to both sides as shown on the photographs and hold the position for five seconds. 4. Repeat the exercise three times."
3	"1. Keep your mouth closed. 2. Move your tongue inside your mouth without opening your mouth or moving the jaw. Let the tongue move slowly in a circle in the gap between teeth and lips and move as circle-like-shaped as possible. The tongue slightly presses in outward direction as shown on the photographs. 3. After each fully completed round: T.A.P. Perform the exercise three times."
4	"Keep your mouth closed. Tap with your fingertips for about 30 seconds repeatedly and gently on the region of the mandible joint. Do you notice a difference before and after the exercise?"
5	"1. T.A.P. 2. Look into your mirror. 3. The line of your upper front teeth should touch the lower front teeth line. Hold this position while you perform the exercise as follows: Shape your lips as if it were for a kiss as shown on the photograph. Then open and close your mouth in a "fish-like" manner several times. Repeat the whole exercise three times."
6	"1. Your teeth should stand in occlusion. 2. T.A.P. 3. Your lips are closed. 4. Make faces like a clown."
7	"1. T.A.P. 2. The upper lip hides the upper line of teeth. The two index fingers massage the upper lip region above the lips' red. Direction of massage as can be seen on the photographs. During the exercise the upper lip should not move."
8	"1. Speak with a passive tongue resting inside your mouth. 2. Use your lips for articulation."

Moreover, any questions concerning the procedure were addressed to ensure that participants understood the purpose of the study.

Then the participants received the questionnaires, a ball-point pen and a small mirror to enable them to control their performance of each exercise. Table 2 summarizes the translated instructions associated with each exercise in the questionnaire. Instructions were identical for both participant groups and were also read aloud. Participants were given the opportunity to ask questions if anything was unclear to them.

Demographic data were collected together with informed consent after the evaluation of the exercises. The experimenter gave a brief demonstration of the exercises. After each one, participants were asked to imitate it using the mirror to monitor their specific actions of the required facial and tongue muscles. The experimenter gave further feedback on individual participants' performance of the exercises, where it seemed appropriate. She also answered any questions concerning the correct performance.

There were intervals lasting approximately two minutes after each exercise and its evaluation before the researcher and participant proceeded to the next exercise. The total amount of time to complete each session varied from 30 to 45 minutes.

Data analyses

Participants' ratings were treated as dependent measures in two sets of two-factorial repeated measures analyses of variance (ANOVA) to identify any significant main effects as well as interactions between dependent and independent measures. In these analyses, participant groups (musicians, speech and language therapists) served as an independent between-subject factor. Due to the predominance of females in both subject groups, sex was not considered as a factor. The first set of ANOVAs addressed ratings of overall characteristics shared between exercises, whereas the second set addressed ratings of specific aspects within each myofunctional exercise. The significance level for all analyses was set to $p < .05$. Free verbal reports were submitted to content analyses.

Results

Table 3 summarizes the mean ratings of general characteristics of the eight myofunctional exercises of each of the two participant groups. In general, the lowest ratings were attributed to the 'tediousness' of the exercises, whereas both groups provided higher ratings of the exercises in terms of being 'appropriate', 'useful' and 'fun'. The subsequent ANOVAs (Table 4) confirmed highly significant differences of ratings between groups across exercises for most items with the exception of 'useful', for which only a statistical tendency in differences of the ratings emerged.

Professional music teachers commented 79 times (10 responses on average per exercise) and speech and language therapists 115 times (14 responses on average per exercise) on individual exercises. The responses consisted of individual words, clauses, and complete sentences. The answers were predominantly positive with only a very few exceptions. A translated version of the complete list of verbal responses per participant group and exercise is given in the appendix.

The music teachers answered in respect to both general aspects such as warm-up practice, the building-up of muscles, relaxation, improvement of coordination, etc., and very specific aspects such as changing the sound by varying the tongue position when playing the clarinet, improvement in self-perception of the tongue, lips, etc.

