

“HIGH INTENSITY INTERVAL TRAINING APPLIED TO THE TROMBONE PRACTICE”

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1. STORY OF MY RESEARCH

I have been playing the trombone since I was 8 years old. During my development as a trombone player I remember that I have always struggled with something technical, such as tempo or tuning. While I have always reached a point through hard work where I could resolve these small problems, over the years I had always struggled with my endurance and the high register. In fact, as I reached a higher level of training I noticed the problem was not going away. Playing demanding pieces such as *Nino Rota* and *Frank Martin Ballade* really caused problems for me because of the intensive requirements for endurance and the high register. After playing this kind of pieces I always found myself exhausted and consequently it was difficult to maintain a healthy continuity in my daily practice. Every time I felt overworked I had to take one extra day to rest and relax, and this only appeared to be getting worse until the point that it became a daily concern: even before I picked up my instrument to play I wondered how my sound was going to be.

The fact of missing a good continuity in my daily practice was incredibly stressful for me. It began to affect my confidence and even made me doubt the basic skills that I had already achieved. Indeed, as I began the Master's program at The University of Codarts I realized that I needed to do something in order to change this situation. The repertoire was becoming more demanding and I was having problems with my stamina. I also needed to find different ways to improve my high register to play this difficult repertoire. At first I thought that it might be a good idea to start relaxation methods in my daily practice such as Alexander Technique, Feldenkrais, etc.

Then I started thinking on how I could plan scheduled breaks to my daily practice. I used to play for long periods of time without taking breaks but I learned from 2015 that taking scheduled breaks are really helpful in order to keep yourself fresh every day. However, a research based on how to rest will not be a practical way to push me to improve the high register.

It took a couple of months for me to realize the possible answer to my problems of endurance and high register. This happened one day while working on an exercise based on weightlifting when I realized something quite obvious that I had never thought about before: By doing weightlifting the muscles stretch and become tight. This exercise breaks the fibers and consequently the muscles become bigger. By doing this activity continuously, after some time you might be able to lift more weight and to build up more stamina.

We play the trombone with the embouchure which is a mix of several muscles working together.

Even though the embouchure is composed of muscles and we obviously cannot train weight lifting with them, I figured out that I needed a kind of "weight training" for my trombone playing: Something that could not only strengthen the muscles to allow more stability in the high register, but also something that would help those muscles to maintain their strength while I was playing and at the same time help my endurance.

I was happy with the other technical skills that I had, for example how I use the air, the articulation and sound, but on the other hand I was struggling with high register and endurance, so what I needed was a method that help me improve my weakest points.

This drove me to the following decisions:

1. I had to find a method to use in my daily practice that reproduces the same feeling that weight lifting does in the body but for my embouchure.
2. Because this is physically demanding I wanted a method already proved and researched in the sports world.
3. It had to be related to developing endurance and stamina.
4. It needed to be a quick exercise and give fast results because I needed to show improvement fast to stay on top of my studies.

I always thought that the fact of playing an instrument has a lot in common with the athletes, especially with the techniques, preparation and performances we both use:

1. They make repetitive movements and technically precise. This can cause muscle or bone injuries due to overwork. Some researches confirmed that there are more lesions suffered by musicians than by athletes.
2. We both need a daily practice to keep or improve the level.
3. Both activities are basically sustained by the musculoskeletal system and they require a big cardiac effort, as recent researches can prove.
4. We both must give the most of it in a certain moment (as in a sport competition or a concert).
5. We are exposed in front of an audience and we have to deal with that pressure.
6. Both worlds demand a big amount of focus and coordination.
7. Combination of body and mind.

After spending a few more days researching and asking experts of the sports world such as *Manuel Ventura*¹ and *Victor Orduña*² I found the answer I was looking for. I found High Intensity Interval Training (HIIT).

I developed the following research question:

1.2. How can I develop exercises that combine HIIT with trombone playing in my musical daily practice in order to improve my endurance and high register?

1.3. What is HIIT?

*"High-intensity interval training (HIIT) is a form of exercise in which you alternate between very intense anaerobic periods and slower recovery periods for a shorter, more efficient workout"*³.

I believed that HIIT would be excellent for me as a trombone player because it is a fast and really effective way to train the muscles and gain endurance, and that was exactly what I needed to improve.

1.4. HIIT examples & Effects

To begin with my literature review, I familiarized myself with many examples of HIIT workouts within sports. For more detailed information of these examples on HIIT workouts see Appendix 1.

