The learning of

trumpet, cornet and flugelhorn

A reasoned method

by

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Preliminary remarks

The author of this method is not a professional : he is neither a teacher, nor a performer or a « virtuoso », « master »,... . Simple private individual, self-taught person, amateur and passionate musician, he began to practice relatively late (at about 13-14 yo).

A « slight » habit with piano also allowed him to be aware of the differences between melodic instruments and harmonic instruments. The piano, as well as other keyboard instruments (organ, hapsichord, etc), are nearly the only instruments allowing « sticking » chords on (one say *« a piano amounts to an entire orchestra »* ?) : these harmonic forms endow them an musical enrichment which is important to know : the user of a melodic instrument (woodwind, non stringed, etc) can found advantageous the practice, in parallel, of such an instrument.

The informations incorporated in this method result from personal reflections accumuled since several years. These reflections have thus been cleaned up, and this was made easier by the profile of the the author (statistician as well as economist), and allowed the implementation of an methodic mind concerning the approach and the use of this instrument.

This method constitutes thus a synthesis of several other methods (cf appendix 4, **bibliography** in fine), of the listening of the great performers (even outside the brass players) and of a personal practice, sometimes unfortunately interrupted, of this magnificent instrument.

Every basis of knowledge necessary for the carrying out have, in this way, been systematically listed and matured :

(a) their respective role has been « isolatedly » analysed and tested ;

(b) interactions between these elements have been studied : combinations, simultaneities, precedences, accumulations, impossibilities.

With this method, one could set up a table crossing :

(a) the possibilies (« technical characteristics » or « functionalities ») of the instrument : sound pipe (or resounder), kind of emitted sounds, accessible range, mechanical or acoustic distinctive featuress (mouthpieces, cylinders and valves, slides, chord clefs, water clefs, mutes) ;

(b) the possible « tasks » for the instrumentalist, taking into account his characteristics : source of energy (muscles), vector of energy (air), vibrating reed (exciter).

A maximum of rationality has thus been looked for in this following offered method.

On can observe that, generally speaking, it seems impossible to advocate a unique teaching method, or only one way of work. It is much less possible to « forecast » the feasible level of succes according to personal efforts and objectives in time : this depends upon individual characteristics which take place in the playing of an instrumentalist. A good knowledge of techniques and of art, as well as individual abilities, are not always sufficient for reaching a desirable level.

Indeed, a diligent work, involving all individual abilities and exploring every dimension of the instrument, does not necessarily lead to « valuable » or of « professional » level results, nor of a « virtuosity » level, etc. One may like creating something without being « good » for that (as well as one may be valuable for something without liking doing it).

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0. Plan of the method

This method deals with the following questions.

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The following appendices are to be developed

Appendix 0. Some informations on the trumpet / cornaline

Appendix 1. Mouthpieces

Appendix 2. Abbreviated harmonic notations

Appendix 3. English-french lexicon and used abbreviations

Appendix 4. Selected bibliography

Appendix 5. Basic exercises

Appendix 6. Circular breathing

Appendix 7. Exercises on fingering

Appendix 8. Synthesis on the production of the sound

Appendix 9. Use of the piccolo trumpet

Appendix 10. Reflections on the psychological aspects linked to performance

Appendix 11. Glossary of technical terms or specific expressions

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1. Foreword and prerequisites

As every musical instrument, **trumpet is a demanding instrument**, requiring a good physical fitness, but also a lot of patience, concentration and efforts.

Nevertheless, this instrument offers **great satisfactions**, when playing as a soloist as well as playing with « accompaniment » (group of friends, orchestras, jazz bands, choir, etc). The performance of numerous compositions, more or less known, is enough rapidly accessible. Thus, it may be possible to play (eg within the 3 first years of learning) works such as the following ones :

(a) **baroque** and **classical** : « Suite in D major n° HWV 341 » or « Sarabande » by Georges Frederic Haendel ; « Trumpet's march of Aida » by Giuseppe Verdi, « The old castle château » (Picture at an exhibition, second picture) by Modeste Moussorgsky ;

(b) **folk** (folklore) or **pop** (popular). In the beginning, these works were generallys anonymous. Afterwards, they have often been appropriated by several composers : « Dear old Stockholm » (Sweden), « Amazing Grace » by John Newton ; « The carnival of Venice » (Autriche) ;

(c) **latino** (Latin america) : « Desafinado », « One note samba » or « The girl from Ipanema » by Antonio Carlos Jobim ;

(d) **jazz** : « When the saints go marchin'in» (negro spiritual, next gospel), « Killer Joe » (cf performance bay Quincy Jones) or « I remember Clifford » by Benny Golson ; « How high the moon » by Morgan Lewis ; « Harlem nocturne » by Earle Hagen ; « Mack the knife » by Kurt Weill ; « Nature boy » by Eden Ahbez ;

(e) **generics** or **themes** (movies music or broadcasting series), eg : « Cavatina » by Michel Legrand (movie « the cave se rebiffe ») ; « Cavatina » by Stanley Myers (movie « The deer hunter ») ; part for trumpet (movie « the marginal » from Ennio Morricone) ; « Les cinq dernières minutes (The last five minutes) » (TV series) ; « Midnight cowboy » (theme from the movie) ; part for trumpet in « Ma quando arrivano the ragazze » by Riz Ortolani (movie from Mario Pupi) ; parts for trumpet (in particular « muted ») performed by Miles Davis in various movies ;

(f) **variety show** or **miscellanous**, eg : « A trumpeter's lullaby » or « Serenata » (notably performed by Maurice André) by Leroy Anderson ; « Julia » form The Beatles ; « the petit jardin (The little garden) » by Jacques Dutronc ; « My way » by Claude François ; « Ballad for a trumpet » by Nini Rosso, « the Madrague » by Georges Bourgeois, etc.

It is also possible to **« adapt » works intended to other instruments** (brass, woodwinds or strings), by realizing possible transpositions (case of a Bb trumpet). This tendency seems to develop among greats performers. Nevertheless, this possibility meets some obvious limits :

(a) differences, sometimes rhedibitory ones, between ranges : eg pieces for piano or violin are almoste unplayable with a trumpet (even with a piccolo) ; even if playables, these pieces may be of a inadequate musicality ;

(b) the control of long breathing outs : thus, the « Moto perpetuo » by Niccolo Paganini belongs to the instrument feats of the genre (cf performances by Sergei Nakarjakov or by Wynton Marsalis) (cf § 3.2.5. and appendix 6, on **circular breathing**) ;

(c) nimbleness (velocity) : the inertia of trumpet playing, or classical difficulties in fingering, forbid the performing of some parts.

The « scale » of musical genres which are accessible with a trumpet is yet, all the same, very wide, as far as the range of the works matches the range of the instrument, and their nimbleness is not hindered by the (biological) inertia of the performer or by the (mechanical) inertia of the instrument.

One can then undertake its strudy with pleasure, either by playing alone, either with an « accompanied » manner : indeed, it is possible to develop musical accompaniments (§ 9.) that can be handled on a HI-FI system when playing simultaneously. This arouses and handtain the motivation. Moreover, this tends to favor progress at two levels : skill and mastery of the instrument (synchronization with the various elements coming into play), mastering of the coordination (synchronization with the accompaniment equipment, the band or the orchestra : rhythms, sound volumes, counterpoints, etc).

Afterwards, with growing experience, it will be possible to play for an audience of close relatives or friends, neighbours, colleagues), or again to play with other instrumentalists (group, orchestra).

1.1. Preliminary immodesty

The reading of methods for trumpet is always instructive : one can draw inside what seems useful for developping and improving one's own « **playing** ». Various methods are recognized and efficient (cf appendix 4, **selected bibliography**).

This trumpet method was, first, devoted to ... its own author. It is the result, indeed, of its own practice of the instrument, and it also get back various aspects of that practice which cause problems to him, and still continue ..., in every « dimensions » of the instrumental practice : articulations (tonguing and fingering), getting one's breath back (breathing), large intervals (flexibility), velocity (coordination and anticipation), extreme registers, etc.

Nevertheless, it seemed useful to offer it to whose are playing this instrument, at least as **exchange of experiments**. It assembles, indeed, appropriate informations for various individual « profiles » : personal characteristics or abilities. It also attempts a setup of the **necessary synthesis of knowledgs (and of understanding)** when learning to play with this instrument.

1.2. Work surface

Training oneself for playing trumpet implies first **organizing the training**. Several points have to be considered :

(a) first the **space**. An adapted **working place** allows one to concentrate quietly upon the difficulties to solve. It should preferably be « isolated » : music room, gymnase, nature (park, country), various buildings (chapel, church), etc. It must, moreover, be easily accessible (cf distances, limitations of access), and allow a sufficiently frequent use.

Un room in a housing (house or appartment) produces an enough violent « sound return », which can be harmful to hearing itself. Some instrumentalists carry out a sound isulation of the room (prevention of neighbour confusions). Others use specific mutes, which muffle sufficiently the sound ; some models allow, moreover, recording on personal micro-computer (eg the Silent brass by Yamaha). Nevertheless, a playing with a mute is generally more tiring than a « normal » playing without mute : it requires more breath and implies some endurance (holding of notes) ;

(b) then **time**. A serious practice makes it necessary to « take one's time », ie to make it a rule reserve ***time slots*** (preferably daily ones). According to individual circumstances, that avalaible time may vary a lot.

Moreover, according to personal equation and mentionned constraints, the **daily frequency of playing** (warming-up, training or performance) have an influence on its optimality. A **balance** must be done between :

(1) **« playign a short time, but more often »** (strategy rather for beginners, because it takes care of the lips of the embouchure),

(2) **« playing for a long time, but less often »** (strategy rather for skilled individuals, because it favors, and also necessitates, endurance).

The optimum is not easy to determine, as one has to take into account of the **essential and irreducible constraint of the rest** : incompressible periods of rest are necessary, as well between **pieces** performed during a « session » as **between sessions** themselves.

The general daily diagram (eg from 8 am to 8 pm) endows the following form :

playing1 (duration 1) - break1 (duration2) - playing2 (duration3) - break2 (duration4) - ... - playing n (duration n) - break n (duration n+1)

This diagram must not be considered as imposde nor rigid : the ***durations*** (work or break) and the ***number n of playings*** (warming-ups, technical exercises, excerpts of pieces) are to be determined in an adapted manner (age, availability, state of health, etc). When a personal diagram is determined, that is to say it is sufficiently convenient at a given time, it should be followed with a maximum faithfulness as it seems to produce good results and lead to significant progresses.

Som authors recommend an activity with a minimum daily duration (eg 40 mn), in order to maintain the last achieved level of performance. But this is only an objective, and may not suit every student : it does not take into account the progressive « inurement » (which allows more playing), and it can also be restrictive for an advanced student.

An empirical rule, which seems to prove itself, consists in making it a rule durations of pause (rests) as long as durations of playing (activity), whatever the total duration of the score (exercise, concert piece) to be performed. One can even observe that a « rest » lasting a day (or even more) allows a **« recovery »**, which can have the effect of improving the emitting of the notes (attacks) as well as their correctness (level) and their tone (cf § 2.8.1. infra) ;

(c) also, **objectives**. It is **valuable to impose oneself (realistic) objectives and to have the will of being linked to them**. As one goes along work experience and insurance, it will be possible to raise the level of difficulties.

Nevertheless, **one must never approach too much its own instant limits** : indeed, that fault leads to various « accidents » (tiredness, postural traumas, problems with lips). The « backlashes » may sometimes be more detrimental. On then must try spotting that « limiting activity area » and stay on this side of that area.

The individual work surface must then be adapted to one's possibilities : starting with « modest » objectives, then develop each kind of difficulty, seems beneficial ;

(d) the **patience**. The results of the efforts (the « returns on investment ») will not be immediate. Thus, the minimum times of rest indicated, which are imperative, tend to slow down them. At the beginning of the instrumental practice, these results are necessarily slow to get, then modest : this is normal. An important quality then is **tenacity** and **perseverance** ;

(e) **permanently get into mind each performance** before realizing it. A mean consists in getting used to (mentally) doing hearing the desired sound before producing it : in other words, **anticipating the expected sound product** is a beneficial attitude, which contributes also to increase self-confidence in playing. By exemple, the (mental) anticipation of the appearance of a given note (pitch, level) should favor a more reliable attack of that note (***anticipated mentalisation***).

Indeed, in everyday life, the activity consisting in participate to a conversation implies anticipating a context and ideas suggested by this last. It is the same for learning or improvising with an instrument.

Conversely, playing is comparable to reciting : the performance of a piece for trumpet presuppose its whole knowledge and cannot allows hesitation.

Between these two situations, the « reading » of a score, as well as that of writtent text, requires developping reflexes for linking together the tasks (reading, performance) between present and immediate futur ;

(f) **look for musicality inside performance** (whatever the piece, even a simple scale or arpeggio). It is suitable to put oneself (toujours mentally) instead of an audience : the produced sound must be the one which one himself would hope hearing (eg during a concert).

One must then be demanding, and take a very critical sense ... with respect to oneself. Third parties (teachers, friends) may such a way give sometimes very precious advices.

1.3. Prerequisites

As a ***wind instrument,*** a **trumpet** (or little « **trunk** ») will be briefly described. The name of **cornaline**, made up of the word **corne** and the name **Aline**, would « sound » much better. Other « objects » have besides the same name : a mineral, from one part, and a fruit (the one of the dogwood), from the other part.

1.3.1. The physical properties of the instrument, as well mechanical as acoustical, will not be detailed (cf appendix 0, **some informations about the trumpet**).

The **choice of a trumpet** is certainly important, but the **choice of a mouthpiece** is much more important. One can correctly learn playing with a poor instrument : indeed, ***all the qualities of the instrumentalist « make », above all, the sound*** (cf Julius Kosleck : « *with a good mouthpiece it is possible to play one a badly constructed instrument ; with a badly proportioned mouthpiece, it is impossible to produce a good tone or play with any degree of certainty* »).

Conversely, the characteristics of a mouthpiece influence the playing. They can, in particular, facilitate this playing. We sketch some general technical surveys on these subjects (cf appendix 1, **mouthpieces**).

1.3.2. **The instrumentalist will be supposed familiar with the music theory and musical writing**. This thus implies some habituation with the music in general. Indeed, the music theory and the notation system are **prerequisites pertaining to other courses or methods**.

It often happens that instrumental methods, adressed in particular to young players, contain at the same time (a) what pertain to writing and musical conventions and (b) what pertain to technics and ***instrumental performance***. This is generally the result of practical considerations : advantages of a teaching method paralleling these two courses, etc.

But this educational process loses its advantage when the basis of the music (music theory, harmony or counterpoint) are yet acquired. Moreover, one must not mix the kinds, and the **three activities of « language », « technics » and « expression » are really distincts** :

(a) the **language** (or the « rules » of the music theory) is nearly identical for every instruments : wind, strings, drums. There are some differences liked to their particular nature : stringed instruments (pizzicati, glissandi, tremoli), sticked strings (« mecanichal » pedals), rhythm section, etc. But the « kernel » of this language is the same ;

(b) nevertheless, most of the **technical rules** reported here for the trumpet are valid only for it, or for equivalent brass instruments : their technical mastery (eg working on breathing, tongue, fingering) require specific actions. These rules may be (widely enough) transposed to same kind of brass instruments (ie with mouthpiece and valves, rotary valves, or keys and holes) : eg french horn, trombone, euphonium, helicon, saxhorn, tuba, ophicleide. But some of them don not apply to some other wind instruments, notably the subfamily of wood wind instruments (instruments with simple or double reeds : saxophone, oboe, clarinet, bassoon, etc) ;

(c) the mastering of the **stylistic expression** (tone, shades) is also a source of difference with respect to instruments belonging to different families.

Thus, most instruments have in comon an increase if « tension » that is necessary in order to produce a sound ranging from low notes to high ones : indeed, when the sound « goes up », the increase in the frequency of the sound (exciter) is parallel to a stronger tension (labial reed, artificial reeds, strings, leather instruments).

Likewise, in the « classical » pieces, the ***vibrato*** is (as a rule) forbidden for a trumpet, whereas it is nearly the usual thing for a violin.

Furthermore, the ***scores for winds*** are generally « adjusted » on the ***respiratory aptitudes of the instrumentalists*** (thus with the rhythm of the human breathing), in order to produce the specific expression of the instrument. This is less true for the (pinched or striked) strings, even though the breathing of a violin player or of a pianist play an important role in the progress of his playing.

Finally, the story of the Music shows that its genesis comes, at the same time, from natural elements (vocal cords, hand beatings) and from artificial elements (hitted wooden pipes, blowing in horns, etc). But, the technical evolution of these elements, as well as their practice and the associated stylistics, have, to a large extent, diverged.

Moreover, one can underline that :

(a) the learning of ***music theory*** does not present any particular difficulty : it requires memory and a bit of logic. That is why its knowledge, which is not difficult to acquire, is here pre-supposed ;

(b) the ***musicale writing*** contains somtimes, for a wind instrument, specific precisions, concerning the mode of performing (technics for obtaining and returning musical sounds). This is notably the case for the times of inhalation (**times for breathings, indicated by commas** above the staff), for the way of performing various ornaments (mordant, grace notes, trills, vibrato, portamento, glissando) or special effects (jazz : growls, mutes and other effests, halway down valves, bell in water, etc) ;

(c) an even light knowledge of the ***theory of harmony*** is often worthwhile : indeed, (1) it facilitate the musical understanding in general, (2) it certains more the performance of arpeggios with the instrument, (3) it facilitate the coordination with other instruments and (4) it leads toward the techniques of improvising (« cadenzas » of baroque concertos, solos in playing jazz, various musical inventiveness, etc). The ***melodic and harmonic notations*** used here are indicated or reminded further (cf appendix 2, **abbreviated harmonic notations**) ;

1.3.3. Considering the above, this method contains only « **starts of exercises** » (§ 7) : these are ***models of short « melodic » lines*** classified by kind of difficulty. Contrary to numerous methods, one assesses unuseful the « filling » of pages with exercises detailed in every parts being to play : ie scales (major, minor, pentatonic, etc), registers (low, medium, high, hyper-high), various kinds of arppegios (basis and their reversals), etc. Indeed :

(a) these written paddings have an advantage in familiarise, visually, the player (notably young students) with the scales written with treble key (G2), then with the practice of the corresponding fingering. But that abundance of « systematic » scores is tedious, and is harmful : the attention to be carried toward **real technical difficulties associated to the practice of the instrument** risk then to be « flooded » in the waves of the scores ;

(b) moreover, if, during the performance of some exercises (scales, arppegios, up or down, with reversals, etc), the visualisation of the written scores is very formative (it favors their reading « in real time » and arouses skills for anticipating), it is also very useful to perform these exercises by **mental abstraction** (associated with the practice of performance and of fingering), that is without score under the eyes ;

(c) to sum up, one can (1) firstly, **work with a favorite scale** (eg an « easy » scale : C1, F2 or G2), then (2) secondly (ie once the technique mastered with the favorite scale), **work the same difficulties with each of the other scales, in turn**. In other words, one can postpone (temporarily) the performance of the other scales and arppegios as long as a technical difficulty has not been solved with the favorite scale. It is the same for each suggested exercise.