Tab. 3: Means (and standard deviations) of ratings of general characteristics of myofunctional exercises with respect to the two participant groups.

		Exercise								
Variable	Group	1	2	3	4	5	6	7	8	Total
Tedious	Mus.	2.7	3.05	3.6	1.2	3.35	2.35	2.5	3.25	2.75
		(1.17)	(1.36)	(1.1)	(.52)	(1.09)	(1.18)	(1.28)	(1.37)	(1.13)
	Spe.	2.68	1.95	2.47	1.05	2.05	2.58	3.0	2.68	2.31
		(1.29)	(1.08)	(1.26)	(.23)	(1.13)	(1.31)	(1.41)	(1.46)	(1.15)
Pleasant	Mus.	3.25	3.5	3.2	3.95	3.35	3.8	3.25	3.1	3.43
		(.79)	(1.05)	(1.01)	(1.28)	(.99)	(.83)	(1.12)	(.85)	(.99)
	Spe.	3.16	3.68	3.53	4.05	3.47	3.26	3.0	3.05	3.4
		(.77)	(.67)	(.77)	(.78)	(.61)	(.87)	(.67)	(.91)	(.76)
Applicable	Mus.	3.01	3.9	3.15	3.15	3.55	3.9	2.95	3.45	3.38
		(1.43)	(1.25)	(1.27)	(1.66)	(1.5)	(1.25)	(1.47)	(1.54)	(1.42)
	Spe.	4.95	5.0	5.0	4.21	5.0	4.26	4.79	4.79	4.75
		(.23)	(.0)	(.0)	(1.23)	(.0)	(1.37)	(.21)	(.21)	(.41)
Appropriate	Mus.	4.0	4.15	4.0	4.05	4.35	4.75	4.1	4.55	4.24
		(.97)	(1.18)	(1.03	(1.19)	(.99)	(.44)	(1.07)	(.69)	(.93)
	Spe.	4.74	5.0	5.0	4.16	5.0	5.0	4.95	4.74	4.82
		(.45)	(.0)	(.0)	(1.07)	(.0)	(.0)	(.23)	(.93)	(.34)
Cognitive demand	Mus.	4.0	3.55	3.6	2.25	3.65	3.4	2.85	3.7	3.38
		(1.17)	(1.5)	(1.31)	(1.25)	(1.31)	(1.43)	(1.35)	(1.42)	(1.34)
	Spe.	4.79	3.95	4.0	2.68	3.84	3.42	4.05	4.32	3.88
		(.71)	(1.08)	(1.05)	(1.42)	(1.34)	(1.35)	(1.08)	(1.0)	(1.13)
Useful	Mus.	4.05	4.5	4.5	4.3	4.7	4.55	3.75	4.2	4.32
		(1.57)	(1.24)	(1.32)	(1.49)	(1.08)	(1.28)	(1.48)	(1.77)	(1.4)
	Spe.	6.0	5.95	5.85	5.15	6.0	5.3	5.85	5.75	5.73
		(.0)	(.22)	(.49)	(1.23)	(.0)	(1.17)	(.49)	(1.12)	(.59)
Fun	Mus.	4.65	4.55	5.15	4.3	4.7	5.05	3.35	5.05	4.6
		(1.09)	(1.19)	(.75)	(1.34)	(1.08)	(.95)	(1.53)	(1.1)	(1.13)
	Spe.	4.16	4.95	4.79	4.95	5.05	4.42	4.11	4.63	4.63
		(1.34)	(.71)	(.98)	(1.03)	(.71)	(1.5)	(.88)	(1.5)	(1.08)

Note: All ratings are based on 5-point scales except of "Useful" and "Fun", which were based on 6-point scales; larger numbers indicate greater agreement in all variables. Mus. = musicians (N = 20); Spe. = speech and language therapists (N = 19).

Tab. 4: Summary of two-factorial repeated measures analyses of variance (ANOVA) performed on ratings of perceived qualities of myofunctional exercises.