As I examined these workouts I began to think about how I could adapt them to trombone playing.

Following this review of various HIIT approaches in sport I needed to consider how HIIT could be applied when playing the trombone.

The first step was to try to find a tested way to show whether or not HIIT is a good method to develop stamina⁴, which helps to improve our endurance. Then I found out that in Stockholm's Karolinska Institute there were students testing how High-intensity Interval Training can provide similar health benefits to the ones from prolonged endurance exercises:

¹ 2000 first prize in Master 40 IFBB International Championship

² 3rd champion in 110m hurdles, National Spanish Trainer of Playas Castellón

³ Says personal trainer Daniel Lagimodiere <http://www.reallifit.com/>

⁴ "Moral or physical strength to resist or withstand illness, fatigue or hardship" Oxford English Dictionary

Håkan Westerblad⁵ explained in his study “Ryanodine receptor fragmentation and sarcoplasmic reticulum Ca²⁺ leak after one session of high-intensity interval exercise” from 2015 that:

Our study shows that three minutes of high-intensity exercise breaks down calcium channels in the muscle cells. This causes a lasting change in how the cells handle calcium, and is an excellent signal for adaptation, such as the formation of new mitochondria. Mitochondria are the components of the cell whose primary job is to burn sugar and to release energy to be used by the cells. They are usually described as the powerhouses of the cell. An increase in the number of mitochondria signals means an increase in muscle endurance.

Strenuous exercise increases the number of free radicals (oxidants) in the body, which in the case of HIIT causes the breakdown of the calcium channel. The same breakdown happens when muscles are put under strenuous endurance. Calcium ions allow muscles to contract and relax and they are activated by nerve impulses. Cells have a natural mechanism to nullify the free radicals, and depending on the level of fitness, it could take between two and seven days for the muscle to recover.

The team asked active men to perform one session of three to six sets of high-intensity cycling for 30 seconds, with a four-minute rest between each set. They took a thigh muscle biopsy 24 hours after the exercise and discovered an extensive release of free radicals.

When the same experiment was repeated with elite endurance athletes, they found the release wasn't as impressive since they are used to intensive exercise. The researchers also looked at how antioxidants like vitamins E and C affect muscle recovery by looking at mice treated with antioxidants before and after simulated high-intensity interval exercise. (2015: 15492–15497)

The professor also added that “our study shows that antioxidants remove the effect on the calcium channels, which might explain why they can weaken muscular response to endurance training”. [...] “Our results also show that the calcium channels aren't affected by the three minutes of high-intensity interval exercise in elite endurance athletes, who have built up more effective antioxidative systems”.⁶

After reading through the article of Stockholm's Karolinska Institute I drew a couple of conclusions I could apply to my research as well:

1. The HIIT applied to trombone practice can deliver the same or even better results than prolonged high register exercises in a shorter amount of time.
2. The HIIT applied to trombone practice might be less effective for those people who already acquired a quite high level in their trombone practice (as elite-sports people).

⁵ Principal investigator and professor at Karolinska Institutet's Department of Physiology and Pharmacology

⁶ The paper was published in “Proceedings of the National Academy of Sciences”.

2. DEVELOPING EXERCISES FOR THE TROMBONE

Up to this point I was still wondering how HIIT could be used without weight training and how I could apply this approach while practicing my trombone. I asked several experts from both worlds, sports and trombone, such as Janine Stubbe, Rogelio Iguarada and my trombone teacher Alexander Verbeek.

I also found out that the way of applying HIIT for an elite swimmer, a cyclist or runner does not necessarily need weights, but it was more about applying really intense periods of exercise and giving a hundred percent of your anaerobic capacity. This was to be alternates with smaller recovery periods over shorter periods. So my conclusion was:

I needed to find a group of exercises which demanded an intense amount of stamina over a short period with carefully timed breaks in between.

If I could incorporate a method like this in my daily practice that fitted with the other routines I was used to do, then I hoped I could reach all my goals. These were:

1. To be able to handle challenging repertoire without getting too tired.
2. To be able to play really high register.
3. To improve my sound in the high register.

If I could achieve this then I believed that I could also achieve a longer term goal of improvement in my alto trombone skills. Excellent in alto trombone required to win auditions in an orchestra which is one of my dreams for my career.

2.1 EXPERTS' ADVICE

I used the information these experts gave me as a bridge between the HIIT sports and the trombone practice, adapting this method and bringing it to the world of the trombone, but always keeping its essence.