After eliminating the previous « paddings », some methods contain, finally, few useful pages for a technical training. As a consequence, the « heart » of these methods (approach, progressive solving and combining of difficulties) ie reduced to a limited number of educational elements. Some of them, rather old (ending XIXth-beginning XXth), thus contain few « exploitable material » (useful technical informations) and are, in the end, very disapppointing.

1.3.4. Appendix 3 includes an **english-french lexicon and used abbreviations**. This **terminology** may help the reading of written manuals in french language. One can notice some curiosities : thus, the Anglo-Saxon people call « ***mouthpiece*** » (or sometimes « ***chops*** ») what French people call « ***embouchure*** », and the french word « ***embouchure*** » (physical part of the instrument) is translated in english by « ***mouthpiece*** ».

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2. Anatomy and physiology

This chapter is central for the learning of the instrument.

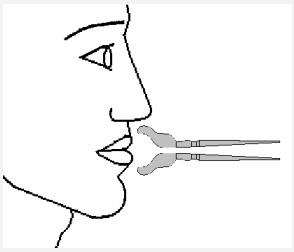
Play of a instrument tel qu'une trumpet consists in associating closely an **biological organism** and a **physical material**, then an « alive » and malleable element to an « inert » and hard element. Inescapably, the adequation of the first to the second must pass by an **adaptation** of the first element (**forming of the embouchure**) (cf infra).

2.1. Posture of the body

2.1.1. The whole body must **help performing**, and not hamper it : it is then necessary to check, at least at the beginnning of the learning, the position of the different parts of the body.

(a) **standing up** (eg when playing solo). One recommend maintaining the body quite droit and vertical, then bringing the instrument toward the face with the left hand. According to individual morphology (dentition and embouchure), the trumpet can be more or less tilted in order to get a maximum ease for performing : **the air must « pass » naturally** ;

Position of the instrument according to the morphology of the features and of the jaws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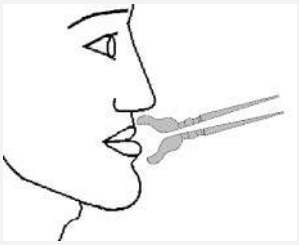
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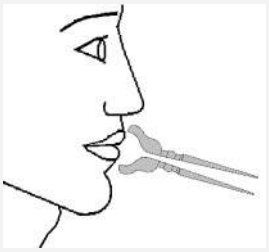
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(b) **sitting position** (eg orchestra). It is important not to cross the legs and hold in place the back, as straight as possible (thus not too much sink in the seat), in order to allow and secure an easy breathing ;

(c) in both cases, the elbows and forearm must be placed symmetrically on each side of the body, conforming to an angle about 45° (angle between the floor and the plane formed by the 3 following points : shoulder, elbow, wrist). A balance must here be done between (1) the **hampering of the breathing** when the ***arms are too close together*** from the trunk, and (2) the **tiredness of the arms** when the ***arms are too horizontal***. The instrument must, as a rule, be hold vertically (cylinders located in an imaginary vertical plane in front of the instrumentalist) : nevertheless, it may sometimes, according to the performer's morphology (right wrist and right hand), be slightly tilted toward the right or toward the left.

2.1.2. **Periods of intense or prolonged activity** (training or performance) may lead to various problems : pain in the back, in the arms, in the ribs, in the neck, in the abdomen, as well as in the lips or teeth. These problems entail, in particular, muscular stiffness (eg aches felt in the

cheeks). Besides the consequence of a too important activity (duration, efforts), they may result, as the case may be (the following situations may accumulate), from :

(a) a ***faulty posture*** (back, arms) ;

(b) an ***inadequate technique of breathing*** (abdomen, throat) ;

(c) a ***lack of training***, or a playing aiming at overcoming ***new difficulties*** (divers) ;

(d) the ***crushing of the middle embouchure*** with the mouthpiece (excessive pressure on the mouth) (lips).

2.1.3. An easier performance implies also an adapted **clothing dress**. This dress must be « confortable » and must not hamper the performer (breathing, moves of the arms) : it must then be baggy enough (nevertheless, cf eg Sergei Nakarijakov). Also, it must not upset him (heat, cold) : as most wind instruments, the **trumpet is a very « physical » instrument** which implementation requires a certain muscular effort (from the bottom to the top : abdominal belt, intercostal muscles, larynx, tongue and lips), which contributes, after warming-up, to increase the temperature of the body.

2.1.4. A **« left-handed »** should get used to play (then to work his fingering) with the right hand. The difficulty is comparable to that of the left hand of a right-handed person playing piano. It does not exist besides (almost) no trumpet for left-handed person (supplied at usual prices).

Moreover, trying to play with the left hand with an usual trumpet prevents, as a rule, the activation of the valve slides (necessary above all when playing in the low register), which are located on the left side of the instrument.

A sometimes recommended practice consists in training oneself, from time to time, by activating the valves with the non usual hand (left hand if the usual hand is the right one).

One can notice that, in the case of a brass instrument with « reversed » rolling-up (eg flugelhorn), a right-handed person must « passer » the right hand above the tube of the instrument. Likewise, a horn player must activate the rotary valves of the french horn with the fingers of the left hand, and this in any case.

2.1.5. One will pay a particular attention to the **forth finger of the usual hand** (right or left one) (***ring finger***), which activates the valve n° 3. Indeed, this finger is the one which « articulates » less than its neighbourings. There is so a « natural » (ou physiological) heterogeneity in the ease of the mouvement, which makes unequal the action of the used fingers : 2 (index finger, on valve 1), 3 (middle finger, on valve 2) and 4 (third or ring finger, on valve 3). This last is, in a way, « enclosed » and « hampered » in its movement.

As for the piano, one can ***activate this articulation*** by particularly well-keeping the concerned fingerings (cf infra), and prepare this work as follows (warming-up) :

(a) put the active hand face down on a table ;

(b) lift the forth finger (ring finger) as high as possible (but without forcing), then lower it in a rest position ;

(c) repeat many times (a) and (b) at a given speed ;

(d) next, progressively accelerate the tempo.

2.2. Important remark

The holding of the trumpet implies 3 « supports » :

(a) the ***left hand***, which must enclose the cylinders in order to get a good holding of the instrument, but without contraction ;

(b) the ***right hand***, which thumb and little finger support also more or less the instrument (the one under the start of the tube, the other in the hook or in the retaining ring) ;

(c) the ***median and inner embouchures***, located behind and against the mouthpiece, which fit the shape represented by its front rim (and, secondarily the basin).

According to the difficulty of the piece to be performed, and in particular, the « heaviness » of the fingering (forks, bascules), these 3 points may have a tendancy to move. Indeed :

(a) on one hand (upstream), the supply of air stream coming from the lungs contributes, as well as the move of the lips, to make the instrument moves ;

(b) on the other hand, the ends of the median fingers (second, middle and third), which activate the buttons of the valves, are « disruptive » elements because they transmit vertical more or less fast moves to the instrument, and these moves may have an effect on the lips.

A too fast or strong move of the mouthpiece risk to hamper the performance (failure). But, the lips must not, in any case, be « too » much pressed against the mouthpiece in order to try helping to stabilize the set.

The only one solution, notably for preserving the **best possible reliability (or safety) in the attack of the notes**, lies then in the three following actions :

(a) a **firm holding of the trumpet** : that holding commes mainly from the ***left hand***. One can surround the cylinders with the help of a thick « handkerchief », or of a leather « glove » (anti-corrosion protect-valves), so as to weaken the pressure on the fingers (notably, the index finger) of that hand (risk of numbness) ;

(b) a possible **push (towards the left) of the palm of the right hand against the cylinders**, as far as this does not hamper the activation of the valves (because the palm contains the muscles and the nerves which allow activation of the phalanxes) ;

(c) and, above all, the **reinforcement of the embouchure** (development of its muscles) (cf infra) which contributes, finally, to a better stability of the instrument.

2.3. The embouchure and its parts

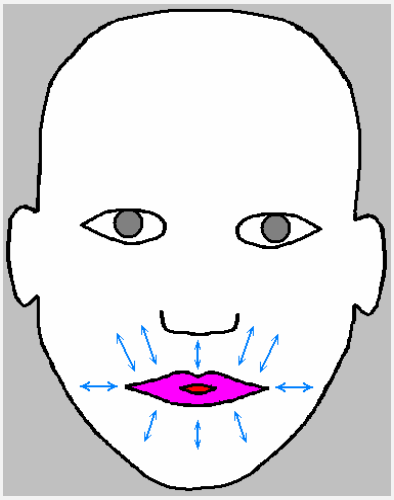
The **embouchure** denotes the set of the muscles, nerves, capillary vessels and skin which surround and include the round muscle of the mouth (lips). Thus :

(a) the **lips** contain interlaced muscles. The set of the labial and peri-labial musculation consists of : the orbicular muscle of the mouth, the compressor of the lips, the depressor muscles of the ends of the mouth, the depressor muscles of the lower lip, the mental muscles, the levator muscles of the alae nasi and of the upper lip (superficial muscles, deep-seated muscles), the levator muscles of the ends of the mouth, the levator muscles of the upper lip and the depressor muscles of the nasal septum ;

(b) the **cheeks** consist of the ***masseter*** muscles, the risorius muscles, of the ***buccinator*** muscles (cf in french ***buccin*** = marine whelk and also antique wind instrument) and the zygomatic muscles (big zygomatics, little zygomatics).

The labial and peri-labial muscles work towards various directions (cf diagram below).

Embouchure and face



Yet, the work of these muscles is fundamental for the instrumentation : it should then be highly progressive and well controlled. One may also **consider the « embouchure » as a set of muscles, covered with the dermis, irrigated by the blood and activated by different nerves**.

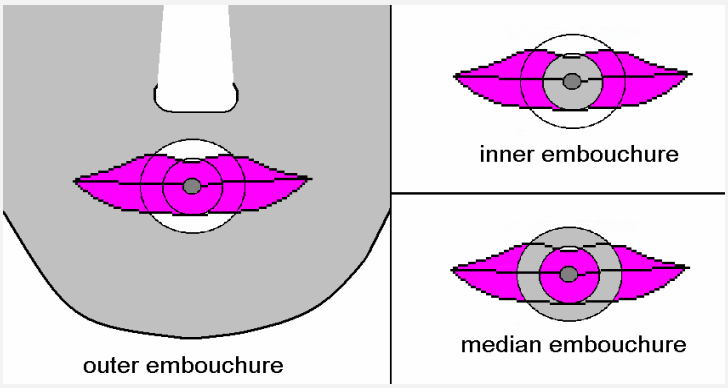
The working of the embouchure (muscle-building, mobility and vibration) during the playing has the effect (a) to modify the « shape » of its surface in various places and (b) to support the contact with the instrument (mouthpiece). As a consequence, during the dynamics of the performance, the deformations of the embouchure will interfere with the fixednes of the instrument : the embouchure plays the role of a **biological zone in touch with the mouthpiece or reinforcing this contact**.

A major objective of the instrumental practice consists then in **training the various muscles of the embouchure**, as well as one trains the specific muscles of a given sport activity.

When seeing a performance, one can observe the way following which the whole embouchure of the performer deforms under the the action of his muscles : according to the performet or to the difficulty of the piece to be interpreted, these moves are sometimes tiny, sometimes more visible.

One can decompose the embouchure in **3 parts** (represented in light grey in the chart below) : the « inner embouchure », the « median embouchure » and the « outer embouchure ».

The three embouchures



2.3.1. The **median embouchure**, or **middle embouchure**, refers to the zone of the mouthpiece which is on contact with the face, ie between the mouthpiece and the lips (or even a neighbouring part, according to the thickness of the lips).

It is a **supporting zone**, a « cushion », on which the mouthpiece leans. This **support has the sole purpose of air tightness** : the objective is to prevent the air stream from flewing by the lateral cracks (**corners**), in order to guarantee its whole power by concentrating the air flow inside the bowl of the mouthpiece.

One must absolutely not crush that part of the embouchure (this crushing is often instinctive among beginners) : indeed, **this cushion must always have a good rush of blood in order to be operational**. A lack of rush of blood, or restricted rush, in this area, entails serious consequences :

(a) first, ***anoxia of the nerves and of the muscles*** (ie insufficient oxygen due to weak breathing), thus a ***lack of reaction*** (supleness and flexibilite of the lips) ;

(b) this then induces a ***lack of vibration*** of the lips which, itself, entails a reduction of sound or a ***smothered sound*** ;

(c) finally, one observes two other important faults : ***reduction of the accessible range*** and ***fall of endurance***.

The median embouchure is a zone of the face which is, at the same time, very small and very frail. One must **permanently handle it carefully** (this notably for beginners) and avoid any abuse towards it : excessive pressure, overwork (lengthy or too « strong » exercises), bad position (body, head, fingers, instrument), etc.

The choice of a mouthpiece depends, notably, upon two parameters (diameter and thickness of the rim), which exert an influence on the pressure and oxygenation of the lips (cf §§ 1.2.1. and appendix 1, **mouthpieces**). Yet, the thickness of the rim has an influence on the median embouchure at two levels : as the thickness of the rim increases, the pressure on the median embouchure reduces (ceteris paribus) and the risks of leaks of air flewing by the corners are lesser, but the moves of the lips (flexibility) are more hampered by increased rubbings between the lips and the rim.

A good flexibility implies an almost null pressure of the mouthpiece upon the lips : an interesting exercise consists in trying to get hight tones by pinching the lips, but without crushing it under the mouthpiece (*« no pressure » method*).

One must notice that, without these precautions, the median embouchure would be « trapped », being enclosed between the set of teeth (dental « wall ») and the mouthpiece, all these zones being hard, or even agressive (according to the individual morphology) : this is the reason why the holding, conscious and permanent, of its integrity, of its freedom of manoeuvre and its supleness are a efficiency factor in playing trumpet (tone, flexibility). This cushion must always be sufficiently thick for being operational. The physiological movements can then be realised in accordance with their natural course : blood → nerve → muscle → pressure.

2.3.2. The **inner embouchure** refers to the part of the lips located inside the previous median zone : it includes the **vibratory zone of the lips which surrounds orifice for the exit of air** : this zone will be called **oral opening (OO)**. It is via the OO that the air passes, going from « biological element » (the mouth) toward the « physical element » (the instrument).

That **« unconstrained » zone** (or **« free zone »**), **with respect to** the instrument, is then mainly situated behind the basin of the mouthpiece.

The inner embouchure is a **« zone of vibration » of the lips** (« buzz » comes from the onomatopoeia « bzz ») : it is a « double labial reed », that is a biological vibrating reed (exciter of the acousticians).

The labial muscle is then, at the same time, a muscle and a vibrating reed.

Each vibration produced with the inner embouchure initializes a **sound wave** which develops inside the mouthpiece, the plug and the tube of the instrument, until the bell and beyond.

Although various studies on this matter do not always agree together, one can limit himself to a ***simple interpretation of the mechanism*** (cf diagram below). This last follows the course of the « physiological » air stream before the OO, then the « physical » course of the air stream located after the OO (ie inside the instrument) (« horizontal » air stream) :

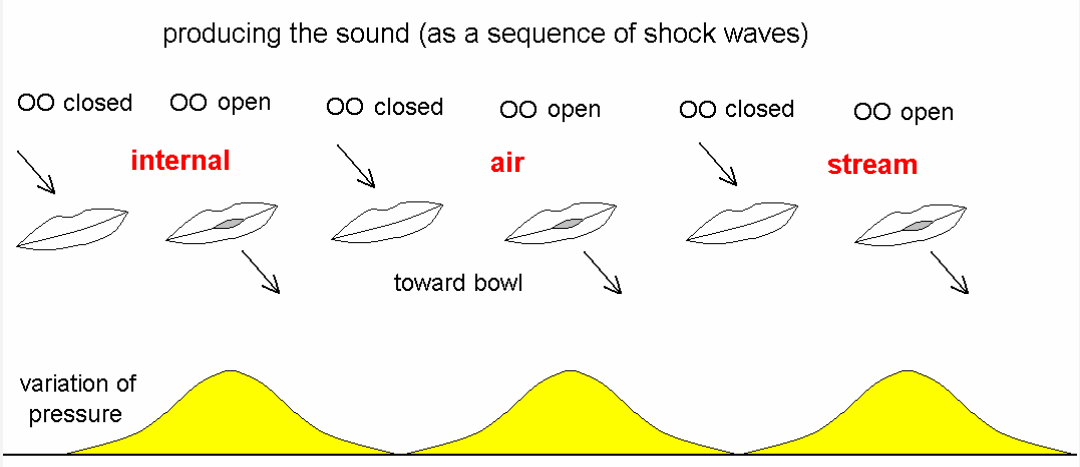
(a) **closed lips** (***vertical compression from one toward the other***) the air flow coming from the inner air stream (lungs) comes under ***pressure*** inside the mouth, then behind the lips : this zone will be called **oral cavity (OC)** ;

(b) the **increasing pressure succeeds in forcing the aperture of the OO**, zone with lesser strenght. That simple fact provoque a ***sudden leak of the air*** (from the back to the

front), through the OO and toward the outside, then inside the basin (then in the throat and the backbore) of the mouthpiece. This leak then creates a **first shock wave** ;

(c) symmetrically, after the aperture of the OO, the ***inner pressure*** of the mouth reduces. Because of the **permanent action of the muscles with the aim of close the OO** (vertical compression of the lips), this ends up provocating a **stopping of the emission of air through the OO**. This stop leads a ***fall of pressure inside the bowl***, ie the end of the first shock wave. The innere embouchure and the OO play in this way a « simple » role of **vibrating reed** ;

(d) under the action of the muscular compression (abdominal and intercostal muscles), the lungs empty and the internal pressure of the OC increases again : the previous mechanism {(b),(c)} starts again. As a consequence, the sequence of such mechanisms handtain the production of shock waves, thus the frequency (height) and duration of the sound.



Depending on wether the action exerted by the instrumentalist towards different variables (level of inner pressure, morphology and plasticity of labial muscles), the cycle {(b),(c)} executes more or less quickly, and this determines the frequency of the beats impulsed to the air :

(a) the relaxation of the muscles of the throat (aperture of the pharynx), the falling of the tongue and the relaxation of the labial muscles, lead to a fall of the inner pressure, and then slow down the previous process : this provocates a fall of emitted frequencies, that is a production of tones going toward low pitched notes ;

(b) conversely, an increased tension of the preceeding muscles and the ascent of the tongue increase the internal pressure, and accelerate the previous process : this increase of the emitted frequencies imply a production of tones toward high-pitched notes.

The vibration of the lips is then :

(a) **« controlled »** (at both biological « ends ») : on one hand, by the ***inner pressure of the lungs and the OC***, on the other hand, by the degree of ***aperture of the OO*** ;

(b) « **modulated** » (at an « intermediate » level) by the ***aperture of the throat (pharynx) upstream*** and by the ***height of the tongue*** under the palate (cf infra). These parameters determine ***the shape and the volume of the OC***.