	Effects					
	Group		Exercises		Interaction	
Variable	F (1,37)	*p*	F (7,259)	*p*	F (7,259)	*p*
Tedious	4.03	.052	13.29	.001	4.28	.001
Pleasant	.18	n.s.	6.34	.001	1.31	n.s.
Applicable	26.12	.001	2.82	.001	3.5	.002
Appropriate	11.14	.002	5.31	.001	3.06	.005
Cognitive	3.2	.082	13.64	.001	1.45	n.s.
Useful	44.13	.001	1.91	.069	2.3	.05
Fun	.03	n.s.	5.77	.001	2.87	.007

Tab. 5: Means (and standard deviations) of ratings of individual myofunctional exercises as affecting parts of the orofacial physiognomy.

		Myofunctional exercise								
Variable	Group	1	2	3	4	5	6	7	8	total
Lips	Mus.	1.6	4.15	2.65	1.25	4.35	4.15	4.2	4.25	3.33
		(.99)	(.99)	(1.14)	(.44)	(.99)	(.87)	(1.5)	(1.21)	(1.02)
	Spe.	2.75	4.55	3.26	1.2	4.45	4.3	4.85	3.15	3.56
		(1.16)	(.69)	(.81)	(.41)	(.69)	(.8)	(.37)	(1.27)	(.78)
Tongue	Mus.	4.15	1.8	4.7	1.2	1.75	1.65	1.5	3.5	2.53
		(.93)	(1.11)	(.57)	(.41)	(.85)	(.75)	(.69)	(1.32)	(.83)
	Spe.	4.35	1.85	4.42	1.3	2.1	2.4	2.4	3.85	2.83
		(.81)	(.93)	(.61)	(.57)	(.85)	(1.23)	(1.23)	(1.53)	(.97)
Jaw	Mus.	2.9	3.2	2.85	2.65	2.95	3.15	2.7	3.0	2.93
		(.85)	(1.12)	(1.23)	(.57)	(1.19)	(1.31)	(1.17)	(1.21)	(1.08)
	Spe.	2.9	1.9	1.95	2.2	2.25	2.55	2.5	2.6	2.36
		(1.07)	(.97)	(.85)	(1.4)	(1.02)	(1.05)	(1.43)	(1.14)	(1.12)

Note: All ratings are based on a 5-point scale with larger numbers indicating greater agreement. Mus. = Musicians; Spe. = Speech and language therapists.

Specifically, speech and language therapists found the exercises significantly more applicable, appropriate, and useful than did musicians. Musicians found the eight exercises somewhat more physically tedious, although the statistical difference for this item just missed significance (Musicians: M = 2.75 [SD = 1.34]; speech and language therapists: M = 2.31 [SD = 1.31], p = .052). Notably, both groups found the exercises similarly pleasant and fun. A number of significant interactions were found between the independent and dependent variables, shown in Table 4. Thus, differences in judgments between participant groups were more pronounced for some, but not all of the exercises. Therefore,

evaluations of features such as tedious, appropriate, applicable, useful, and fun were influenced by both the participants' professional backgrounds and the specific exercise in question.

Ratings of the extent to which each of the eight exercises were thought to address lips, tongue, and jaw are summarized in Table 5 (previous page). While the nature of the exercise made it clear which part was supposed to be addressed, it was still important to identify any commonalities and the differences between participants' ratings. As can be inferred from the patterns of mean values, speech and language therapists and musicians were by and large consistent in their ratings across exercises. Nevertheless, there were significant effects for group and/or myofunctional aspect on ratings for the majority of exercises, as shown in Table 6.

Tab. 6: Summary of two-factorial repeated measures analyses of variance (ANOVA) performed on ratings of orofacial physiognomy as affected by specific myofunctional exercises.