MUSIC: Rogelio Iguarada Aragón⁷

I chose to talk with him because he is really aware of how to create good habits from the beginning. The hard demand of energy spent on HIIT can develop a high average of injury if the exercises are not applied properly.

It does not matter how difficult the exercises are if we learn how to create healthy habits in the way they are played.

From the first moment I knew Rogelio Iguarada could give me really good recommendations about how to improve on my main goal of this research.

He suggested the following exercises that I wanted to apply with the HIIT method:

"In order to give you the proper feedback about your resistance I need something else, like a recording of the whole concerto, not only the first movement. But on the other hand I could say that your high register has already improved from summer 2014. However, you have to keep working on the exercises based on high register and resistance in a constant way and always focused, with a correct planning".

⁷ Principal trombone of the Spanish National Orchestra for more than 10 years. He suffers from dystonic syndrome since 1995

Talking about specific exercises I would recommend you to work on extreme contrast drawings which demands good flexibility skills.

“You also have to be aware of how important the resting periods are. This is something basic but it has to go together with a proper preparation and discipline; what I mean with this is that the resting periods should be taken with a calmed mind and always isolated from musical environment, for instance: do an earlier warm up of about one hour. After this warm up, it is better for you to take a rest of about one or two hours. By doing this you allow your muscles to release and it helps your resistance to improve a lot, otherwise you could get tired really quickly in the morning and if you overwork your muscles then you need to rest at least an entire day. Work on extreme contrast drawings which demand good flexibility skills”.

SPORT: Janine Stubbe⁸

I was really interested on having an interview with Janine due to her dedication to the sports world and all her research on it.

This interview was essential for the following work I have done and the consecutive creation of the HIIT applied to the trombone practice.

I am going to highlight the few important points she stated:

- HIIT demands a sort of exercises which last around 15 minutes of your daily practice.
- Work them as a gymnastic exercises
- Timing must be specified

TROMBONE TEACHER: Alexander Verbeek

The following questions were asked to Alexander during my first intervention cycle in order to clarify the following steps I needed to take and to see if he agreed on the topic I chose. You can see the rest of the interview in the Appendix 2 pg. 34.

Q: I would like to know your opinion about my work on High Intensity Interval Training applied to the trombone practice.

A: I think it can be very interesting if you do a proper research about that. How do muscles react on certain exercises? How much time do they need to recover? What can you do to be in the best shape on a certain moment? Is it generally the same for every person or does everybody needs his/her own plan? So I think there as a big medical aspect in this as well.

Q: Could you give me more advice in order to get more information on this topic?

A: Talk to physiotherapists, work together with Erasmus University, search for studies that have already been done, try out different preparations yourself and be very aware of what it does with your body.

⁸ lecturer in sports management in the University of Amsterdam <http://www.hva.nl/over-de-hva/contact/content/s/t/stubj/j.h.stubbe.html>

3. INTERVENTION APPLIED TO MY PRACTICE

It is here, after assuming all the information explained previously, that I started applying all this knowledge with the goal of finally creating the trombone exercises.

The first HIIT exercise for trombone was created because of Rogelio's assessment, when he told me that the dynamic drawings were needed in order to start creating endurance in the muscles. The embouchure has to get used to the feeling of going from **ff** to **pp**. This has the same impact in the muscles as the squat jumps (energy in the jump contraction=energy while playing **ff**)⁹.

Based on the information I acquired from the literature and my experts' advice I began to develop several HIIT exercises for trombone. I added an extra "T" for trombone so they are now called HIITT. I tested all of these HIITT exercises through self-experimentation over several months in order to determine their effectiveness. The self-experimentation process can be seen in Intervention Cycle 1 (pg. 17 - 25) of this report. Following the self-experimentation period, I carried out a small pilot study on several of my trombone colleagues under the supervision of my research coach Dr. Nicole Jordan and my main subject teacher Alex Verbeek. This pilot study is described in Intervention Cycle 2 of this report (pg. 26 – 32). In the following section I will describe in detail the HIIT exercises that I developed for trombone.

3.1 HIIT EXERCISES FOR TROMBONE (HIITT)¹⁰

These exercises require a really high technical skill level and they are made to be practiced progressively. You must be able to play them with the mouthpiece so you make sure that you can naturally play them without any kind of trick (such as pressing lips or no air).

You should practice them in the last part of your daily practice; once you have done all the work you planned for the day so when you finish them your muscles can rest a big amount of hours until the next day. This is something really important because it allows your muscles to recover and if you do not rest properly, the average of injury increases.