The following diagram clarify the way the **movement of the lips** influences the emitting of the sound (high ou low pitched) as these are more or less pressed together (and not against the mouthpiece !). If one supposes a sufficient pressure of the air inside the biological air stream (compression of the abdominal and intercostal muscles) :

(a) positionning the **lips as in a resting position** (middle position, diagram 1) gives a vibration with generally « middle-pitched » notes (eg between E1 and A2) ;

(b) **« rolling up » of the lips** toward the inside of the mouth (compressed position, diagram 2), together with a vertical compression and a sufficient horizontal muscular holding (avoid « smile » too much), favors the emitting of hight-pitched notes (eg over A2) ;

(c) conversely, **« unrolling » of the lips** toward the outside of the mouth (relaxed position, diagram 3), together with a vertical decompression and a same muscular horizontal holding, helps the emitting of notes in the low register (eg below E1).

In this last case, an extreme relaxation even allows to « leave » the normal range of the trumpet toward ultre-low register (ie under the lower limit of F1#). Indeed, coupled with opening the larynx and lowering the tongue, this relaxation allows :

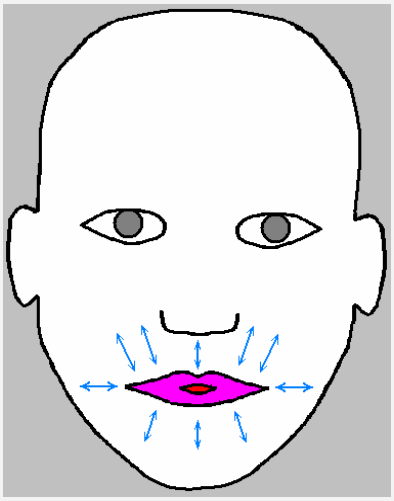
(a) the reaching of F1 (by use of the slides of the valves 1 or 3) ;

(b) the emitting of **pedal notes**, which are not « musical » notes (ie pleasant to hear) (cf infra).

2.3.3. The **outer embouchure** refers to the rest of the embouchure, thas is handly the whole of the other muscles of the face, and handly the **corners of the lips**.

That **reinforcing zone** helps, also, for emitting the sound. It is important because the (left and right) corners of the lips must be activated and worked in order to support the action of the inner embouchure and of the exhaled air (cf following diagram). Moreover, it may happen that a sustained training cause « aches » (slight pains) of the outer embouchure, because these muscles are not usually as trained as those of the other embouchures.

Main part of the outer embouchure (peri-labial zone)
(arrows indicate the direction of the muscular compressions)



2.3.4. During the learning, it is necessary to **mentally « separate »** what is a matter for each of these areas of the face, that is to succeed in identifying these parts of the whole embouchure as well as the role of each of them. Faced to experience, one observes that (other things being equal) :

(a) **hard and firm corners** are opposed to a **soft OO**, which must remain « fleshy » (vibration) ;

(b) the **horizontal compression of the corners** (mouth put forward, like a « kiss ») makes easier the descent toward low-pitched notes (low frequencies) ;

(c) the **vertical compression of the corners** (mouth put backward, with a moderate « smile ») makes easier the ascent toward high-pitched notes (high frequencies).

2.4. The air supply

Every expulsion of air through the mouth is necessarily preceded by an entrance.

2.4.1. Entrancewise, the breathing in is caused by lowering an important muscle, which is often « forgotten » : the diaphragm. This last contributes to inflate the abdomen, as far as the filling of the lungs happens « from the bottom ».

Very often, this cette inspiration is produced in a sudden way, in order to inhale very quickly an amount of air at moments (sometimes very short) separating the production of two successive notes.

2.4.2. When going out, the moving of the air inside the body and inside the instrument defines the notion of **air stream** (***gaseous environment***). This move is mainly due to the **pressure of the abdominal belt** (meaning here : abdominal and intercostal muscles). This carrier of compressed air is the **fondamentale source of energy** which initiate the sound : a well controlled ***air supply***, or ***air flow***, together with a sufficient quantity, allows the production of musical sounds.

By sound **musical**, one generally means a sound which combines the **accuracy of the emitted note** (good height of the sound, or exact frequency) and its **sound quality** (that which makes the musical interest and the specificity of the instrument). Concerning the « cornaline », one can remark that :

(a) a **musical note may not be right**, because of the acoustic wrongness of the instrument (cf infra) ;

(b) conversely, a **right note may not be musical** (eg when forcing the trumpet with the playing of the lips).

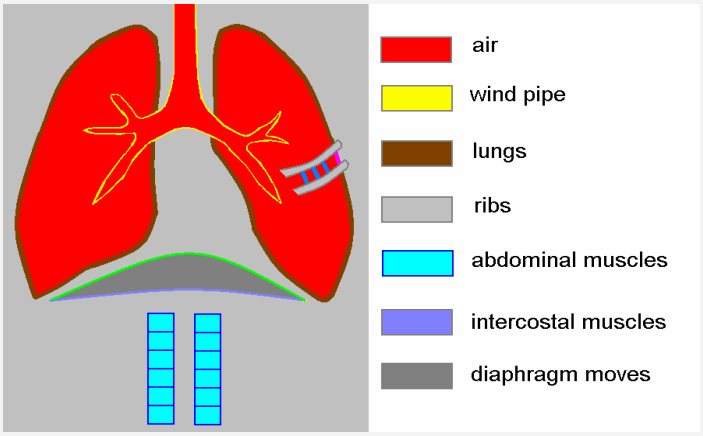
Thus, ***air is a gas which compression originates the sound***. That compression results from the ***energy*** emitted by the rib cage and the abdomen by activating (contracting) the abdominal and inter-costal muscles : these contractions may be slow or fast (ie « abrupt ») (speed), weak or strong (power).

As soon as the pre-warming-up (breathing exercises) and the warming-up (cf infra), one must use this air fully. One has to ***think at the same time to the inspiration and to the expiration*** : a « good » inhalation (inspiration) must lead to a « good » exhalation (expiration) (cf diagram below).

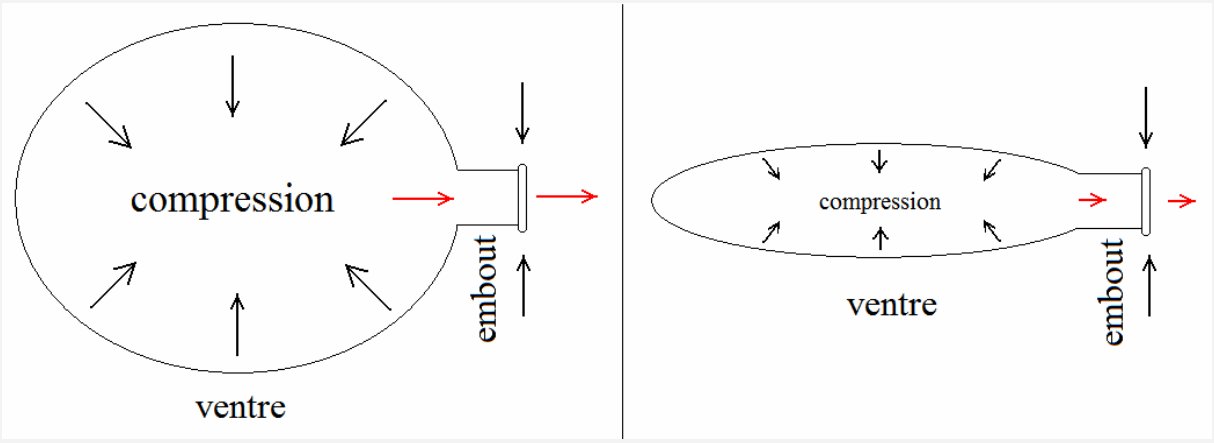
The lungs, the intercostal muscles and the diaphagm

(cf http://www.anatomie-humaine.com/Espace-intercostal.html?id_document=128)

(cf http://www.anatomie-humaine.com/Le-diaphragme.html)



2.4.3. A **comparaison with a toy balloon** (toy made of latex) is eloquent :



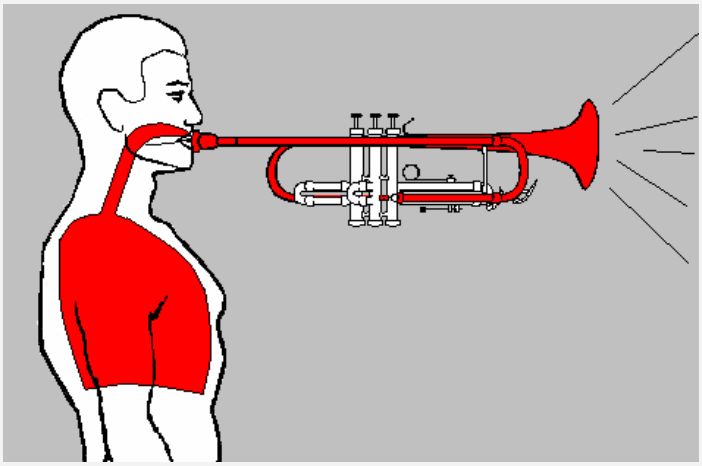
(a) inflation of balloon : this necessitates an initial effort (or energy). The air is kept prisoner by keeping closed the cylindrical tip of the balloon (stretching of its ends). The rubbery elasticity of the balloon then induces forces pressuring the air (directed towards the inside of the balloon) ;

(b) by slightly relaxing the end of the tip, the balloon deflates : this results from its inner pressure. That inner pressure, resulting from the air and the closing of the tip, then entails the vibration of this last : it is the buzz. By letting varying the stretching of the ends, the pressure (thus the speed of expulsion of the air) vary : this allows augmenting (hight notes) or reducing (low notes) the emitted frequencies.

The bag of the balloon corresponds to the abdominal muscles (intercostal as well as abdominal ones), the inside of the bag corresponds to the lungs (and, to a certain degree, to the OC) and the tip corresponds to the lips.

2.4.4. The ***sound quality***, the ***endurance***, the ***range*** and the ***flexibility*** of the performer depend on the way this air flow is managed, as well as input flow or output flow. In short, **the management of this air flow and an absolute sound control are the fondamental activities** of the instrumentalist.

Movement of the air flow
Volumes of air are represented in red (internal and external « air columns »)



In order to expire the air, the volume of air inside the lungs (filling) must be sufficient.

It is nevertheless **unnecessary to fill the lungs excessively** : this distends the intercostal muscles too much, and restricts their elasticity, thus their reactivity for creating a sufficient compression. Indeed, too much inhalation of air leads to an exaggerated extension of the muscles and tendons of the abdominal and intercostal zones, which makes it more difficult breathing out, and also the reactivity during the playing.

A ***stronger muscular strain*** (measured eg as kg / cm) makes more difficult the expulsion of the air, thus tends to limit the ***speed of expiration*** (eg as cm^3 / s) ; on the contrary, a weaker tension tends to augment that expulsion. The fonction f linking up these two variables T and V is thus, as a rule, of a decreasing shape, ie :

$$V = f(T_-),$$

where the sign - indicates a negative derivative of V with respect to T.

It should then exist an intermediate « zone » (couple tension - speed) which allows playing in sufficiently confortable conditions. That zone may vary greatly from an individual to another.

In some cases, a sequence of inspirations and expirations can help the relaxation during the playing, but its excess can also provoke sensations of falling asleep or even vertigo. Elsewhere, for lack of in time inhalation, a « lack of air » can provoke a kind of suffocation (sudden getting one's breath back) detrimental (to the performer as well as to the performance). On then must avoid this type of situation (blockings, anoxia).

It is sufficient to inhale enough air in order to realize the necessary expiration effort. One estimates sometimes that the effort necessary for getting a forced expiration, ie a sufficient compression, is similar to the one consisting of cough : indeed, this (sudden) effort contracts the abdominal and intercostal muscles from a way comparable to an exhalation inside the instrument.

In order to train oneself in realizing these efforts with the aim of forming the sound, one can practice :

(a) various **apnoea exercises** (cf § 3.2.) ;

(b) various ***sudden expirations of the air*** (HU), as during a coughing fit : these last result from abrupt compressions of the concerned muscles (abdominal and intercostal ones). Until possible opposite indications, the suggested exercises may be started with this kind of « attack » of the sound.

The exercises with tied notes or with tonguing are useful for checking the flow of air : indeed, if the air stream is interrupted, the sound weakens or stops. The ***interruption of the air flow*** is generally due to one, or many, among the following factors : insufficient inspiration (according to the length of the phrase), insufficient support of the abdominal belt (abdominal and intercostal muscles), too small opening of the throat (pharynx) and a position of the tongue too high, OO badly hold in place towards its closing (vertical compression of the lips between themselves).

Remark. A good inspiration and a good expiration need a **sufficient aperture of the throat (pharynx)**. One distinguishes various muscles in the « back » of the throat :

(a) in the ***peripharyngeal space*** : the digastric muscles, the stylo-hyoidian muscles, the stylo-pharyngians muscles, the stylo-glosses muscles, the petro-pharyngian muscles, the pterygoidian muscles (lateral muscles and median muscles) ;

(b) inside the ***rhinopharynx*** and the ***oropharynx*** : the ***constrictor muscles*** of the pharynx (upper and middle muscles), the muscles of the soft palate (tensor and elevator muscles), the ***palato-pharyngian muscles***, the amygdalo-glosse muscles, the palato-glosse muscles and the uvular muscles.

A sufficient aperture of the pharynx helps, moreover, getting a full and clear sound.

As the management of the air must be contreled at the beginning, it must afterwards become automatic and natural, as during an ordinary conversation. The trumpet player must then train his breathing (cf § 3.2.).

The air flow leads to the production of the notes via the vibrations of the OO, and this vibration increases all the long of the pipe (plug and gimlet of the trumpet). The sounds simply come from putting in vibration the air stream at the OO level : there is thus a coupling of an ***exciter*** (the OO) and of a ***resonator*** (the « cornaline »). This is an exemple of **resonance phenomenon (or « entry in resonance »)**.

2.5. The work of the tongue

The ***muscles inside the mouth*** play a particular role. One can list several of them : mylo-hyoidian muscles, genio-hyoidian muscles, genio-glosse muscles, longitudinal muscles (below the tongue), hyo-glosse muscles, transverse muscles of the tongue, longitudinal muscle (above the tongue).

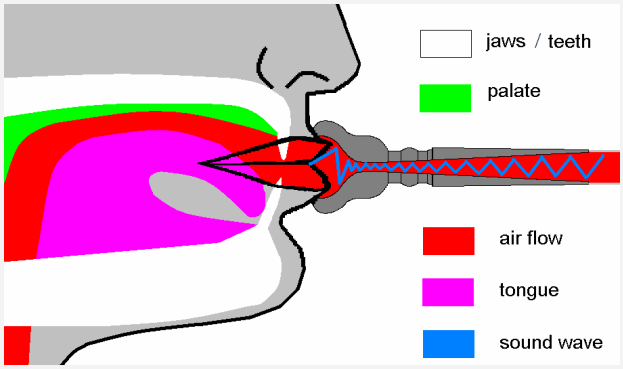
2.5.1. The ***muscles linked to the utilization of the tongue*** are to « help » the production of the sound. The **tongue does create the sound**. Indeed, the **tongue is an intermediate tool which controls the flow of air** by restricting more or less the sound flow. It simply changes the direction of the initial sound production. Thus, the lingual muscles are used :

(a) from one part, for the (lingual) ***articulation***, ie for the ***production of the notes*** ;

(b) from an other part, as important tools for developping the ***flexibility*** and extending the ***range*** : the position of the tongue inside the OC makes its volume and shapee vary, which helps getting a given height of the sound.

The training and the mastering of the tongue then constitute factors for progress (cf diagram below). As the tongue is used to modify the shape and the volume of the oral cavity (cf diagrams of § 2.5.2.), one must practice such a way. By exemple, in the exercises for extending the register (toward the low pitched notes or toward the high pitched ones) (cf § 8.), one can say (or spell) the vowels which determine the relations « oral cavity ↔ tongue » : these vowels favor too the access to the low (A, O), median (E) or high (I, U) registers.

Circuit of breathed out air flow, lingual-palatal passage and entry into vibration



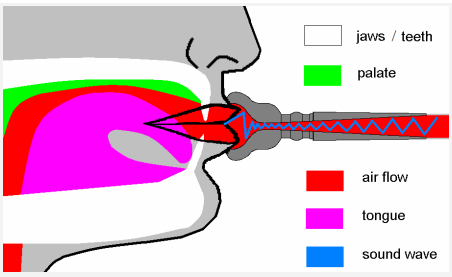
2.5.2. The two kinds of movements of the tongue

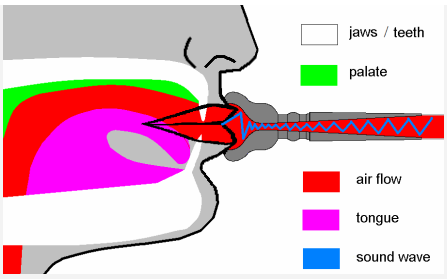
The tongue can move inside the OC according to two main ways :

(a) the **tongue goes up and down** : this « vertical » direction of the movement makes easier the ***variations inside the range***, ie the production of the high tones (tongue near the palate, syllables TI, DI, KI, etc) or of the low tones (tongue at the bottom of the OC, syllables TA, DA or KA). One can check this fact by simply playing C2 and G2 alternately, and by linking these notes (attacks by pronouncing TI or DI) ;

(b) the **tongue moves back or forward** : this « horizontal » direction of the movement, which tally with the usual ***« tonguing »***, makes easier the ***velocity***. One can check this point by playing quickly, and alternately, C2 and E2, in a tied manner : this case combines, in fact, the two situations (a) and (b).

Play of the tongue during the expulsion of the air (variations of the sub-palatal volume)





During the warming-up, one must then keep an eye on the work of the tongue, and its relation with the air stream, in order to produce a note. One can practice the attack of a unique note with a forced air stream HU (thus without moving the tongue), or by coughing in order to form GU's : the aim is first to produce the note only with the air stream, and to use a minimum move of the tongue for getting a clean attack and a pleasant sonority (« full » or « round » tones) (cf supra).

2.5.3 .The three « tonguing » modes

In the past, the teachers asked for « doing as if » one was expelling a pip of fruit with the tip of the tongue. This processs is still sometimes used during the training (control of the « tonguing » : accuracy, regularity, marcato forte, etc). But that way produces a too « sharp » sound : the OO is first closed by the end of the tongue, then it releases the air brutally. That practice leads not only to a hard-hitting emission, but also to a move of the tongue with excessive amplitude (from before to back), detrimental to velocity.

The emitting of a less hard-hitting sound, « without tonguing », improves the **technics of tonguing**. A common practice consists in ***emitting a sound so that the air flow, when passing between the tongue and the palate, is « modulated »*** as follows :

(a) positioning the end of the tongue against the back of the incisors of the lower jaw (cf above diagram) : this forms an arched tongue (concavity), which favors an access toward the upper register (whith, in particular, the help of a contraction of the pharynx) ;

(b) positioning the end of the tongue toward the top of the palate, against the back of the upper incisors : the tongue, being thus arched in the opposite shape (convexity), favors a fall toward the lower register (by, in particular, relaxing the muscles of the throat).

One usually distinguishes 3 types of **tonguing**, sometimes compared to the **action of a valve**. The various comments pointed out by a composer on a score may still complicate the technique : accentuations (staccato, etc), variations of tempo (accelerando, etc), variations of sound volume (de ***ppp*** = pianissimo à ***fff*** = fortissimo), etc.