	Effects					
	Group		Myofunctional aspect		Interaction	
Exercise	F (1,38)	*p*	F (2,76)	*p*	F (2,76)	*p*
1	6.5	.05	48.35	.001	4.11	.05
2	3.02	.09	84.65	.001	7.86	.001
3	1.1	n.s.	65.63	.001	7.56	.001
4	.39	n.s.	30.14	.001	1.3	n.s.
5	.2	n.s.	80.65	.001	3.71	.05
6	.22	n.s.	55.74	.001	5.16	.01
7	3.26	.08	101.13	.001	4.69	.05
8	1.07	n.s.	7.41	.01	3.71	.05

Discussion

In this study, groups of musicians and speech and language therapists evaluated a selection of eight exercises that were especially developed in the context of myofunctional speech and language therapy (OFT). Judges rated the practicability of the exercises in music teaching and speech and language therapy after a brief supervised practice period. Commonalities and differences in group judgments emerged.

First of all, it was easy for both groups of participants to detect the purpose of each exercise. Despite some differences, the overall pattern of ratings suggests that the objective of each exercise is similarly evident to both groups. In particular, exercises that were designed to provide the opportunity to practise motor control of the lips (no. 2 and 5) were thought to be most effective for the lips across groups. Similar patterns emerged for ratings of exercises nos. 1 and 3, designed to stimulate motor control of the tongue. Finally, the exercise for the jaw (no.4) was rated as being most comfortable and easy to perform by all participants. The groups disagreed as to their perceptions only of Exercise no. 1, while both gave the highest ratings for this exercise. It appears, then, that the intended characteristics of each individual exercise were perceived as expected by both groups.

Second, the speech and language therapists, who were more experienced in the myo-

functional approach, showed greater confidence with respect to the applicability, appropriateness, and usefulness of the exercises as compared to musicians. With respect to the last two items, however, the relatively high ratings in the musicians' group suggest that some positive aspects of the exercises in teaching wind instruments were observed. Nevertheless these results suggest that musicians might find it more difficult, in general, to incorporate myofunctional exercises into their teaching curriculum than do speech and language therapists.

It is worth noting, that, with respect to prospective clients, namely children, similar views emerged in both groups as to the exercises' emotional (fun, pleasantness) and cognitive aspects. Free verbal responses provided some details of how participants thought some of the exercises could be used in their respective fields. Specifically, some musicians specified a number of contexts in which a given exercise might be useful for enhancing the efficiency of teaching and practising. These observations contradict the more ambiguous results obtained from the overall ratings.

In sum, speech and language therapy practitioners found a set of orofacial myofunctional exercises highly acceptable, following brief exposure, as a way of enhancing general and specific motor control of speech production. By contrast, musicians and music teachers showed somewhat lower levels of acceptance in response to the same set of exercises. Future studies should address the effectiveness of learning strategies, which aim at a decomposition of the complex orofacial muscle activity used in the process of sound production particularly in the music domain.

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Appendix

Musicians' and speech and language therapists' verbal reports on myofunctional exercises.

Exercise	Musicians' verbal responses	Speech and language therapists' verbal responses
'counting teeth'	"Of great use so that my horn students (beginners) can catch a better feeling of the tongue and of the work with the tongue" (M1, female, 19 years); "Promotes the movement processes of the tongue (fine motor control)" (M3, male, 21 years); "Feeling the tip of the tongue without interrupting the melody line" (M4, female, 33 years); "Sound changes with change of position of the tongue" (M7, female, 21 years); "You can use it when explaining the concept of 'proper attack' of a tone [in playing wind or brass instruments]" (M8, female, 23 years); "Relaxing and consciously experiencing the tongue muscles" (M12, male, 21 years); "Conscious perception of the tongue and its relaxation" (M13, female, 26 years); "Conscious perception of the fine motorial use of the tip of the tongue. Room orientation of the tongue inside the mouth. Important for proper tone attack" (M14, female, 30 years); "Articulation with the tongue/perception of tension around the lower jar/ perception of the mouth" (M16, male, 30 years); "As a perception exercise; adding to this other exercises could be performed as well" (M18, female, 23 years); "To make pupils consciously aware of the meaning of the use of their tongue" (M19, male, 35 years); "Perception training for children	"Improvement in coordination and accuracy of motor movements" (S1, female, 39 years); "Breathing (inspiration) stops in most cases" (S3, female, 22 years); "Strengthening of tongue, improvement in coordination" (S4, female, 24 years); "Part of Orofacial Myofunctional Therapy to promote the ability to properly start the act of swallowing. Building up the the tongue muscles can be considered as a prerequisite for above" (S6, female, 25 years); "Orofacial Myofunctional Therapy: Adhering to tongue resting position, lip coordination, strength dosage, perception" (S10, female, 24 years); "Adequate tension of the lip muscles, support of the tongue's resting position" (S11, female, 24 years); "Improving coordination" (S12, female, 51 years); "Strengthening of the lip muscles, improvement concerning independent movement in respect to jaw and mouth. Maintaining the correct resting position of the tongue" (S16, female, 46 years); "Applicable in disorders of the face and mouth region" (S17, female, 43 years); "OFT, basic necessity" (S18, female, 46 years); "Getting a sense for distinction between lips and jaw" (S19, female, 62 years); "Sound initiation of the phonetics "s" and "sh" (known to be difficult for preschoolers)" (S20, female, 35 years);

	with attention deficit disorder" (M20, female, 49 years);	
'wind mouth and showing the teeth'	"Very good for my pupils." (M1, female, 19 years); "Relaxation." (M2, male, 23 years); "Training of the mouth muscles." (M3, male, 21 years); "Useful for children but still more for adults, to activate the mouth, lip and tongue muscles." (M4, female, 33 years); "Embouchure building; relaxation." (M7, female, 21 years); "Can be useful for embouchure building (explanation or control)." (M8, female, 23 years); "Building up the muscles; lip coordination." (M11, female, 20 years) "Training/stretching of the lip muscles." (M12, male, 21 years); "Activates tired lip movements, better perception of the lip tension." (M13, female, 26 years); "Consciously directing the muscles of lips and mouth as well as an adequate muscle tension of the mouth region is important to woodwind and brass players." (M14, female, 30 years); "Perception of jaw and tongue position/lip coordination." (M16, male, 30 years); "One can improve the articulation in singing (e.g. school choir)." (M18, female, 23 years); "Strengthening of the muscles, coordination; approach to embouchure building." (M19, male, 35 years); "Preliminary exercise for articulation exercises." (M20, female, 49 years);	"Strengthening lip muscles. " (S1, female, 39 years); "Strengthening of the muscles to obtain a proper mouth closing. " (S4, female, 24 years); "Part of the Orofacial Myofunctional Therapy to obtain the ability to correctly start the swallowing act. Supporting the lip muscles to obtain correct mouth closing." (S6, female, 25 years); "OFT = Orofacial Myofunctional Therapy." (S8, female, 39 years and S12, female, 51years); "see above." (S9, female, 27 years); "Orofacial Myofunctional Therapy: Adhering to tongue resting position, lip coordination, strength dosage, perception. " (S10, female, 24 years); "Adquate tension of the lip muscles, support of the tongue's resting position. " (S11, female, 24 years); "Improving coordination." (S13, female, 29 years); "Strengthening and coordination of the lip muscles." (S14, female, 26 years); "dito - tongue exercise." (S15, female, 31 years); "Strengthening of the lip muscles, improvement concerning independent movement in respect to jaw and mouth. Maintaining the correct resting position of the tongue. " (S16, female, 46 years); "Applicable in disorders of the face and mouth region." (S17, female, 43 years); "Getting a sense for distinction between lips and jaw. " (S19, female, 62 years); "Sound initiation of the phonetics "s" and "sh" (known to be difficult for preschoolers). " (S20, female, 35 years);
'circulating candy and monkey mouth'	"Relaxing the muscles, perhaps good aproach for embouchure building." (M1, female, 19 years); "Coordination training of the tongue ." (M3, male, 21 years); "Perception of the main tongue muscles and a large room inside the mouth is required." (M4, female, 33 years); "Rather useless; breathing not flowing. Tongue becomes solid." (M9, male, 25 years); "To show, that a tongue movement is	"Strengthening of the muscles (lip/tongue)." (S4, female, 24 years); "Part of Orofacial Myofunctional Therapy to promote the ability to properly start the act of swallowing. Building up the the tongue muscles can be considered as a prerequisite for above." (S6, female, 25 years); "OFT = Orofacial Myofunctional Therapy." (S8, female, 39 years and S12, female, 51years); "Promotes correct mouth closure." (S8, female, 39 years);