The following indications are to be performed within the framework of the exercises.

2.5.3.1. **Simple tonguing**

It consists in emitting the sound of a note by « articulating » a particular syllable (elementary phoneme) : generally, **TU** (or **TE**). The chosen syllable can be used whatever the rhythmical type : binary (2/4, 4/4, etc) or ternary (3/4, 6/8, etc).

Other syllables may nevertheless be used :

(a) **according to the « hardness » of the required attack**, or required by the score : TU (ou TE) is harder than DU (or DE), which itself is harder than GU (or GUE), as the ***tongue « hits » the palate from the front to the back*** ;

(b) **according to the register** (low, medium or high) : eg TA, DA or GA make easier the descent toward low tones (wider aperture of the pharynx), TI, DI or GUI facilitate the rise toward high tones (by closing more the pharynx). The tongue is then located higher with regard to the palate.

Before or during the performance of a piece, it can be useful to choose the syllable which will make easier the style of attack as well as the variation of range.

A **difficulty**, sometimes neglected or gone unnoticed, consists in **mainaining an « homogenous » sound as output, whatever the tonguing, whatever the hardness and whatever the register** : same « output » (or same outside « impression ») for the attack, same sound quality. The exercises following that direction are very distrustful : in fact, these attempts are very difficult to accomplish.

2.5.3.2. **Double tonguing**

When the tempo of a performance is quick (presto or prestissimo), the previous simple attack meets some limits : this may be checked by trying to play with TU TU TU TU of the 4/4 sixteenths with a tempo over 120 for a quarter note.

The kind and the action of tonguing must then be adapted.

After experimentation, it appears that emitting the syllables **TU** and **KU** alterntively (eg TU KU TU KU, etc) was giving good results. The tongue then play its role of « valve » in the above mentionned two places of the OC : at the **front** of the palate or at the back of the teeth (upward or downward, acording to the range) for TU, in the **middle** of the palate, between the molars, for KU.

The couples of chosen syllables are generally used for binary rhythms (2/4, 4/4, etc) : thus, in 4/4, one performs sixteenths with sequences made of (TU KU TU KU). Nevertheless, for ternary rhythm (eg 3/4), it is possible to perform the 6 quavers with sequences such that (TU KU TU KU TU KU), while emphasizing the strong beat as well as the weak beats.

As previously, one can chose other combinations :

(a) **according to the « hardness » of the attack** : TU KU TU KU or TU PU TU PU are combinations harder that DU GU DU GU ;

(b) **according to the register** : eg TA KA TA KA (ou DA GA DA GA) make easier the descent toward low notes, and TI KI TI KI (ou DI GUI DI GUI) make easier the ascent toward high notes.

The main difficulty of this type of tonguing consists in **perform a perfect equality of the sound production** in every scenarios : indeed, TU is, for physiological and physical reasons,

a harder attack than KU (ditto for the other syllables). In order to realize a ***clock playing***, and a sound production well « constant », one process consists in :

(a) trying to **« reinforce » the weak attacks** (KU, KA, KI, or PU, or GU, GA, GUI) by playing (more en more quickly) identical sequences : eg (KU KU KU KU), or (KI KI KI KI), etc ;

(b) completing this strategy and training oneself in **« weakening » the strong attacks** (play the TU as gently as possible).

2.5.3.3. **Triple tonguing**

This tonguing cumulates the previous difficulties. It applies, generally speaking, to ternary rhythm (3/4, 6/8, etc) as well as triplets of notes.

The emission of the syllables **TU**, **TU** and **KU** alternately (eg TU TU KU, TU TU KU, etc) is advocated, with severall variants yet pointed out, such that DU DU GU or DI DI GUI, or again TA TA KA or TI TI KI. The making of a perfect equality of the sound emission is, still, important.

An other difficulty is the risk of « clash » or of delaying the emission between the initial TU and TU as the tempo increases : usually, with a sustained tempo, one can pronounce 2 successive TU but not 3 TU. Often, nevertheless, the pieces of trumpets need the performance of triplets gathering a same note (eg G2 G2 G2 or C2 C2 C2), and this late is easier than that of triplets which notes are varying (eg G2 A2 G2 or C2 B2 C2).

During a performance of a succession of triplets, an alternative to this kind of attack consist in emitting alternated syllables such that (TU KU TU) (KU TU KU), etc. This process prevents clashing between TU and TU, and may also improve the performance of hard as well as weak syllables.

2.5.3.4. **Some « curiosities »**

« Special » rhythms such that 5/4, or 5/8, or 7/4, etc, can be performed by drawing inspiration from the above, taking into account the required tempo, which may be quick or slow : for instance « Take five » (key signature 5/4), by Paul Desmond is quick enough and requires different syllables, whereas the symphonic poem « The isle of the dead » (signature 5/8) by Serge Rachmaninoff is more slow and only once syllable suffices (eg GUA or GUE).

2.6.Technical studies and scales : fingers and fingering

This kind of exercise must, first, insure a good **use of the fingers**. The **control of the fingering** in every tonality demands some skillfullness : one suggests various **fingering exercises** (cf appendix 7, **exercises on fingering**).

2.6.1. Valves technique

By design itself, the inner mechanism of the group « sleeve valve and valves » of a trumpet has the goal getting (by half-tones) every ***« intermediate » note*** between the ***« on open » notes***.

2.6.1.1. The on open notes are those « basic notes » of the trumpet, and they are produced without lowering the valves. For a standard C trumpet, these notes are C1 and its harmonics : G2, C2, E2, G3, B3b, C3 (which is generally called **high C**).

Now, one can also notice that :

(a) the wider interval between on open notes is a ***fifth*** (C1-G2), located toward the low register ;

(b) the other intervals between on open notes are less wide : forth (G2-C2), major third (C2-E2), minor third (E2-G3), forth (G3-C3), major third (C3-E3), etc.

2.6.1.2. In practice, the logics of a valve system associated to a sound pipe takes into account the following data :

(a) the height of the sound of an on open note, produced by the tube, decreases (« continuously ») when that pipe grows longer (cf principle of the trombone). In other words, the **frequency of a sound tube decreases with the increase of its length** ;

(b) the construction of a **divertion of a given lenght** (valve slide and its base), connected to the pipe, gives the same result, but the decrease is « stagely » : in other words, it is constant, and the difference of height depends upon the length of the divertion. One can, in the same way, make other divertions of this kind, each one being associated to a stage of a given decrease.

2.6.1.3. One then looked for carrying out every chromatic intermediates (ie by 1/2-tone) going down from an on open note (these levels are sometimes also called **partials**). If the spectrum (Fourier transform) of a given signal has equidistant peaks and (integer) multiples of a given frequency, that frequency is called « fondamental », and the other equidistant peaks are its « harmonics », whereas the residual peaks are sometimes called its « partials ».

The technical difficulty consists in ascertain (1) a number of valves, (2) the length of the associated valve slides as well as (3) an activation of the combinations of the valve buttons which allow playing every intermediate of the previous fifth C1-G2, by lowering the pitch from G2 towards C1.

The solving of that technical difficulty led, following various experimentations (XVIIIth-XIXth centuries), to hold nothing but 3 valves (only) (system invented by Etienne François Périnet, 1839).

For a tube of « standard » length (150 cm), and schematizing the acoustical reasonings, it was possible to associate to each valve a divertion with the help of a slide which length is determined (par iterations or according to the formulas of acoustics) as follows :

(a) a first valve lowers each on open note (thus the previous G2) of a half-tone when its associated slide is 6 % of the total length of the pipe (ie 9 cm). This is the role of the second valve of the modern trumpet ;

(b) an other valve lowers, in the same isolated way, an on open note of one tone with a slide which length is 18 cm (ie 12 % total length of the pipe). This is the role of the first valve of the trumpet ;

(c) the third valve lowers, in the same isolated way, an on open note of one ton and helf when its slide is 18 % of the total length (ie 27 cm). This is the role of the third valve of the trumpet actuelle.

These 3 valves then allow 8 combinations, of which 7 (namely 0, 2, 1, 12, 23, 13, 123, that is 0, 2, 1, 3, 23, 13, 123) are sufficient for performing every chromatic note between C1 and G2.

The same principle is applicable to the other on open notes (C2, E2, G3, B3b, C3) : their case is besides simpler to treat, because they need less combinations of valves.

Finally, one can reach such a way (at best) the note F1# going down from C2.

2.6.1.4. The **acoustical wrongness of the trumpet** affects, by construction (ie because of the principle of the slide system itself), its whole range. One must, indeed notice that the trumpet is, strictly speaking, « wrong » inside all its registers (cf **the wrongness of the trumpet**).

By definition of a **« cent »**, 1 tone = 200 cents (cf appendix 9, on the **use of the piccolo trumpet**), but common human ear cannot detect a difference which height is under 10 cents (ie 1 / 20^{th} of a tone, or 1 / 10^{th} of a half-tone).

Taking into account these mesurement units, one observes that the incorrect notes of a standard trumpet are in general approximatively, and without any correction (lips or slides) (cf § 2.6.2. on the standard fingering) :

(a) differences less than 10 cents : A1 (+8 cents), C1# (+7 cents), G2 (+9 cents), A2 (+8 cents), C2 (+7 cents), D1# (-10 cents), G2 (+9 cents), A3 (+8 cents), C3 (+7 cents) ;

(b) differences of 10 cents or more (thus perceptible by the human ear) : E1 (+11 cents), D1 (-14 cents), D2 (-14 cents).

The notes belonging to the **first register** (low pitches ranging between F1# and E1b) are thus notably more « out of tune » (heights, intervals) than those of the upper registers. A minimal training must allow succeeding in playing « correctly ». Indeed, the correction of the previous faults is possible (cf **fingering and activation of the slides**) :

(a) **working with the lips**. This allows, to a certain extent, lowering by around 1/2 tone a too high note (cf exercises). By definition, this work of the lips, as well as a lesser brething, allow thus the making of « partials » (cf exercises) : a **partiel** is then her considered as a diverted note (high) with respect to a « normal » note (itself height centered). To perform a partial, the instrumentalist can then use his lips (flexibility) and his breathing (pressure inside the OC).

On the contrary, the lips scarcely allow raising (some cents) a too low note : indeed, there is a **« click effect »** (or **« ratchet effect »**) upwards, which provokes a sudden change from a pitch to the immediate upper harmonic sound (with the same fingering).

In any case, **such a slight shift of the sound height may correct the pitch, but also may be harmful with respect to its quality** : we have yet noticed that a sound may be musical without being right (ie at the right height = wrong note), and it may be right without being musical ;

(b) **lengthening of the valve slides** : the more often, the slide 3 (or « trigger » as the case may be : flugelhorn, etc), and sometimes (according to the model of trumpet) the slide 1. Thus, one suggests generally, playing the C1# (+7 cents) by lengthening the slide 3 by 1,7 cm (that is strongly enough).

One can also, if necessary, combine the slides 3 and 1 : the concerned notes are obtained with a lesser lengthning of each of them. Moreover, the piece to be performed being memorized, one can take notice of it, and can avoid handling too often the slides : one only needs, as possible, to determine the position juste before the phrasing which is the more distorted by the wrongness of the instrument, then to secure it during the performance of these passages, and finally return the slides to their shorter position.

The above is especially important during a rather slow phrase, whose notes are « long notes » and the operation of lengthening the slides is practicable, than during a fast phrase, where this operation is risky (and even impossible).

In practice, it is simpler to **« wedge » the cornaline** by successive trials in order to **locate the extentions of the slides** allowing an as right as possible performance of the notes, without the help of the lips (preferably) : then **one has to memorize these extensions** once for all (for a given instrument).

It is possible, by combining the work of the lips and the valve slides (1 or 3 according to the model of cornaline), reach the note F1 (ie the F located just below the range of the cornaline).

As a consequence, when **purchasing a trumpet**, it is highly advised to **check its accuracy**. Some means are among the following ones :

(a) play the basic scale upwards and tie C1, D1, E1, F1 and G2 (accuracy of the low seconds, major and minor ones). Some instruments (eg the SML Paris TP600) sometimes exhibit a G2 which is too low (it suffices to play the fifth C1-G2 and notice it) : a correction is possible thanks to the alternate fingering 13 (which corrects the height) (cf § 2.6.4. on the alternate fingering) ;

(b) play the scale downwards and tie C1, B1, A1, G1 (accuracy of the very low seconds, major and minor ones) ;

(c) play chromatically, going up and down, the tied scale from C1 to G2 (accuracy of the minor seconds) ;

(d) play chromatically, going up and down, the tied scale from C1 to F1# = G1b (accuracy of the minor seconds).

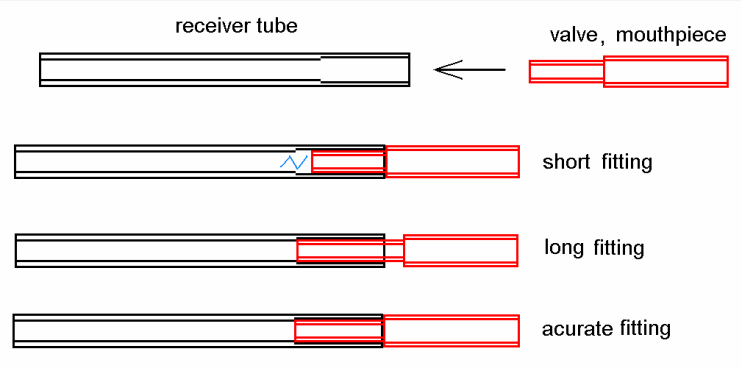
(e) play slowly E2 alternatively on open (0) and with 12 or 3 (as for a tremolo) ; the same for C2 on open (0) and with 23. More generally, play any note and alternate (quickly enough) its standard fingering with its possible alternating fingering, as pointed out above ;

(b) play any « ordinary » note and its octave (higher or lower) : the interval must « sound » accurately. Try also the pedal notes, or alternating ordinary notes and pedal notes ;

If the instrument if faulty, some notes will notably stay out « correct scales » or it will even be impossible to correct precisely their height (with the help of the lips or of the valve chords).

Moreover, and according to one's avalaible budget, it is better choosing an instrument which produces notes slightly over the right pitch, rather than the contrary : indeed, it is in any case possible lowering the notes either, as a general way, with the chord slide, or, in a particular way, with the valve slides. So, if a C trumpet is too height in pitch (eg sounds like C#, after the warming-up with the instrument), the chord slide allows correcting this fault ; as the proportionnalities of the valve slides may be modified and bend more the faulty notes, the lengthening of these slides may, if any, correct also the problem. On the contrary, a too low trumpet may always be too low, even after correction, and requires instead transposing the pieces to be performed.

In practice, many instruments (notably for study), even low priced ones, often have an enough satisfying quality, and can be used without great difficulty. They allow too practicing the indicated correction efforts, which has also its own utility. One then has to concentrate on the **quality of manufacturing** : geometry of the pipe, of the bell, of the cylinders and valves, of the slides. Moreover, one may check the fitting of the various tubes making up the trumpet (diameter, depth, « uncoupling ») : indeed, as the mouthpiece or a tube is not in a continuous contact inside the tube, this « flaw » introduces additional perturbations of the air flow (cf diagram below).



2.6.2. Usual or normal fingering

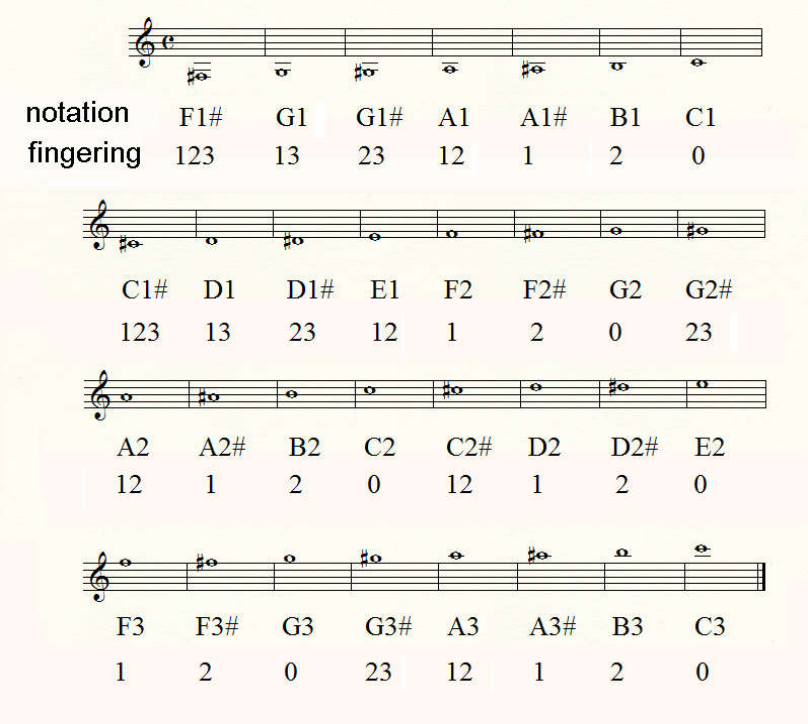
The **« normal » fingering**, or **« standard » fingering**, as well as the **« normal »range**, of the trumpet are reminded in the diagram below, with our ***chosen numbering of the notes*** : the « normal » range (or usual ambit) of the trumpet extends from F# (denoted F1#) below the staff to high C (denoted C3) over the staff. This range allows the more « pleasant » sounds.

Our numbering differs from :

(a) the ***notation based on the standard 88 keys piano*** (7 octaves 1/4 : the C1 of the trumpet corresponds to the C4 of the piano) ;

(b) the ***« universal » notation*** (eg used by acousticians), based on the sound frequencies (eg A2 = 440 Hz).

Notation and usual fingering



In order to perform a « natural » fingering, without hesitation, one has to take the time for **moving from a step of conscience to a step of automatic reflex** : as for many activities, the learning must ***begin with slow moves, then continue with faster moves*** (***passage thoughts - reflexes***).

A ***(physical) metronome*** is very useful. Nevertheless, one will be able to go without it by also developing a ***mental metronome***, or « inner » metronome (sense of durations as well as of rhythms).

2.6.3. The fingers must not be (too) elevated above the top of the valves (valve buttons) : this delays the ***ability to react of the fingering***. At every time during the playing, it is then preferable to hold in place the tip of the fingers and the valves buttons. Moreover :

(a) one must search for **precise move of the fingers**, whatever the tempo (fast or slow). The performance of the fingering must be « relaxed », without excessive move of the fingers. At the same time, one must be physically relaxed : a tension of the arm, of the hand or of the fingers adds, in the long run, some tiredness. Of course, the « mecanichal » constraints must be litghtened : faultless geometry of the cylinders and valves, enough lubrication of the valves, springs in good condition.

(b) in a general manner, the **valves must be either down, or up, without intermediate position**. For avoiding some failures (jingle between notes, failed notes, badly centered notes) due to the delay of activation, it is advisable to quickly lower the valves before performing each « tongued » note. Besides the fingers themselves, the rise of the valves is commanded by the elasticity of their spring, by the manufacturing quality of the

instrument (appropriateness of the cylinder and of the valves, plastic wedges well positionned and in good condition), as well as the care given to the lubrication. The choice of the lubricant (and above all of its viscosity) matters too.