	also possible with an open jaw when mouth closed." (M13, female, 26 years); "Breathing has deepened. Orientation of the tongue in the mouth room. Tongue control." (M14, female, 30 years); "Decrease jaw and lip tension, reinforcement of tongue muscles." (M16, male, 30 years); "For clarinet players perhaps a good exercise to get a better feeling for the reed; in music lessons (generally) rather not applicable." (M18, female, 23 years); "Focusing on tongue movement as a preliminary exercise for singing." (M20, female, 49 years);	"See above." (S9, female, 27 years); "Tongue movement. Activation of certain muscle groups. Finding the tongue's correct resting position." (S10, female, 24 years); "Reorganizing the tension of tongue and lip muscles." (S11, female, 24 years); "Strengthening of the tongue muscles+ perception+ coordination." (S14, female, 26 years); "Ditto - mouth motor support." (S15, female, 31 years); "Strengthening of the lip muscles, improvement of skills in tongue movement, Strengthening of the tongue, maintaining the correct resting position of the tongue." (S16, female, 46 years); "See prominent answers.(relevance)" (S17, female, 43 years); "OFT, basic necessity." (S18, female, 46 years); "General basics in the treatment of Dyslalia. A favorite exercise." (S19, female, 62 years); "Training of lip closure + tongue strength/-tension. Specific tongue movement exercises (mouth muscle weakness, useful also for indistinct articulation and inter-dental malformations." (S20, female, 35 years);
'tapping with finger on jaw joint'	"Relaxes the jaw-joint." (M4, female, 33 years); "Eases. " (M9, male, 25 years); "Reduces tenseness." (M12, male, 21 years); "To become consciously aware of the of the resonance regions in the cheeks-/ and jaw. Reducing muscle tension in this region." (M13, female, 26 years); "Conscious use of the jaw when playing horn. Pupils learn to feel where the jaw joint is." (M14, female, 30 years); "Being aware of the jaw movement and the room of the inner mouth" (M16, male, 30 years); "To enhance ease of jaw and mouth movement." (M18, female, 23 years); "Enhancing conscious self-perception" (M20, female, 49 years);	"Supporting perception" (S1, female, 39 years); "Reduction of muscle tension in this area, particularly important in teeth gnashing." (S4, female, 24 years); "Jaw relaxation." (S5, female, 27 years); "Improves perception of the outside region of the mouth/oral area." (S6, female, 25 years); "See above." (S9, female, 27 years); "Perception training; activation of the facial tension; Tonus feel; relaxation of the jaw joint's; direct breath stimulation in correlation to the diaphragm." (S10, female, 24 years); "Supporting perception in the orofacial area as well as relaxation of the face muscles, especially useful in therapy of children'y and adult's voice disorders and muttering." (S11, female, 24 years); "OFT = Orofacial Myofunctional Therapy." (S12, female, 51years); "Reduction of tension in the jaw mus-

		cles." (S14, female, 26 years); "Supporting perception. Reducing tension." (S15, female, 31 years); "Perception and relaxation of the jaw joint." (S16, female, 46 years); "OFT, basic necessity" (S18, female, 46 years); "Self-perception, coordination; sense of touch and hearing." (S19, female, 62 years); "Relaxation of facial muscles/jaw. Patients with medical problems of the jaw." (S20, female, 35 years);
'fishmouth'	"Training of mouth and lip muscles." (M3, male, 21 years); "Enhances the abiltiy to discriminate differences in muscle tension; after exercise reduction of tension is noticeable." (M4, female, 33 years); "Makes firm." (M9, male, 25 years); Against feeble upper and lower lip movements." (M13, female, 26 years); "Being able to directly influence lip tension and movement, which is important to embouchure building on french horn. Feeling that breathing becomes more calm." (M14, female, 30 years); "Perception of the lip tension." (M16, male, 30 years); "Strengthening of the muscles involved in embouchure building." ." (M19, male, 35 years); "Sound formation." (M20, female, 49 years);	"Supporting mouth closure." (S1, female, 39 years); "Part of Orofacial Myofunctional Therapy to promote the ability to properly start the act of swallowing. Building up the the tongue muscles can be considered as a prerequisite for above." (S6, female, 25 years); "Support of the facial muscles, stop the physiological tongue situation at facial movements." (S8, female, 39 years); "See above." (S9, female, 27 years); "Activation of the upper lip." (S10, female, 24 years); "Eutonisierung (=proper tension) of the orofacial muscles." (S11, female, 24 years); "OFT = Orofacial Myofunctional Therapy." (S12, female, 51years); "Strengthening and coordination of the lips." (S14, female, 26 years); "Improvement on the tongue flexibility and the lip tension. Strengthening of the lip muscles, improvement of independence of jaw and mouth movement, improving compliance in maintaining the tongue's correct anatomical resting position." (S16, female, 46 years); "See above." (S17, female, 43 years); "OFT, basic necessity." (S18, female, 46 years); "Improving coordination and self-perception." (S19, female, 62 years); "Lip training for insufficient mouth closure. Good training in cases of too weak of a mouth's muscle tension." (S20, female, 35 years);
'clownface'	"Perception and training of all face muscles." (M3, male, 21 years); "Activates the face muscles very strongly. Induces of what the vocalists mean when using the term of 'singing forwardly' or 'bringing the	"Improvement of perception and motor control of the facial muscles." (S1, female, 39 years); "Part of Orofacial Myofunctional Therapy to promote the ability to properly start the act of swallowing. Building up

	voice forward'. Opens the interior rooms of mouth and nose." (M4, female, 33 years); "Relaxing embouchure." (M8, female, 23 years); "Building up the muscles; lip coordination." (M11, female, 20 years) "Training/stretching of the lip muscles." (M12, male, 21 years); " 'Waking up' the face and relaxation of hypertensed muscles." (M13, female, 26 years); "For loosening the muscles after or between horn playing." (M14, female, 30 years); "The feeling of relaxation after a completed exercise can be useful to the following singing." (M15, female, 33years); "Relaxation of the lips. Perception of the face muscles. Concentration." (M16, male, 30 years); "For giving relief if one has tensed up when playing the clarinet." (M18, female, 23 years); "Relaxation." (M19, male, 35 years); "Relaxing the involved muscles before singing." (M20, female, 49 years);	the tongue muscles can be considered as a prerequisite for above." (S6, female, 25 years); "Strengthening mouth closure and the correct anatomic resting position of the tongue." (S8, female, 39 years); "See above." (S9, female, 27 years); "Influencing the tension of facial muscles. Conscious activation of certain muscles (willfully influencing). Relaxation." (S10, female, 24 years); "Correct resting position of the tongue despite movement of the face muscles." (S11, female, 24 years); "OFT = Orofacial Myofunctional Therapy." (S12, female, 51years); "Activation of the complete face muscles." (S14, female, 26 years); "Strengthening of the tongue muscles. Independence of jaw and mouth muscles." (S16, female, 46 years); "See above." (S17, female, 43 years); "OFT, basic necessity." (S18, female, 46 years); "Usable in the treatment of all kinds of Dyslalia." (S19, female, 62 years); "Training of facial muscles in hypotense face muscles. Promotes lip closure." (S20, female, 35 years);
'upper lip fight'	"This one exercise trains exactly the muscles, necessary for a brass instrument." (M3, male, 21 years); "Due to the high position of the palate the resonance rooms are opened." (M4, female, 33 years); "None." (M9, male, 25 years); "Becoming aware of the upper lip. For warming up before starting to play on the instrument, since this exercise promotes the blood circulation." (M14, female, 30 years); "Relaxation of the lips. Perception of the mouth muscles." (M16, male, 30 years); "Massage." (M19, male, 35 years); "Warming up before singing." (M20, female, 49 years);	"Supports lip closure. Strengthening of upper lip muscles." (S1, female, 39 years); "Strengthening of the upper lip muscles. Achieving correct lip closure." (S4, female, 24 years); "Support of the lip muscles (lip closure as a part of the OFT-Therapy)." (S6, female, 25 years); "See above." (S9, female, 27 years); "Coordination/attention. Control of dosage of used strength. Strengthening the upper lip." (S10, female, 24 years); "Stretching upper lip muscles. Supporting the correct resting position of the tongue despite activity of the lip muscles." (S11, female, 24 years); "Strengthening of the upper lip muscles." (S14, female, 26 years); "Strengthening of the upper lip." (S16, female, 46 years); "See above." (S17, female, 43 years); " OFT, basic necessity." (S18, female, 46 years); "Perception and training of the lips. Coordination of hand and mouth." (S19, female, 62 years);