Nevertheless, it may happen (eg in jazz) that the valves are lowered, at a quarter or half length, during a generally short enough moment, in order to produce special effects : muffling the sound, continuous (increased or lowered) sound, as a « knocking », etc. It is generally necessary to breath harder for realizing these effects.

The ***positioning of the right hand with respect to the instrument*** may cause discussion :

(a) many instrumentalists put the fifth finger (little finger) of the right hand inside the hook (or retaining ring) of the instrument, the first finger being « wedged » near the first spacer (located after the mouthpiece) ;

(b) others prefer (permanently, or temporarily, according to the difficulty) keep a freedom of movement at the right hand, the little finger being positioned above the hook and the thumb on the side of the first cylinder.

The argument for the second choice is attached to the risk of using the hook for moving closer, instinctively and excessively, the mouthpiece towards the mouth, thus squashing in the embouchure in a harmful way for the lips. Nevertheless, this drawback seems to concern the beginners, which embouchure is not yet well trained (musculature). The trained artists have, in principle, and by « hypothesis », an enough strong embouchure (muscular « hardness » and thickness) for being able to counterbalance the pressure exerted by the mouthpiece upon the lips, pressure which must in any case remain minimal.

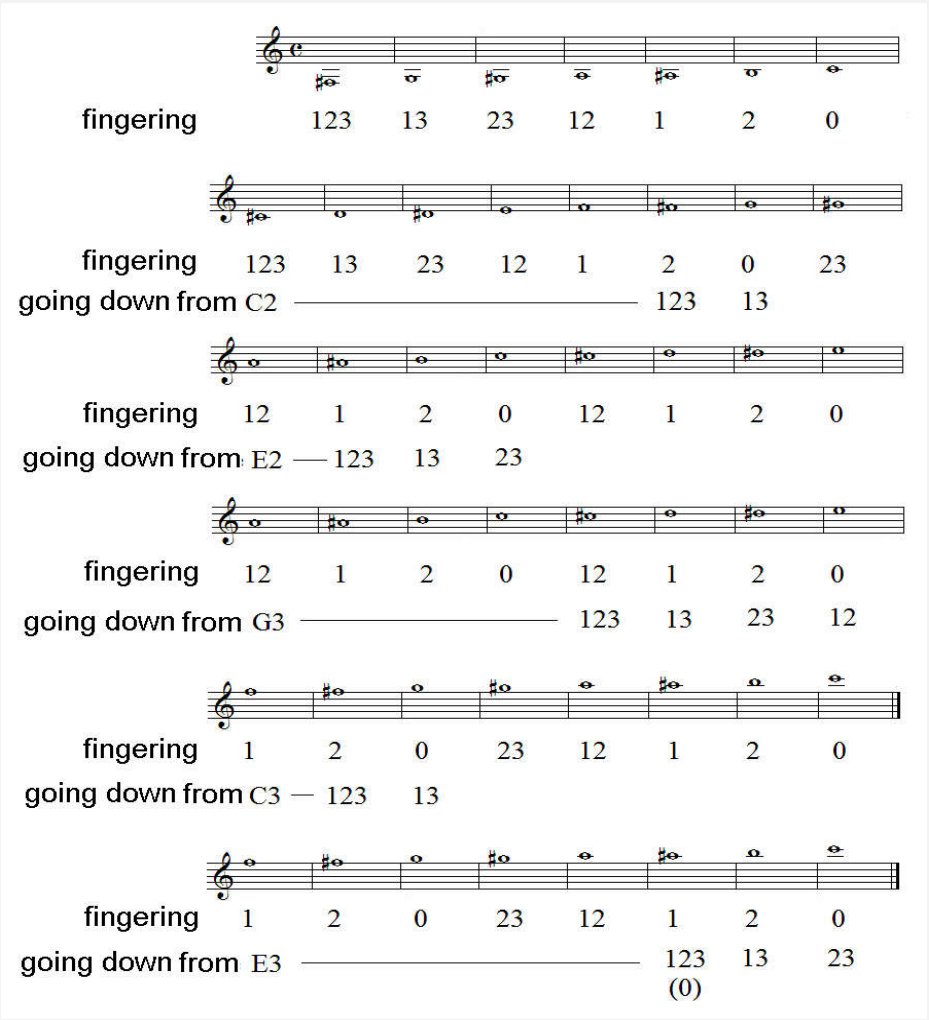
2.6.4. ***« Atypical » fingering***

Some notes can be played with a **alternative fingering** : eg use of the combination l3 of the valves for G, or of the single valve 3 for E and A (cf diagram below). This is besides useful for performing some kinds of exercises : notably, flexibility of the lips without tubular moves.

2.6.4.1. The description of the technics of the valves (cf § 2.6.1.3.) and the knowledge of standard fingering (cf § 2.6.2.) show that some combinations of keys (called non standard fingering) « overlap » the « usual » combinations (standard fingering) (cf diagram below). Some notes can be reached with various fingerings : thus, B3b has 3 ones (the normal fingering 1, the false harmonic 0 and the descent 123 from E3).

By « cheating » somewhat, one has yet noticed that F1 can also be reached (with the fingering 123, by relaxing much the lips and lengthening enough the valve slides 1 or 3) : this exercise is nevertheless quite delicate as the sonority may be spoiled such a way (« hollow » or « dull » sound).

Alternative fingerings



In principle, the alternative fingering is not used (***« non standard »*** fingering).

Nevertheless, it may be useful in some situations, eg :

(a) for **correcting some faulty notes** (**heights**) (old instruments, output of manufacturing) : thus, a too low G2 can sometimes (case of the SML Paris TP 600) be advantageously executed with 13 (instead of 0) ;

(b) for realizing **fast melodic lines** that usual fingering does not allows realizing (without risk) ;

(c) for performing **tremolos**. A tremolo is a (very) fast succession of standard and alternatif fingerings producing the « same » note : so is a sequence of E2 alternating 0 and 3.

Indeed, **the fingering to be applied must be as « light » as possible** : this is the case when only one valve is lowered. Thus :

(a) the performance of a trill alternating 1 and 23 (**« bascule »**) for alternating F1 and E1b cannot take advantage of this possibility (lack of substitution fingering). A trill requiring

a **« fork »** (toggling of 13 and 2 for performing sequences of D1 and F1#) is a priori excluded, as being unrealizable (and moreover never used in trumpet works) ;

(b) on the contrary, a trill requiring the alternation of 12 and 23 (bascule) for the notes A2 and G2# can be advantageously performed with 3 and 23 : indeed, only the key 2 is to be activated. Moreover, the trumpet is less « wrong » in this register than in the lower register ; given the velocity of the line and the limits of the ear acoustic abilities (discrimination from over 10 cents), a « median » listener should not detect differences (cf § 2.6.5.).

On can then distinguish 3 kinds of difficulties : slight fingering (no, or only one, valve lowered), half-light (or half-heavy) fingering (2 valves simultaneously lowered) and heavy fingering (three valves lowered). This distinction depends, nevertheless, on the tempo of the piece to be performed, as well as on the linking of the valve activations : thus, 123 (C1#) alternated with 23 (D1#) is a link between a heavy and a half-heavy, fingering, but is easy to perform (one valve to be activated), even in a « presto » tempo ; conversely, a fast trill formed with 1 and 2 (eg B2b alternated with B2) may seem delicate to perform.

2.6.4.2. The evocated **risk** is that of **too sudden movings of the instrument** resulting from the effort necessitated to perform some fingerings : previous bascules or « forks ». The holding of the instrument with the help of the left hand can, indeed, be insufficient because one also wants it to keep suppleness in order to avoid a painful contraction. As a consequence, the moves may lead two major drawbacks :

(a) ***lack of airtightness of the labial corners*** ;

(b) ***too sudden shift of the mouthpiece with respect to the lips*** (pitching effect), and then production of unexpected notes, or « out of tune notes » (this notion is here distinguished from that of « wrong note » : ie bad reading of a score).

Finally :

(a) when ***performing « tied » notes***, the ***flexibility of the lips*** plays the major role (linked with the breathing) ;

(b) when performing a non tied notes (staccato attack, etc), one must pay much attention for performing a **perfect coordination of air stream (breathing), the tongue, the OO and the fingers**. The corresponding exercises will then be started very slowly (awareness of the mechanism and concentration), next performed faster and faster, in order to still control this coordination.

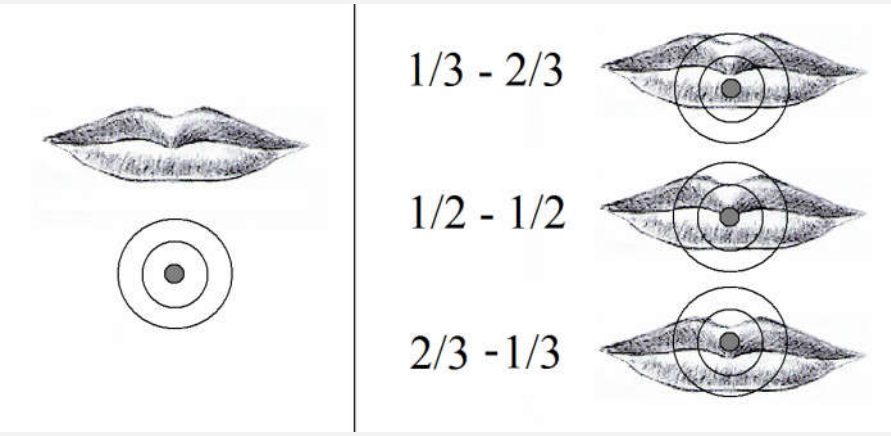
2.7. Mouth and mouthpiece

This point is crucial and implies the **choice of the more appropriate mouthpiece** (cf appendix 1, **mouthpieces**).

A consequence of the warming-up or of the training lies in a **better adequation between the mouth and the mouthpiece** : the shape of the lips must « marry », to some extent, that of the mouthpiece. In other words, the morphology of the mouth should become, in time, the « opposite » geometry (the negative) of the mouthpiece. This consequence is advantageous, because thus the exhaled air does not leak between the outer embouchure and the outside

(**airtightness** of the corners), which helps, in particular, to increase the concentration of the air stream inside the mouthpiece, and also the flexibility of the lips.

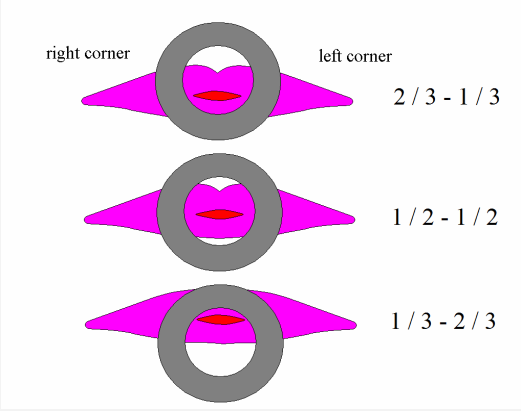
2.7.1. Positioning the mouthpiece upward or downward (cf diagram)



There is no definitive rule concerning this positioning :

(a) J.B. Arban advocated a ***1/3-2/3 position***, ie a « downward » mouthpiece. This position tends to send the air stream upward inside the basin of the mouthpiece (« Arban positioning ») : this favors emitting a « narrowed » air flow between the lower lip and the top of the bowl. It seems to be the case for instrumentalists whose lower lip is fuller than the upper ;

(b) conversely, a ***2/3-1/3 position*** favors emitting an air flow, which is now « narrowed » between the upper lip and the bottom of the bowl (eg position which can be observed with Romain Leleu). The horn players also direct their instrument downward. It seems to be linked to instrumentalists whose upper lip is « overhanging » with regard to the lower lip (cf references to the « beak » of the trumpet players).



Both « extreme » previous positions make easier a vibration with high frequencies, then an access toward the high register. Indeed, they lead to respectively position the lower (upper) lip very near from the top (bottom) of the basin, the other lip playing a role of « support » (in any event very light), which induces an tight air flow ;

(c) the median (ou central) position 1/2-1/2 may nevertheless be prefered, at least as an initial position.

Indeed, (1) it is the power of the rib cage and of the abdomen whichs allow controlling the compression of the air, and (2) it is the muscular power of the embouchure which allows the control of the lips (aperture and closing of the OO : the famous labial « pliers »). As a consequence, it is the couple « embouchure, compression » which controls the vibration, then the emitted frequencies, and so the height of the sound. The position of the tongue and the aperture of the pharynx finally contribute to make easier and reinforce the scanning (or the course) along the range of the instrument.

With this position, the access to the upper register can be favored by moving forward the lips (inner embouchure) inside the basin (without touching its bottom, to avoid the risk of breaking the vibration) ; this depends also on the depth of the mouthpiece.

In order to find an optimal position, one can begin with a 1/2-1/2 positioning, then, after various trials, vary slightly and progressively, in order to get the satisfactory results : accuracy, sonority, airtightness, flexibility. One then must not neglect the role of everyone **morphology** in the choice of that position :

(a) ***regularity of the dental wall*** in its 3 dimensions (height, width and depth), inter-dental spaces, wearing of a dental device, etc ;

(b) ***shape of the lips*** : more or less thin, more or less bended, thicknew more or less shared out in width, etc ;

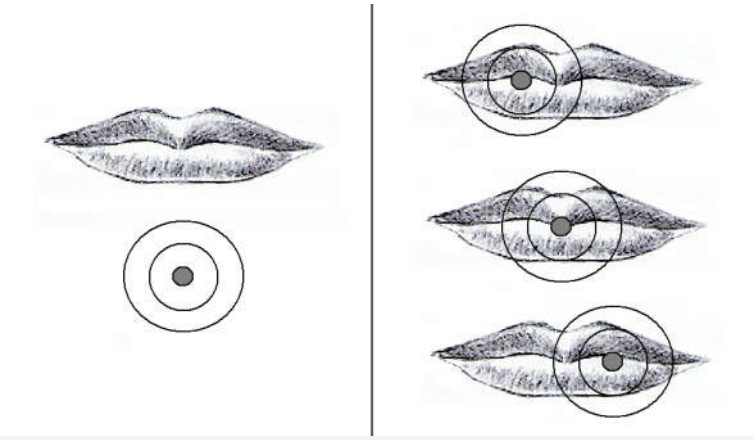
(c) ***labial muscular mass*** (lower or upper) : the « lower » lip is often thicker than the « upper », which may explain a preference for a 1/3-2/3 position.

It is generally advised **not to modify the adopted positioning when playing** (performance), by exemple inside the same phrase, in particular if one has to play fast lines or to access to the upper register. One can generally, besides the usual technique, « compensate » this constraint by raising or lowering (very) slightly the head (then the OO), or by sending the air toward the top or toward the bottom of the mouthpiece (***pivot technique***), which contributes to move the instrument from top to bottom (that is an other kind of the above evocated pitching).

On the contrary, this modification of the position is possible (without great risk) between two phrases separated with a pause (rest, etc), even short ; this may also be preferable when one phrase is in the low register and the following one in the hight register (or the converse).

2.7.2. Positioning the mouthpiece in width (cf diagram)

It is advised to put the mouthpiece in the middle of the lips. This is « natural » because of the approximate symetry of the lips with respect to a vertical plane from the back to the front of the head.



It may nevertheless happen that some players (eg Melissa Venema) put their instrument laterally. This may result from a « defective » jaw or dental conformation, which often is temporary (wery young persons, dental device). In such cases, the working of the embouchure will develop with the time, according to the correction of this conformation.

2.7.3. Positioning the mouthpiece in depth

It is important to **put into conformity the « surface » of the mouth** (inner and median embouchures) with the **« surface » of the mouthpiece** (rim and bowl), without nevertheless let the lips touch the bottom of the bowl (risk of stopping the vibration). This objective must be combined with two rather conflicting objectives :

(a) a **minimal pressure of the mouthpiece** on this part of the embouchure (middle embouchure) ;

(b) **no loss (leaks) of air** outside (outer embouchure), meaning a correct airtightness, which implies to well concentrate the air flow toward the throat of the mouthpiece.

The only one general guide is then getting (a) the greater ease in emitting the sound and (b) a maximum of « convenience » in the relation (very fine contact) between the lips and the mouthpiece.

2.8. The emitting of the sound

As well as the management of the air and the work of the tongue, the emitting of the sound is an **important technique**. One can emit many kinds of sounds, with or without mouthpiece.

2.8.1. The vibration (« buzz » or « buzzing »)

The lips are (complex) muscles which can also vibrate (cf § 2.3.2.).

On can produce a **vibration of the lips** (or buzz) by emitting the air et 3 levels :

(a) « internal » or « deep » vibration, or **flutter tongue** : obtained by pronouncing GRRR with the bottom of the throat. This process produces a damped vibration as it must cross the whole CB ;

(b) « middle » vibration : obtained by pronouncing BRRR with the middle of the BC. In this case, the vibration is more striked ;

(c) « external » vibration : obtained by pronouncing PRRR at the level of the lips. It is generally this third kind of vibration which is practised, because it gives more impulse from the lips, then more power to the emitted sound.

Indeed, in every case, **the lips must be able to vibrate**. For putting the lips into vibration, one can do the following :

(a) without ***mouthpiece*** : move closer the upper and lower lips until they are in firm contact between them (vertical compression), then blow sufficiently to expel the air which is under pressure inside the mouth. By compressing more or less one lip against the other, one can vary the height of the sound ;

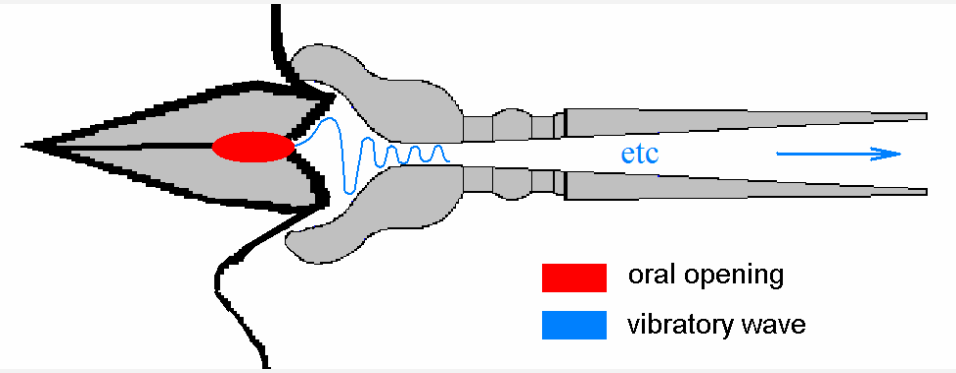
(b) with ***the « slightly » kept mouthpiece*** : use the thumb and the index finger of the left hand (without pressing the hand toward the lips). Then proceed as in (a) ;

(c) with the ***partial instrument*** : insert the mouthpiece inside the plug of the tube, and then lengthen the tube more or less, from the shorter (lowering of the valve 2 and taking off its own slide) to the longer (lowering of the valve 3 and extraction of its own slide).

(d) with the ***complete instrument*** : proceed as in (c), the slides remaining at their normal place. Nevertheless, the vibration here changes its nature as, from one part, the tube transmits its resonance to the lips and, from the other part, the set composed of the mouthpiece and the instrument becomes an « obstacle » for the moving of the air (acoustic impedance). The acoustic and musical result is radically changed : therefore, this case cannot be considered as a true « buzzing ».

In each of these situations, one must impulse a maximum of air inside the mouthpiece, without leak by the corners and without closing the OO, in order to produce a ensured sound, centered (right level) or « full » (timbre, or tone quality, instrument-specific, without distortion).

Production of the vibration through oral opening (OO)



On may keep an eye on the OO and the corners with the help of a mirror : these areas must be firm and crushed together.

In order to **develop the labial muscles** whithout the instrument, one can train to :

(a) ***« roll up » the lips*** (towards the inside) ;

(b) ***« unroll » the lips*** (towards the outside) ;

(c) ***« pinch » the lips***, more or less strongly, one against the other.

Besides this muscular development, the **interest of this kind of exercises, as well as others mentioned in this method, lies in its feasibleness in space and in time** : indeed, one can perform these exercises everywhere and at any moment.

Moreover, in case of temporary impossibility to play (one day, or even much more), the return toward the instrument is often successfull. One could say that *« one day without playing allows oneself to realize a progress ; two days without playing allow other people to realize the progress ; three days without playing allow everybody to realize this progress* ». In other words, a « long » enough relaxation of the embouchure gives back to it its mobility and its sound efficiency. The time for recovering may nevertheless vary according to circumstances (length, intensity or strongness of the playing, ill-treatment of the lips, etc), the state of health, the age.

The buzz does not give the normal sonority of the trumpet : it is but an **exercise which aim is to make the lips vibrating and to develop the inner embouchure**. Its use is to aim at control and amplify the vibration of the lips, that is to train and reinforce this part of the embouchure.

Some authors recommend sometimes performing a buzz, without mouthpiece, during a (minimum) daily duration of 4 mn.

Then **the (vertical and horizontal) compression of the corners must be practised** : indeed, a good compression of the corners gives a good strength to the embouchure. The corners of the mouth, as well as the OO, must be « conscious ». By varying the compression at the level of the OO, the air can pass with a sufficient speed, which prevents every weakening, or even every occlusion, of the OO. If the OO closes, the air cannot pass, which causes a stopping of the sound (common mistake when playing in the hight register).

A very simple test allows checking the labial suppleness. It consists in **suddenly taking off the mouthpiece while continuing blowing** : the lips then carry on with vibrating during a (short) moment.

2.8.2. The tools for emitting the sound

The usual musical performance (with the instrument) does not use the « buzz », because this last produces, indeed, an unpleasant sound. The normal playing with a trumpet implies a relatively open OO, less « closed » than for producing a buzz.

For going up along the registers (eg from medium toward high), one can **activate 3 biological variables** (neglecting here the physical parameters such that the characteristics of the mouthpiece or the impedance of the instrument) :

(a) the **upstream air flow**. The compression of the abdominal and intercostal muscles determine the pressure, then the speed, of the expelled air from the lungs inside the CB, then trough the OO. These variables are the first which intervene for going up toward the higher register : the ***stronger the inner compression, the easier the sound goes upwards***. It is then important not to hesitate to « breath » ;

(b) the **position of the tongue inside the mouth**. The curvature of the tongue and the palatal-lingual volume help also climbing up along the range (§ 2.5.) : the more the tongue goes upward and gets closer to the palate (diminution of the CB volume), the more the air flow is tightened and the more the rising along the range is made easier. One must, at same time, feel a certain narrowing of the throat ;

(c) the **variations (size, shape and tension) of the OO** end the array of the first tools allowing a rise in the register. The aperture of the mouth must then be reduced in order to play in the higher register.

These 3 physiological variables must be activated in a well controlled way. The previous awareness of the mechanisms of the muscles of the face, as well as the vigilance which must go with it, have to be permanently maintained : during a warming-up as well as during a musical performance.

Let us note F the height (frequency) of the sound, P the air pressure inside the lungs (resulting from the muscular tensions of the abdomen A and of the intercostal muscles C), G the aperture of the throat - pharynx, H the height of the tongue under the palate and O the OO (eg its factitious « surface »), one can write a **simplified model of the physiological aspects of the production of the sound in height** :

$$F = g\,(P_+ , G_+ , H_+ , O_-),$$

where the sign + indicates that a positive variation of a right-handed variable X entails a positive variation of F (positive derivative), and the signe − that positive variation of X entrails a negative variation of F (negative derivative), taking into account the equation :

$$P = h\,(A_+ , C_+),$$

the interpretation being the same (the « inner » pressure depends on the contraction of the muscles).

Fonctions g and h depend on the instrumentalist, and characterize his « personal equation » : ability for compressing the lungs, for opening the glottis, for provokating the rise of the tongue, etc. They reflect then his level of training and of (technical) talent.

One can write same kinds of equations for defining a **model for the physiological aspects of the sound production in intensity** : the frequency F is then replaced by the intensity I, also called (sound) volume or dynamics.

Finally, the **compression of the corners is the one of the foundations of the efficiency of the embouchure** (outer one). The pressure of the left arm, the instrument and the mouthpiece put on the relatively small area situated on the lips and around them, suggest developping

methodically these zones and the corresponding muscles ; this in order to be able to support situations of training or performance requiring an extended exposition to such difficulties.

Except the case of circular breathing (cf § 3.2.5. below), it is not recommended to inflate the cheeks during the playing (Dizzy Gillespie does). This move entails a « relaxation » of some muscles of the outer embouchure, which tends (ceteris paribus) to separate the corners between them : whence a risk of air leaking and a less control of its pressure.

2.8.3. Labial exercises

Training the lips may, again, be practiced everywhere and at any time. The exercises are very simple :

(a) ***maintening a pencil***. Hold this one inside the OO (as with a recorder flute) and compress it between the lips (**vertical compression**) so that it stays in an horizontal position ; then move the lips so that the front end of the pencil goes up and down. One can, if need be, replace the pencil with a more heavy object ;

(b) ***plucking-contraction***. Pinch the lips one against the other : this **reciprocal support** produces an occlusion of the OO (vertical compression of the upper lip downward, and of the lower lip upward). Then contract the corners, one against the other : closer horizontal move of the right corner toward the left, and of left corner toward the right. Repeat this exercise several times, and speed up the tempo ;

(c) ***contraction-plucking***. Proceed in reverse order : contraction of the corners (closer move between them), then pinch the lips. Repeat this exercise several times, and speed up the tempo ;

(d) ***rolling up - unrolling*** (cf § 2.3.2. supra).

In general, the final shape of the mouth will be different : the first one (exercise (b)) products a result with a rather « thinner » mouth, whereas the second (exercise (c)) a rather « thicker » mouth.

2.9. Synthesis : the formation of the sound

The **breathed in air** comes from an action of the diaphragm (moving downward) (cf breath control : how and when breathing). The sound produced by the trumpet comes then from a shifting of the air, firt breathed in, toward the outside of the body.

The breathing in is made by letting the air pass through the **corners of the lips** : the outer embouchure then works at these moments (space of the corners), but it must go back to its previous position as soon as the breathing out starts. As a rule, one must not move the mouthpiece with respect to median and inner embouchures (cf nevertheless infra).

Often, in practice, the **breathing in occurs between two « phrases »**. It may be very fast : according to the tempo, the moment when it is made, the need for reconstituting the stock of air, etc. In some cases, it is possible to breath often enough : it is then not necessary to absorb much air, and this allows a stronger or better controlled compression. In other cases, the phrase being quite long, one must absorb more air without stretching excessively the rib cage.

The **expelled air** moves in four steps related to four areas (3 anatomical and 1 physical) :

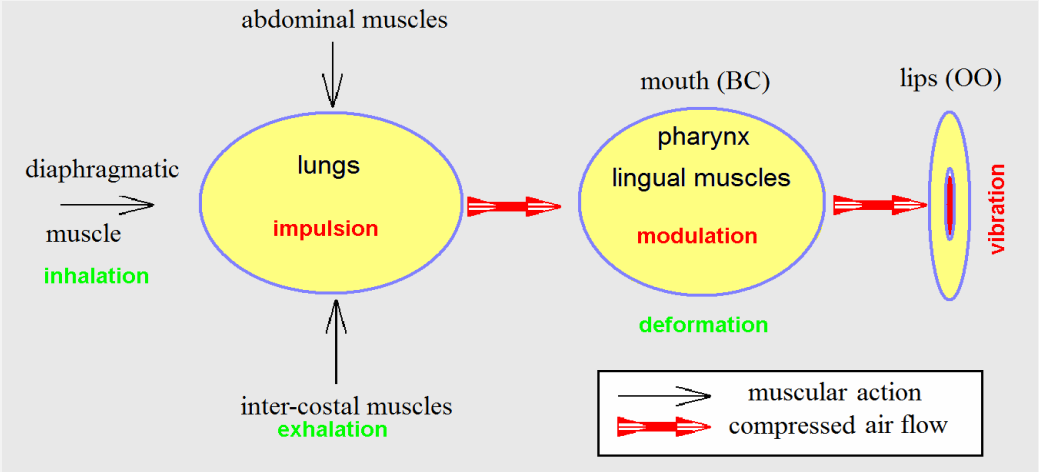
2.9.1. the **zone of the trunk**, which contains (a) the lungs and (b) the abdominal and intercostal muscles. These ***muscles*** allow compressing the lungs and control the pressure (thus the speed) of the emission of the air up to the level of the mouth ;

2.9.2. the **oral zone (OC)**, which contains (a) the volume of air inside the mouth (between the tongue and the palate) and (b) the tongue itself ;

2.9.3. the **bio-physical boundary**, which consist of (a) the teeth and (b) the lips (including the OO). This zone is essential for ***producing the sound*** : indeed, it is the vibration of air between the lips and the OO (inner embouchure) which is the origin of the sound (***exciter***) ;

2.9.4. the **zone outside the body**, ie **inside the instrument itself**. The maintaining (or deportement) of the body and the holding of the trumpet take place solely to favor the emitting of the sound. The air, when passing by the container composed of the mouthpiece (rim, bowl, throat and backbore), will be amplified by the trumpet, which simply plays a role of sound pipe (***resounder***).

The following diagram displays only the biological area. One distinguishes the **structure** (components) and the **functionning** (interactions) of the previous elements. It also clarifies (a) the origin of the **muscular energy** which activates the air at different stages, (b) the **direction of the air flow** (inhalation, exhalation, deformation) and (c) the **modifications** resulting from the working (impulse, modulation, vibration).



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3. The breathing : a fundamental prerequisite

For a wind instrument, **air is the fundamental element** for its functioning. During the strained expiration required by the emitting of air, the abdominal muscles and the intercostal muscles contract : this way makes then possible controlling the emitted quantity of air, that is its speed (ie volume / time unit) and its pressure (ie force / volume).

3.1. Breathing and pre-warming-up

That phase of the preparation aims to reach :

(a) a ***physical control in holding*** (1) the levels of inspiration and expiration connected to performance, and (2) the overall homeostatic function (that is the capacity of a any system, open or closed, for maintaining its equilibrium in functioning despite external constraints) ;

(b) a certain ***harmony*** between the air flow to supply and the (physiological and psychological) activities connected to the instrumentation.

It is then necessary to work about the air flow before working with the instrument itself : this is the aim of the pre-warming-up. This last must immediately precede the warming-up : in case of important gap between warming-up and practice or performance, it seems preferable to start again the exercises on « air supply + concentration », even from a lightened way.

These **preparatory exercises of breathing** have also the advantage to generate a sensation of calm and concentration. This put the instrumentalist into a frame of mind convenient for working (training or performance). One has only to **avoid the general anoxia**, which may sometimes drag feelings of falling asleep or of vertigo.

3.2. Exercises of breathing

These exercises usually precede a warming-up : practice of the buzz or first daily contact with the instrument. One can imagine severall types of exercises according to one's suitability. Most exercices must contribute to train the useful muscles : (a) diaphragm in connection with the inspiration, (b) intercostal and abdominal ones for expiration.

These exercises may be realised in a synchronous way with various rhythms in musical performance (ie those of a score). One will call « **beat** », or « **duration** », a time unit around one second : this duration may vary. The following exercises are similar to those of the choir members or other wind instrumentalists (brass instruments, woodwind). It is important to **keep an open pharynx**.

The following exemple limits to a 4 beats score (of course, other rhythms are possibles : 3 beats, etc). The rhythms, durations, frequencies, etc, may, moreover outre, be modulated ad libitum.

3.2.1. Concentration and preparation (relaxation) : slow beats (eg 2 s)

(a) inspiration during 4 beats, then expiration during 4 beats (to be repeated) ;

(b) inspiration during 4 beats, then expiration during 8 beats (to be repeated) ;

(c) inspiration during 8 beats, then expiration during 4 beats (to be repeated).

3.2.2. Control of the lung capacity : optimization of the movements, faster beats (eg 1 s)

(a) inspiration during 4 beats, stopping the breath during 4 beats, then expiration during 4 beats (to be repeated) ;

(b) inspiration during 4 beats, stopping the breath during 4 beats, then expiration during 8 beats (to be repeated) ;

(c) inspiration during 4 beats, stopping the breath during 8 beats, then expiration during 8 beats (to be repeated) ;

(d) inspiration during 8 beats, stopping the breath during 8 beats, then expiration during 8 beats (to be repeated).

3.2.3. Controlling the flows and the serenity

(a) inspiration during 4 beats, then expiration during 8 beats (to be repeated) ;

(b) inspiration during 2 beats, then expiration during 8 beats (to be repeated) ;

(c) inspiration during 1 beat, then expiration during 8 beats (to be repeated).

Start again {(a),(b),(c)} with an expiration during 16 beats (to be repeated).

3.2.4. Managing the breathing during performance

With the instrument, the ***breathing***, as well as the ***fingering***, must not hamper the good progress of the performance : absence of hesitation, avoid to be short of breath, etc. In both these cases, it may be useful to define « marks » on the score (if these last are not indicated or the score is not known by heart) : these marks point out the instants for getting back one's breath or the moment where one must use a given fingering.

A **« breathing »** is (sometimes) generally pointed out with a dedicated symbol : it is a **comma located above the staff**, at the place where one can or must get his breath back (**breathing comma**).

In the absence of indication, one can apply the following processes (and annotate the score in accordance with them) :

(a) if the score to be played has **rests** (pauses, etc), the solution is simple : it is sufficient to « adapt » one's playing (inhalation) to these times of rest. The quantity of breathed in air depends on the duration of the rest as well as of the length of the next phrase (anticipation) ;

(b) if the score to be played is more « dense » (eg quavers or semi-quavers wen the tempo is 120 for a forth note), two possibilities are opened. Either, thanks to the previous exercises, one is able to **« last » the course** : this depends on the length of the passage to be performed (a poorly trained player may hold out during 15 s to 30 s without having to breath again). Or, one can try to **« shorten » slightly (ie according to a less possible perceptible way) the notes** located just before the main (or semi-main) beat of a bar and to inspire quickly during this shortcut : in this way, with a 4/4 or C tempo, the firts beat is the main one (then one may shorten the previous note), the third beat is semi-strong (shorten the 2th note). In the same way, one can still take advantage the existence of possible symbols such as

crescendo (inspiration « before ») or ***decrescendo*** (inspiration « after »), or still ***pizzicato*** or ***marcato*** (inspiration « between ») and act according to the same way ;

(c) other situations, much more « demanding », require possible ***circular breathing*** (cf § 3.2.5. below).

For a wind instrument, which production is linked to the air and to the breathing, the composers often take into account this biological constraint : the genre or the style of their compositions then match with the « human breathing » by means of adapted phrases.

3.2.5. The « circular » breathing

The previous « standard » way of breathing does not allow a **playing without interruption**. Nevertheless, it leads to the best results in terms of confidence in playing (risks) and of sound production (quality).

There exists an other way of « breathing », called **circular breathing** (cf appendix 6) : the aim of this technique is avoiding breathing through the corners (inhalation through the nose), while ensuring an exhalation of the air through the OO (thanks to a stocking of this air inside the BC).

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4. Warming-up

As for sport, the warming-up considered her consists in **get various muscles to work** : these muscles are devoted to the specific playing with instruments having a mouthpiece : diaphragmatic muscle, abdominal muscle, inter-costal muscle, pharynx, tongue and embouchure (lips).

The **importance of a regular warming-up** must be underlined. This warming-up may precede a daily training as well as an performance in real life. It aims at leading the performer towards a satisfactory level of fulfilment (ie without detectable faults) and to reach a fullness of playing. It must be adapted to every instrumentalist (age, experience, health state).

4.1. The objectives

The « warming-up » consists in particular in a **physiological work of the various muscles of the embouchure**.

From a less apparent way, it has also for consequence to **adapt the lips** (inner and median embouchures) **to the mouthpiece** (cf the shape of the lips of trumpet players) : it is the lips which go towards the mouthpiece, and not the converse. This contact (or « cushion ») between the lips and the mouthpiece is fondamental : on one hand, it corresponds to a « soft » part located between the teeth and the mouthpiece (which are hard parts) ; on the other hand, its surface is very small and its contents (skin, nerves, muscles, capillary vessels) very frail.

As a consequence, **one never has to crush the mouthpiece upon the lips**. This mistake prevents from oxygenation of the labial muscles and of the corresponding nerves, and then quickly impair the performances : its entails in particular a loss of flexibility and of endurance (« *stamina* »). It may even lead to serious physical damages of the lips (torn muscle, burst).

Various trials show that it is possible to perform high notes (eg above G3) without pressure on the lips (« no pressure method », cf supra), by simply applying the mouthpiece on a well adapted cushion (the lips). This applying may become a(n) (always limited) pressure only in order to **avoid a leakage of air between the median embouchure and the corners** : this necessity must disappear as the training and the musculation of the embouchure develop.

On must be reminiscent of the 3 tools which allow ***going up in the range*** :

(a) the flow of air (origin : lungs, intercostal and abdominal muscles) which must create an inner compression, necessary and sufficient ;

(b) the OC (more or less open pharynx, tongue more or less nearby the palate), which shape widened or narrowed favors or restreint the passage of the air : given the flow, when the passage is narrowing, the air flow becomes tighter ;

(c) the OO (inside of the labial cushion), which is a vibratory muscle.

It is then useless (and harmful) to misuse the lips with an excessive pressure of the mouthpiece for trying going up in the high notes. It just exists an important « counterweight » to this risk : it is the strengthening of the median and inner embouchures, that is the strengthening of the power of the underlying muscles. These lasts then allow a better resistance against every possible increase of the pressure.

4.2. Warming-up : reasons and effects

The first aim of the warming-up is **preparing the muscles** used during the performance in order to reach a **maximum control**. As well as a sportsman checks his breathing and makes his muscles work before a training or an event, likewise an instrumentalist must **make the muscles of the abdomen, of the throat, of the tongue and of the embouchure work**. Thus, the temperature of these muscles increases and they can attain an appropriate functioning level, ie a suitable level of efficiency. Conversely, the general efficiency (in partitular the « mechanical » one) of the organs allowing a good playing will be low, and even will reduce, in the case one tries dodge this phase of warming-up : when trying to play a sustained piece, at once and without warming-up, one observes that it is difficult, and even impossible, to last easily.

Moreover, it is useful to begin a warming-up (as well as a training) with an appropriate frame of mind : the relaxation favors the concentration et, conversely, the concentration leads to relax (on the emotional level). The exercises for monitoring the breathing are then very appropriate prerequisites (cf §§ 3.1. and 3.2.).