'talking without tongue'	"Relaxes the tongue and activates oral muscles and body tension." (M4, female, 33 years); "Sound is influenced." (M7, female, 21 years); "It's not a good exercise since it promotes hypertension of the back and the root of tongue and pushes on the larynx. For singing it is important, that as much space as possible is in the back area of the mouth." (M13, female, 26 years); "For activating the facial muscles (important for embuchure on the french horn)." (M14, female, 30 years); "I can imagine that this exercise can serve the vowel compensation in a funny way." (M15, female, 33years); "Perception of tongue, lips and jaw." (M16, male, 30 years); "Emphasizing the value of the tongue for speaking and playing an instrument." (M18, female, 23 years); "Strengthening of the tongue." (M19, male, 35 years); "Preliminary exercise to the training of articulation." (M20, female, 49 years);	"Muscles of the tongue are invigorated. The lip's shaping improves." (S1, female, 39 years); "Strengthening of the muscle group responsible for drawing the tongue backwards (M. hyoglossus), e.g. in the therapy of certain dental disorders." (S4, female, 24 years); "Part of Orofacial Myofunctional Therapy to promote the ability to properly start the act of swallowing. Building up the the tongue muscles can be considered as a prerequisite for above." (S6, female, 25 years); "Exercises the muscles responsible for drawing the tongue backwards." (S8, female, 39 years); "See above." (S9, female, 27 years); "Trains specifically the muscles responsible for drawing the tongue backwards. Important as an exercise for learning the correct swallowing-act." (S10, female, 24 years); "Supporting the muscles responsible for drawing the tongue backwards, important e.g. in articulation / myofunctional disorders." (S11, female, 24 years); "OFT = Orofacial Myofunctional Therapy." (S12, female, 51years); "Refreshment or strengthening of the (tongue)." (S14, female, 26 years); "Strengthening the muscles responsible for drawing the tongue backwards. Coordination of lip movements and concentration on the tongue." (S16, female, 46 years); "Exercise is harmful and not physiologic. It may lead to amplified mouth breathing and perhaps to compensation mechanisms in posture and muscle strain." (S17, female, 43 years); "OFT, basic necessity." (S18, female, 46 years); "Completely new for me, but super! 'will adopt it!" (S19, female, 62 years); "Requires precise listening, exercises the muscles responsible for drawing the tongue backwards. The speaking speed slows down" (S20, female, 35 years);

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