4.2.1. As soo as the beginning of the learning of instrumental playing, one must built **a good understanding of the techniques and of the physiology connected to a warming-up**. The reasons and the techniques of a warming-up then concern the muscles to be activated and the ways for performing the exercises.

The warming-up has also the aim of helping the performer. Thus, regarding a preparation, the **self-confidence** may follow :

(a) in part, the awareness of the interest of a warming-up : to reach a valuable level ;

(b) in part, a methodical and efficient warming-up.

4.2.2. In every situations (warming-ups, but also real-life exercises or performance), the **musicality must be looked for**.

Thus, every exercise, even elementary, must be performed with a maximum of complete musical sense : energy (sound volume), speed and rhythm, sensitivity (tenderness, poetry).

Often, **instructions concerning nuances** are mentioned on the score by its composer. They must then be generally followed :

(a) **tempo** : check the regularity, except for an accelerando or a ralentendo ;

(b) **volume** or **dynamique** : respect the sound intensity (entre ***ppp*** and ***fff***), except for a decrescendo or a crescendo ;

(c) **attack of the notes** : more or less « incisive », from legato (softer form) to staccato or marcato (more forceful forms) ;

(d) **retenues** : climaxes, breathing ;

(e) performance of **« phrasings »** : respect the rendering of a melody (highlighting), etc.

4.2.3. **Frequency of the warming-ups**. Playing severall times a day implies, a priori, practice, at each time, of the breathing exercises preceding these warming-ups. One can nevertheless practice a normal warming-up before a first daily work (exercise or piece), then more light warming-ups before each of the other resumptions : this depends upon the ***instrumentalist*** (***inurement***), the ***number of resumption***, or the ***duration*** or the ***difficulty*** of the warming-ups. The performance which follow each warming-up (exercise or master works) must have a sufficient technical quality and a musical rendering.

The practice of the warming-up exercises entail the respect of the following constraints :

(a) **avoiding the overwork of the muscles** during the warming-up. It is procribed tighting or working the muscles (including the tongue) with an excessive way, in terms of range, duration or strengh : the tiredness will come to the rendez-vous. An excessive tension of the facial muscles tends to hamper every musical performance after a warming-up. By contrast, sufficient **times for relaxing** restore overwhelmingly (or even increase) capacities which were reduced during the effort ;

(b) **being aware of the physiological aspects during the performance** : dynamics (functioning of the lungs, of the tongue, of the embouchure - without facial « contraction » -, of the fingers), and also statics (posture, position of the hands or arms, etc) ;

(c) **good use of the muscles**, and their regularity : this leads, as a rule, to positive results. Conversely, every ill-treatment is harmful and slows down or even compromises the progress.

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5. « Training » and technical improvement

The pre-warming-up (breathing) (§ 3.) and the warming-up (§ 4.) are ordinarily followed by the **training itself**. This last requires much patience and will be useful as far it is regular, methodical and rigourous.

This stet of the preparation plays also a major role : neglecting it may lead to a situation of failure. A good playing with the instrument implies, not only developping the knowledge techniques, but also training oneself : buikding of the muscles and of the vibrator (lippal reed), solving of specific difficulties (management of the air, muscle building of the embouchures, activation of the fingering, of the tonguing, global coordination).

5.1. How to practice ?

After a phase of warming-up, an instrumentalist works, in general, on the following subjects :

(a) ***technical exercises*** : treat first one difficulty alone (scales, arpeggios, tricky fingerings, kinds of sound attacks, flexibility of the lips, etc), then combine two difficulties (flexibility + wide intervals, velocity + arpeggios) and then more (coordination of breathing + OC + range, coordination of breathing + tongue + fingering, etc) ;

(b) ***interpreting musical works*** : either alone (solos « a capella »), or among a group (classical or variety orchestra, jazz band, brass band) ;

(c) ***self-criticism*** : it is necessary to reach becoming one's own critic, and also one's best critic. Registering various sequences of self playing, then listening them with a minimum standing back (the same day, or later), allow identifying and qualifying the tricky individual problems. One then must correct these problems ;

(d) ***creativity*** : realization of phrases according to the moment inspiration, or still personal compositions ;

(e) ***improvization*** : whereas the « free » cadences of classical music are often pre-written by the performer, variations around a given theme are often « invented » in jazz.

As for the other phases of the formation of an instrumentalist, the training must consist of :

(a) ***precise objectives***. The elementary objectives (eg work of the tongue, fingering, velocity, flexibility and wide intervals) must then combine together in order to form more elaborate objectives (eg coordination between tonguing and fingering, or also fast linkings between fingerings, etc) ;

(b) ***method*** and ***rigour***. This entails notably a **scheduling of the « tasks »** : thus, one never work velocity before getting an accurate tonguing, a precise fingering and a good coordination between them (except perhaps for wholly connected phrases). Likewise, the developpement of a **« watch-making playing »** (regularity and equality between the notes or

tones) give much charm to the instrument ; the movements ad libitum have also their interest but are more formative in terms of musicality and stylistics than in terms of pure technics. Finally, the developping of a without complacency **self-criticism** helps correcting various faults ;

(c) sufficient ***motivation*** : thus, the training can be brightened up with pleasant pieces. The resulting motivation follows generally the progress of technicality, and conversely. Yet, these progresses are not necessarily fast (above all in the beginning), and this may, by contrast, demotivate. Then one has great advantage in **alternating technics and pleasure**.

The training should always go together with a control of the following ***technical points*** :

(a) ***mental concentration*** : detachment from the external world, greater possible abstraction when playing (listen oneself playing) ;

(b) ***control of the breathing*** and ***conscience of its physiology*** : speeds, powers, rhythms, resumptions ;

(c) ***control of the sonority*** : precision (exact attacks, ie without delay nor « parasitic noises »), accuracy (« centered » notes in height), fullness (notes conveying with fidelity the sonority of the instrument and highlighting it, according to its type), sound volume (no breathlessness, nor shrilling or « strained » or vulgar, sound) ;

(d) ***control of the rhythms*** (rhythmical studies) : with the use of a metronome (equipment) and developping of a mental metronome. One must not postpone the practice of atypical rhythms : eg en 5/4 (cf « Take five ») or en 5/8 (cf « The ile of the dead ») ;

(e) ***extension en range*** (3 registers + pedal) : with an approach by the weak ambits, then extending gradually ;

(f) ***flexibility of the embouchure***. In particular, the work (strengthening of the musculature) of the median (support of the mouthpiece) and inner (vibrations of the lips) embouchures must usually be followed by an improvement of the flexibility of the lips (performance of intervals or arpeggios with ***growing amplitudes***, with a ***faster tempo***, etc) ;

(g) ***articulations*** of every kind : the ***control of the tongue*** and the ***control of the fingering*** may be the object of a specific work (cf appendix 7, **exercises on fingering**) ;

(h) ***multiple tonguing*** : binary, ternary or atypical ones ;

(i) ***fidelity*** to written pieces and ***musicality*** : perform well the articulation (legato, piccato, marcato, etc) or the instrumental peculiarities (vibrato, mordants, appogiatures, etc), add if any annotations on the scores, follow the indicated expressions or feelings with fidelity (dynamics : amabile, ralentendo, maestoso, pesante, espressivo, etc). Developping a **personal style** is not forbidden ... ;

(j) ***general coordination*** of the know-how (synthesis 1) : skillfullness when playing solo, where « everything must function » ;

(k) ***synchronism*** (synthesis 2) : skillfullness when playing within an ensemble (band, orchestre), inside which not only the individual playings must be optimal, but also the overall coordination.

Thus, it is important to remain concentrated during a rehearsal (eg at a weekly rhythm), as well as during a public performance. This proves separate training (or practice) and performance : the training prepares technically the instrumentalist to face an a public. Nevertheless, the psychological aspects are to be taken into account as soon as the beginning of the learning (cf appendix 10, **reflections on the psychological aspects linked to performance**).

A **regular practice** helps building the concentration and the endurance (stamina), as well as developping technical and musical abilities. Playing trumpet may become a kind of « second habit », a kind of natural or spontaneous activity.

5.2. Bases of a good routine

The main idea is a **maximum use of the means and abilities of the instrument**, or even to **« stretch the instrument to its own limits »** : for that, it is necessary to **vary as far as possible the various kinds of difficulties**. For instance, during the exercises (cf § 7), the playing may be performed by taking into account several basic criterions :

(a) ***range*** : play first inside the median register, then toward the low register, and toward the high register. It is suggested to begin always with the central note of the « usual » range, which covers every steps from F1# to C3 (26 half-tones) : that is, from a theoretical viewpoint, with the note B2b, or instead, in practice, with G2, A2 or even F2. This habit helps, incidentally, acquiring the « absolute pitch », that is recognizing a note which is played by a third party ; moreover, it favors a better reliability (or safety) in the attack of the notes (anticipating their height warrants their performance) ;

(b) ***tempo*** : play first very slowly (lentissimo), then, the quality of playing being ensured with that speed, play faster and faster (up to prestissimo : eg fourth note = 160). All the action variables must be controlled and command the playing : inner air flow, throat and tongue, OO, lips, valves and fingering ;

(c) ***sound volume*** (or ***intensity***, or ***dynamics***) : play first very softly (***ppp***), then more en more loudly (up to ***fff***). Try to play ***fff*** with few air stream and, conversely, ***ppp*** with much flow. Playing by attacking the notes as softly as possible is enough formative : this allows spotting how far it is possible to « save forces » (optimal management of the air) in order to get yet a soft but satisfactory tone ;

(d) ***technics 1*** (scales and tonguing) : play the scales « legato » (1 initial tonguing), then scales « with tongue » (the tonguing being first soft, then more en more emphasized (marcato, staccato) ;

(e) ***technics 2*** (arppegios and tonguing) : play the intervals and the arppegios first legato (1 initial tonguing), then with tongue (the tonguing being first soft, then more en more emphasized (marcato, staccato)

(f) ***expression 1*** : play the phrases without vibrato, then with vibrato, trills, mordents, appoggiaturas, etc ;

(g) ***expression 2*** : play by destorting the sound, play with growl (GRRR with the throat) or with trembling (TRRR with the tongue), play with various mutes (or simply with the hand closing slightly the bell, or with a possible cloth), play by attacking the notes « from below », or even « from above » (eg by trying to perform 1/4 of tones as does Ibrahim Maalouf, but without his fourth cylinder-valve), play with a valve between its two limiting positions, play with the bell brushing against a bowl of water, etc.

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6. Helps to learning

6.1. The practice of a **sport** (eg jogging or swimming), or also that of **singing** (choir or individual) or of an other instrument (eg **other wind instrument**), requires sometimes also some control of the breathing and contributes to a faster progress.

6.2. As yet mentioned, a **mirror** (with various positionings) and a **metronome** (regularity, rhythms) may have a great usefulness.

6.3. Each exercise, or each piece, may be **registered during a performance**.

By attentively listening the recordings, one is able to self-criticize and consider the quality of the produced sounds, of the articulation between notes, etc. That method allows spotting the faults, which then often appear to be evident. **It is absolutely necessary to try correcting these faults of performance**.

6.4. One can use a **microphone** connected on to a micro-computer and install a ***recording software***. The operating system Microsoft Windows has a utility for recording (nevertheless, the saved files have the proprietary format wma). Other softwares for sound processing (Audacity, etc) have a fonctionality consisting in recording and saving the file with current free formats (notably mp3 or ogg Vorbis).

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7. Protocols of performing

The suggested exercises are, at the beginning, generally easy to perform : one can play in the median register, with a short phrasing, a low speed and legato. The **increase in difficulty has the aim of deviating from this « middle »**, and particularly (a) to shape (develop the muscles of) the overall embouchure, (b) to manage the breathing and getting one's air breath back and (c) to become used to various fingerings and scales.

7.1. Basic distinctions

7.1.1. One main process of this method is the **passage from a « well-thought-out attitude » toward a « reflex attitude »** :

(a) during the **reflection**, one analyses the ***why*** and the ***how*** of each of the technical processes to be followed : this takes time (often an « incompressible » time), but this is beneficial in the long run ;

(b) during a **reflex**, one automatically associates a technique or an exercise with the expected result : it is the ***moment of the action***, which requires ***efficiency*** and does not let time for reflection.

7.1.2. In order to perform these exercises from an efficient way, one has also to make a **basic distinction** between :

(a) the **objectives**. These objectives may concern the increase of ***range*** (widening of the extreme notes : low-pitched and high-pitched), the increase of ***stamina*** (holding of notes, or ***« kept notes »***), the increase of the ***velocity*** (complete coordination : breathing, tongue, OO, fingers), the increase of ***flexibility*** in emitting wide intervals. In reality, these objectives combine in a more or less complex way : eg speed in the high register, flexibility between extreme registers, etc ;

(b) the **means** or **tools**. Following the order of the emitted air flow, these are : the abdominal and costal ***contractions***, the breathing and the ***air flow***, the aperture of the throat (***larynx***), the ***positioning and the activation of the tongue*** inside the OC, the ***aperture*** of the OO, the ***mobility*** of the embouchures, the positioning and the direction of the ***mouthpiece***. Can be added to these tools the handling of the ***valves*** and of the ***valves slides*** ;

(c) the **constraints** : among those yet evocated, one must recall the existence of necessary ***precedences***. One cannot realize some « tasls » before others (prematuration) ;

(d) the **waits** : these will obviously depend on the ***frequency of the trainings***, but also of the ***constancy*** in following them (attention or vigilance, concentration, wish of progress, etc).

7.2. The three registers

7.2.1. The suggested exercises (§ 8.) are centered on a first working register : the ***median register*** of the trumpet (eg octave from E1 up to E2). One must then play these exercises in the ***low register*** (from F#1 to D1) and in the ***higher register*** (from F2 to C3).

7.2.2. Playing often in the lower register may lead to some difficulty in going up in the high-pitched notes, and conversely. This is why it is necessary to ***work in every registers***. One suggests, in particular during the warming-ups, ***beginning with the median register***, from which it will be easier to move toward the other registers. Her too, a well trained (fortified) embouchure must allow surpassing the difficulties.

The practice of every register pertains to the previous methods and techniques.

7.2.3. Inside a fourth register, or **very shrill register**, the ***performance presents some risks*** (technical faults, but also damages and other traumas).

In fact, not much works requite a playing above C3, and this is true in every genre : classical (except may be baroque style), jazz, variety shows, folk, etc. Thus, the D3b (E3b for a Bb trumpet) of the first movement of the concerto in Eb by Joseph Haydn is an exception. In jazz, the superacutes (twofold C = C4, etc) are, most of the time, executed solely for shining or producing sound effects : their musicality is sometimes doubtful.

The timbre of an ordinary trumpet (Bb or C) is less aesthetical in this high part of its register, and ***other brass instruments are good replacements*** for it : notably, the piccolo trumpet over C2. Nevertheless, this last instrument is less easy to play than a normal trumpet : it requires in particular working the attack of the notes (which is nevertheless renowned reliable compared to the ordinary trumpet) and also the sonority (because the centering of the notes at the good height is challenging) (cf appendix 9, **use of the piccolo trumpet**).

Other trumpets (in A, C, D or Eb) allow various facilities. Thus, the concerto in Bb by Haydn above mentionned may be played with a Eb trumpet (the fingering is then « simply » the one of the C scale, thus with an intact clef).

7.2.4. At the other extremity of the ambit, one can get a pleasant rendering (sonority, musicality) in the **low register** (eg below C2) with the help of more adapted instruments relative to this register, which are also substitutes of the trumpet : flugelhorn, euphonium, tuba, etc. The instrumental technique is similar to that of the ordinary trumpet, with some adaptations : size and shapes of the mouthpieces, management of the breathing, etc.

7.2.5. In these situations (§§ 7.2.3. and 7.2.4.), one generally has to **adapt hilself to almost - « inescapable » changes of mouthpieces** : the spherical one of the trumpet ate generally relaced by conical mouthpiexes (cornet, flugelhorn). It is not before having got a sufficient strength of the embouchure that one can use different kinds of mouthpieces (precedence constraint).

It is then preferable well mastering the standard scale F1#-C3, which yet needs overcoming good difficulties ...

7.3. Miscellanous subjects

(a) ***wet lips vs dry lips***. Severall instrumentalists dampen their lips before playing : the aim is to ***make the air flow watertight*** at each corner, and also to ***make easier the move of the lips*** (eg closing / aperture of the OO) against the rim of the mouthpiece (reduction of the friction forces), and then to ***increase the flexibility*** during a performance. The choice of a mouthpiece with a thinner or more convex rim allows (to a certain extent) avoiding to have to dampen the lips. Actually, the practice of the dampen lips is not a real drawback : it is indeed often useful (eg for changing more easily the register) ;

(b) ***pivotage***, or ***pivoting***, the head from top to bottom (or conversely). It is sometimes useful to exert a more or less sudden ***move of pivot*** of the head (thus of the instrument), in order to facilitate some manoeuvres : notably, quick performance rapide of wide intervals (fifth, sixth, seventh or octave, or even more), or easier access more towards the high-pitched notes. As a general rule (case of a mouthpiece placed 1/2-1/2) : one lowers the head, thus the mouthpiece which stands together it, in order to go up in frequencies (high register), and one goes back up the head in order to go down (low register). But this pivoting (or pitching) must remain highly limited, because it contributes to exert an extra constraint on the lips and risks, nevertheless, also, leading to performance faults ;

(c) ***moves of the mouthpiece***. As well as pivotage, the ***moves of the mouthpiece*** during a performance (eg vertically pass from 1/3-2/3 to 1/2-1/2) may disturb, above all during an animated passage : the median embouchure may not have time for « recovering » its shape, suppleness and flexibility. The trained instrumentalist, whose embouchure is powerful (its muscles get bigger along with the training), may, on the contrary, modify this location (at least moins between two musical phrases separated by a sufficient rest : « recovering » time) ;

(c) ***controlling the reliability (or the safety) of the attack***. Various exercises allow increasing the accuracy of the attack, notably those concerning « tonguing » and wide intervals. A **simple test** may help controlling that reliability (or safety) : (1) attack an arbitrary note with the instrument, (2) move apart the instrument from the mouth, (3) put on the mouthpiece again then (4) attack the same note (or even a different one). The resulting notes must be right and accurate with, at once : a good ***height*** (well « centered » notes) and a ***lack of sound interferences*** (cracklings, retarded performance, etc).

(d) one offers (cf appendix 8) a **synthesis on the production of the sound** and of playing with the instrument.

7.3. « Routines »

7.3.1. The suggested ***working diagram*** below is generally called « ***routine*** » because of its repetitive nature. It is preferable realizing each exercise wholly and not stopping along the way, except in case of tiredness. In practice, each instrumentalist must be able to create its own working diagram, as appropriate as possible to his « personal equation » (demands, constraints). The general approach is as follows.

One start by listing a ***set of processes*** as varied as possible :

(a) ***transposing*** : the suggested exercises (§ 8.) can be executed according to different scales. It suffices to transpose (in writing or mentally) each of them in these scales, which

presents no difficulty. An side advantage of this approach is the following. The exercise is first memorized in the scale of its writen form ; then it is again « performed from memory » 1/2 tone above (or below), then 1 tone above (or below), etc. The learning (not treated her) of the ***« at sight » transposition*** may get benefits from this process. These processes apply as well to scales as to arppegios or other standard melodic lines ;

(b) ***velocity / endurance*** : start by performing the melodic line presented according to a given (fixed) tempo. This line is systematically writen with whole notes. Play then, with the same tempo, the same line with half notes (1 whole = 2 halves), afterward with triplet of quarter notes (1 whole = 2 triplets of quarters), then with quarter notes, quavers, triplets of quavers, semi-quaver notes. This is equivalent to a ***variation of the rhythm*** or an ***increase of the tempo***. Here again, the training must pass from a step of reflection to a setp of reflex ;

(c) ***attack / insurance*** : play with an ***more en more « sharp » attack*** of the notes. Start with linked notes (legatos) (except the beginnong of the first phrase), then attack with HU, HA or HI (sudden expellings of air), then with GU, GA or GUI, with KU, KA or KI, with BU, BA or BI, with DU, DA or DI, with PU, PA or PI and with TU, TA or TI. The syllable PU has the advantage of facilitating somewhat the « setting on the mouth » of the trumpet (mouth having a shape as for a kiss) ;

(d) ***lips flexibility*** : the **lips flexibility** refers to performing legatos, which force the labial muscles to crush together or to relax vertically (ie from one lip toward the other). These notes are generally based on a ***harmonic diagram*** (***synchronism***) but are executed melodically, that is from a spaced out way (***diachronism***). A typical exemple is the one of ***arpeggios*** (or « spread out » chords). The more the height of the intervals between notes is large (second, third, fourth, fifth, etc), the more the difficulty is, and the more the muscle-building can develop.

In order to **well « isolate » the treatment of this difficulty** with respect to others (fingering, attack of notes, etc), one ***performs these intervals in a legato way*** (no tonguing, except the first). Moreover plus, one must ***hold down a same combination of valves***. One plays « on open » (ie without use of valves), and legato, the « natural notes » (C1, G2, C2, E2, G3, C3) or (C1, G2, C2, E2, G3, B3b, C3) ; next, by activating the valve 2, one plays the notes with a gap of a semi-tone lower (B1, F2#, B2, F3#, B3) or (B1, F2#, B2, F3#, A3, B3) ; etc. When going lower, one takes advantage of the alternative fingering (cf § 2.6.3.) : so, one plays the notes (G1, D1, G2, B2, D2, G3) only with the combination 13 ;

(e) ***sound dynamic (volume)*** : play first pianissimo, then louder and louder. This differs from the attack process (c). One may also try to suddenly attack the notes ***ppp***, or softly the notes ***fff*** ;

(f) ***changes of register*** : as indicated, the sketches of exercises are writen, unless technical necessity, in the ***median register*** of the trumpet (C1 to E2). Il will be useful to passer, as soon as possible, to other registers (low, high) and repeat the same kinds of exercises. Even if the ambit of the low and of the high is narrower than the one of the medium level, the adaptation of the exercises is straighforward.

7.3.2. An other factor of progress consists then in **combining ad libitum the various indicated processes**. For example, among all the possible combinations, one may work those which look the more « difficult ». Indeed, playing easy exercises (for himself) seems

insufficient. Conversely, it is more efficient, for progress, to **perform exercises that look difficults or less interesting to perform** : they will be more en more easy to perform the following day ... or later on.

Each instrumentalist can so create for himself a ***programme « à la carte »***, provided that he **draws as widely as possible among these processes**, in order to treat every category of difficulties : ***« all around » policy***.

7.3.3. The ***usual « scales »*** do not belong to these exercises : major, minor (3 modes), by full tones. Their learning and good performance are of course very important. Nevertheless, taking into account the prerequisites on music theory, the performer can himself easily conceive and performe this kind of exercises without any help of, as yet indicated, lengths of writen pages. **« Mentalizing » the scores** of the exercises in different scales is, in itself, a beneficial exercise.

7.3.4. For the same reasons, the ***usual arpeggios*** are not analyzed in a detailed way : « harmonic arpeggios », diminished arpeggios, augmented arpeggios or full tones arpeggios. The performance of the natural arpeggios, as successive thirds (C1, E1, G2, B2, D2, F2, A3, C3) or as successive fourth (G1, C1, F2, B2b, E2b, A3b), allow a ***better « handling » or « maturation » of the fingering*** as it leads to different automatic reflexes with respect to those linked to the performance of the usual scales : thus, the firsts lead activating in a systematic way the combinations 0, 12, 0, 2, 1, 1, 12, 0, the seconds the combinations 0, 1, 2, 0, 12.

7.3.5. The **« pedal notes »** are located below the normal ambitus of the instrument, that is under F1# (or F1). They must be treatef separately, but are relatively easy to produce. As they are not « musical », it seems better instead talking about « **pedal sounds (or tones)** ». For favoring the emitting of these sounds, on must succeed in associating :

(a) a ***wide aperture of the pharynx*** (throat) ;

(b) a ***slow and regular breathing*** (mastering of the exhalation) ;

(c) a ***relaxing of the lips*** (« soft » lips) (mastering of the embouchure in one of its extreme fonctions).

The fingering to be used is arbitrary : one can get these sounds on open as well as with combination such that 12, 23, 13, 123, etc, of the valves. The simpler way consist in playing on open (valves up).

During this work, one has to ***master the height of the pedal tones*** (centering) : one way consists in playing a note of the standard low register (between F1# and C1), then in playing the pedal located at a given interval (octave, third or fourth, etc) below. If a pedal sound cannot be easily attained (this depends upon its height, on the instrument and ... on the performer), one can try gropingly a fingering (different from 0) which could allow reaching this pedal sound.

The interest of exercises on out of range sounds lies in (a) the (relative) relaxation of the labial muscles, (b) the control of a slow exhalation, (c) the control of the height of the tones. There

is also advantages in alternating the emitting of pedal sounds with the emitting of standard notes (flexibility).

7.3.6. ***Routines or not*** ?

Some artists believe that the « training » with « routines » is not a necessity : instead of playing exercises, they prefer, after a reduced warming-up, playing directly the pieces for brass instruments.

Indeed :

(a) **these pieces generally combine various difficulties** and then are an excellent exercise for learning and training ;

(b) learning a piece requires, not only mastering these difficulties, but also set the musicien in a **closer situation with respect to the performance** (concert, brass band, etc) ;

(c) finally, a musicien who is only training himself has not necessarily a **repertoire** to offer. But it is more satisfactory to be able to present, as soon as the start of the learning, some pieces (even very simple ones), to a public of close relatives or friends : that possibility is rewarding, and the audience can play a role of critic which is not negligible.

Nevertheless, ***some difficulties are always to be overcome, and these must be « approached » in a progressive and well-thought-out way***. Indeed, even after a warming-up, some technical obstacles cannot be overcome easily and be performed directly, and this justifies the necessity of a minimal training.

Thus :

(a) playing in the high-pitched notes implies first going up progressively, as do the vawes of a rising tide ;

(b) performing increasingly wider intervals involves augmenting that amplitude and starting with smaller intervals (minor and major seconds, then minor and major thirds, then minor and major fourth, etc) ;

(c) the velocity (coordination between breathing, tongue and fingering) implies a progressive and initially slow approach, etc.

As a consequence, the combination of these difficulties can be mastered only by training on a basis of routines : thus, performing of successive quick fifths in the high register is highly chanllenging and implies, at least, a good preliminary warming-up as well as a training during many hours, or even many days.

7.4. Some hints

7.4.1. When warming-up, it is advisable to ***advance as far as possible inside each exercise***, but the ***performance must remain « confortable »*** : banish every excessive tension or muscular tiredness. Sometimes, aches may be felt (in particular in the cheeks and the muscles

of the jaws) : this is generally considered as normal because this muscular work is unusual, mainly for beginners.

7.4.2. Unless particular mention, play these exercises (a) with ***regularity*** (duration of the notes, same periods between notes) and (b) with ***evenness*** (same tone between notes). A **fonctioning analogous to that of a « clock »** (rhythm, sonority and timbre, volume) is a security for quality. As often, if one can do the more, one can do the less as well : (a) it is always possible to replace a strict rhythm by a more relaxed one (this kind of rhythm exists in every genre of musics) ; (b) on the other hand, the converse is more difficult without a training implying rigor.

7.4.3. It is useful to use, as often as possible :

(a) a ***mirror*** in order to check the evenness of the (horizontal) plucking of the corners and avoid the stretching-widening of the lips (which thins and weaken this part of the embouchure) ;

(b) a ***metronome*** (material equipmenbt) for controling the evenness of the performance. This ***metronome*** must become a « mendal metronome » provided that one can built (for himself) an « inner clock ».

A simple test consists in (1) selecting a melody which tempo is well rhythmic, preferably slow (eg the « Bolero » by Maurice Ravel), (2) playing then at the same time than its source (radio, record, personal computer), (3) then continuing playing during an provokated interruption of the melody (ask a third party to lower completely the sound), (4) finally restore the sound. No gap must be perceptible ...

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8. The basic exercises

The **suggested scores** contain various basic exercises. When clicking on each of them, one follows a link toward a (downloadable) MIDI file : this allows, at the same time, **reading the score** and **listening the corresponding sound**.

Appendix 5 (**basic exercises**) details the content of these scores, as well as some suggestions related to their performing in the best conditions : finality of the exercise, technique, advices, etc.

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9. Defaults of performing : identification and search for causes

Whatever the « intrinsic » skillfullness of a performer, faults of performance appear often, even among the most experienced. It is then necessary to (a) spot these faults and (b) identify their causes. One will never completely eliminate these faults, above all if the performer tries (too soon) exceeding (too quickly) or overdoing his limits : **one must not cut corners**.

One suppose that the instrumentalist is in perfect physical and mental conditions, and that the instrument is in good working order : faultless geometry, cleanliness of the mouthpiece, of the tube and of the slides, lubrication of the cylinders, greasing of the slides, etc.

9.1. The faults

From the point of vue of the teacher (teaching method for constructing the sound) as well as the one of the « auditoire » (receipt of the finished product), the noticed faults generally concern well-known questions, yet often mentionned :

(a) the ***attack*** of the notes (without or with tonguing) : gaps of production, background noises (cracklings) ;

(b) the ***mistakes when performing a score*** (faulty notes), generally due to a bad reading of the score (forgetting of the key signature, of an alteration, etc) ;

(c) ***unwanted notes*** (« wrong notes »), particularly in the extreme registers (low and high pitches) or during a kept up performance of large intervals ;

(d) the ***breathing*** (too short or insufficient), particularly when « getting the breath back » following a long enough melodical phrase ;

(e) the ***sonority*** : « hollow » sound (muffled sound, sound without fullness) or which height (centering) is questionable ;

(f) the ***fingering*** : special difficulties (« ***fourk*** » between 13 and 2 ; « ***balances*** » between 1 and 23, and between 12 and 23), (more or less long) linkings of the notes (phrasing) and anticipation in moving the fingers ;

(g) the ***coordination*** between tonguing and fingering.

These elements must be permanently controlled.

9.2. The causes

These depend too of a limited number of factors, which still are the same :

(a) ***« technical » facteurs*** : insufficiently open throat, bad breathing (getting the breath back badly managed or anticipated), bad lingual work (positioning, activation of the tongue),

insufficient aperture (or even occlusion) of the OO, excessive compression of the mouthpiece. One can add the muscular tiredness : lips (round muscle) and other muscles forming the embouchure, tongue (too intensively repeated tonguings) ;

(b) ***biological factors*** : damage of the tongue, damage of the oral zone (teeth, lips), respiratory tiredness (intercostal muscles), insufficient air supply (lack of « breathing »), heavy digestion, etc. An ENT disease (should it be only a « sore throat » or a « stinging throat ») or a pneumological pain (bronchitis) may drastically limit the playing ;

(c) ***psychological factors*** : stress or anxiety, before, during, or even after the performance (eg during a competition). One may attempt an analysis of these drawbacks and suggest some **reflections on the psychological aspects linked to performance** (appendix 10).

9.3. The parries

9.3.1. Technical parry

There is no miracle. This kind of faults, common enough among beginners, will be reduced only with the **training** and following the advices of the teachers. The aim of a method of learning is limiting the technical faults, but it cannot be a substitute to an educational « supervision ».

The stopgaps of the technical faults are then :

(a) ***mastering of the breathing*** : intensity (or amplitude), rhythms (cf infra : breathing and pre-warming-up, warming-up, training) ;

(b) ***practicing exercises on warming-up***, which concern the air flow, the tongue, the embouchure (inner, median and outer) and notably the OO, the « contact » with the mouthpiece (positioning, pressure, morphological appropriateness), the fingering, etc.

All the applied exercises must contribute to limiting these drawbacks, in particular : maintained sounds, increasing variations (from « weak » to « great ») of the intervals between notes, wide intervals.

9.3.2. State of health

A good breathing generally comes from a satisfactory (food, sporty) ***lifestyle***. In particular, see to the oral and dental hygiene and keep an eye on the ***« physical » and « physiological » state of the mouth*** (***mouth ulcers***, etc).

An « agressive » ***feeding*** (acids, alcohols, spices) may have an influence on the lips (suppleness, stamina) and limite their performances. Various substances (tobacco, ingestion of fats) take the breath away and limit too the potentials (hiccup, etc). A heavy digestion, a nauseous state, may annihilate the intended efforts for a correct playing.

Winter may bring various inconveniences : cold (sneezes), bronchitis (cough), dryness of the lips (use a lip balm).

Spring too involves some troubles : allergies (sneezes, whimperings).

9.3.3. Anxiety

This situation depends notably on the personal emotivity, but it may often be reduced to a simple apprehension. Nevertheless, that ***apprehension will never disappear entirely***. One can besides take advantage of this observation : firstly, with the ***awareness of its existence*** (which is less stressing than its ignorance due to an insufficient analysis), then by a ***(mental and great) concentration on the performance*** itself (and this diverts, or « evacuates », a part of the emotion).

Thus :

(a) appropriate techniques allow, to a certain extent, reducing anxiety : a ***sufficient preparation*** (breathing, warming-up, technical exercises), as well as ***« checking » one's performance*** real life, contribute deeply to reduce that anxiety (better self-assurance). Some recommend applying yoga exercises.

In every case, ***the training is the basis of the quality of a prestation*** : an insufficient preparation, an early performance, are generally which causes d'anxiety. But ***these « technical » factors are manageables*** ;

(b) even sometimes, the anxiety can be connected to a ***context*** : ***personal problem*** irrelevant to the musical activity itself, a temporarily altered ***health*** (digestion, seasonal disease, etc), or simplly ***stakes connected to the performance*** (playing alone entails less nervous tension than playing in front of friends, and this is in turn less stressing thant playing in front of an audience, in particular a board of examiners, an instrumental competition or a recruitment test) ;

(c) the anxiety may also happen after, or be increased by, the occurrence of an **occasional problem** : sneeze, cough, cramp, anoxia (ie insufficient breathing), etc ;

(d) the **apprehension of the occurrence of a « major risk » during the performance** is obviously the highest point (height) of the anguish. Quel may be this risk ? it seems unanimously that it concerns the ***famous « out of tune note(s) »***. What are the stakes ? According to the context (playing alone, kind of audience, level of difficulty, etc), the « judges » (oneself, audience, examiners) will be more or less inclined to forgive a failure. The wrong note may be very obvious as well very light (and sometimes go unnoticed : less neat attack of the sound, slight alteration of the quality of the sound, slight weakening of its volume). One must then not « get confused » when this problem occurs, and continue performing by maintaining the level of concentration and the regularity of playing : a good and clever « making good » the fault often leads the indulgence (related to the whole quality of the playing), or even the ignorance of the fact.

The ***masteriing of the concentration***, as well as a ***mental preparation to the performance***, can help overcome this stress (think to the post-operative relief). This requires, at least at first, to be alone. That isolation is made easier if one has access to a rehearsal room.

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10. Musical creation and instrumental performance

10.1. The modern ***(digital) techniques*** allow :

(a) a ***serious and rigourous training*** : with the help of recordings, one can check the quality of his own playing (performance) ;

(b) a ***context of playing comparable to the real life one*** : this context allows, moreover, feeling less stress and better concentrate on the technique.

10.2. Severall tools are freely offered on Internet : ***musical editing softwares***, ***scores*** or ***files formatted MIDI*** (« purists » may ignore this paragraph).

10.2.1. The ***MIDI standard*** (musical instrument digital interface) allows transferring and the portability of ***musical contents in digital form*** (MIDI sequencer).

A MIDI file is generally very light, and represents, in adigital form, an ***« image of a musical score »***, which is more or less complex (simple melodic lige, orchestral excerpt). The number of managed « voices » is equal to 16 (or even more). That norm then allows, to a certain extent, « representing » an orchestral score involving at least 16 « instruments ». An instrumental line (or « voice ») reduces then to 3 main variables :

(a) the ***tone quality (of the instrument)***, which is its acoustic specificity and explains its artistic specificity ;

(b) the ***height (frequency)*** of the (digital) sound ;

(c) the ***duration*** of this last.

The limits of that standard rely notably to the quality of the sound : the resulting tone quality of each instrument is digital, then fairly poor (improvements are expected : sampling of real instruments or voices). Moreover, it is not always possible or easy to carry out, with the avalaible softwares, some nuances : piano or forte, crescendo or decrescendo, vibrato.

Nevertheless, this standard ia widely sufficient for training.

10.2.2. Various **score editing softwares** also manage the MIDI standard. Some are free (or commercial, with a free, but limited, version) : **NotePad** from Finale Music, **MuseScore**, **NoteWorthy Composer**, **Cakewalk express** (old), LilyPond (descriptor of score with a programming language, then not wysiwyg), Linux multimedia studio, Magix music maker, etc. Other softwares are commercial : Pizzicato, Sibelius, etc.

These softwares allow not only creating scores for several voices (ordinary instruments of an orchestra, voices of a choir), but also importing and exporting MIDI files :

(a) the ***importation*** has the effect of transcribing the ***MIDI informations into editable scores***, which can then be modified according to the purposes. So, one can separate the ***trumpet part*** (or any melody of interest : other instrument, song, etc) and the ***accompaniment part*** (which is the set of the other « voices » of the overall score). The sheet part of the trumpet may, if any, be transposed (eg Bb or D trumpets) before being printed as an usual score ;

(b) the ***exportation*** allows creating MIDI data files : the ***accompaniment part***, extracted from the overall score, can be « exported » as a « lighted » MIDI file, and this last may be transformed as an usual sound file (eg native WAV or sampled as MP3, OGG-VORBIS, etc). This possibility is particularly interesting when playing while simulating an accompaniment with other instruments (or even with a standard orchestra), although this accompaniment is only « digital » ; it contributes also to improve one's personal discipline (rhythm, coordination, etc).

In particular, ***Finale NotePad*** (favoured by the author) includes (in its portable 2011 version or its 2012 version) many voices (thais is timbres, then instruments). This software is easy to be handled, and allows making progresses in comfortable conditions. This software helped writing the exercises putting them in MIDI format.

Finally, the various previous softwares also allow listening writen parts, then **making easier the decoding** of complex scores (rhythms, interweavings).