HIITT DYNAMICS: An example on how to practice this exercise can be found via the following link: <https://www.youtube.com/watch?v=QKmqNA98OMw>

The purpose of the first exercise is to reinforce the embouchure muscles. It is based on 7 sets of dynamics and flexibility drawings and after each one we have to rest one bar. While playing this exercise, an effect on the musculature is being produced. Because of the high level of stamina demanded, this effect is similar to the one produced after doing 7 sets of weight lifting with your biceps. The contrast between **pp** and **ff** together with the flexibility will help you to build a really good and strong embouchure base in order to play the following exercises.

Timing: 2'50" on high intensity, one bar rest between each set and 30" seconds extra rest before the repetition and 30" of rest more before the following exercise.

⁹ Note: obviously the amount of energy spent on the embouchure is far less than when we do HIIT swimming, cycling or running. This simply happens because the muscles that recreate the embouchure are smaller than those in the leg or arms, although the action is the same (contraction and relaxation).

¹⁰ This is the last version of the exercises after receiving feedback during the intervention cycles. There is an older version in the first intervention cycle where I included all the early mistakes I have done.

HIIT Dynamics

Manel Igualada

$\text{♩} = 120$

1 bar rest

5

1 bar rest

9

1 bar rest

13

1 bar rest

17

1 bar rest

21

1 bar rest

25

1 bar rest

TIMING 3'50"

(Play this exercise twice, but don't forget to rest 30" before the 2nd time and 30" more before you start playing the next exercise)

HIITT HIGH REGISTER: REACHING: An example on how to practice this exercise can be found via the following link: https://www.youtube.com/watch?v=1RGX_iLjg2A

This exercise is well known by trombone players but in this case I added a third higher. It is made in order to help you to reach the really high register notes that just appear in a few trombone pieces. Make sure that the starting note has a really good sound and your lips are well set. It is possible that the last few bars seem impossible to play, but if this happens, then you have to know that it is because you are not shrinking enough the lip's hole. In this case, go back to the mouthpiece and practice with it. It will help you in order to produce the good sound and there is no place to fake notes.

Timing: 2'40" on high intensity, one bar rest between each set and 30" extra rest before and 30" rest more before the following exercise.

HIIT high register reaching

♩=55 Manel Igualada

mf 6

5

10

5

17

4

TOTAL: 3'40"

(Play this exercise twice but don't forget to rest 30"
before you play it again and before the following exercise)

HIITT HIGH REGISTER: SCALES: An example on how to practice this exercise can be found via the following link: <https://www.youtube.com/watch?v=UaKR7gUAVNg>

This is the basic scales' exercise, and the reason why I attached this exercise to a HIIT in music practice is because scales are the best tool in order to improve all the technical fields, such as sound, flexibility, articulation and the high register. In this case we start from a high Bb and we end in a double high F, then this is the difference between a normal scales' exercise and this one.

Playing this exercise in a third place is where it fits better because once we reinforce the embouchure muscles (Nº1) and reach the high notes (Nº2) we have to be able to produce a good sound and also connect the highest notes with the middle register and apply different articulations.

Timing: 2'10" of high intensity, one bar rest between each set and 30" recovery period before we play it as a second time and before the following exercise as well.

HIIT High Register Scales

play first time legato and second time portatto

Manel Igualada

$\text{♩} = 80$

1

5

10

14

19

21

1'30"

TOTAL 3'10"

(Play this exercise twice but don't forget to rest 30" before you play it again and once again before you go through the following exercise)

HIITT GLISSANDO CONNECTIONS: An example on how to practice this exercise can be found via the following link: <https://www.youtube.com/watch?v=BYwNWx0Q4gQ>

This final exercise fits in the last place due to its extremely difficult demand of technical skills. It is made in order to connect what we reached (the really high register) with the low register. The best way to develop healthy skills that make these connections possible is the glissandos in the same position. The muscles have memory and with the glissandos in the same position we do not allow the bad habits to form while playing. We have to be aware that the starting of the sound in every set comes out from a small but relaxed muscles setting, then the sound and the flexibility will be smoother than if we start pressing. This is the most difficult issue to solve and a reason why a lot of brass players have what we call a "click": this is a point in the register where your lips have to switch the setting due to the different opening.

With this exercise there is no possibility for this "click" to happen because we have to play the high notes coming from a low setting. Therefore, by playing this way it is impossible to create bad habits. This exercise will provide us a huge improvement of the flexibility as well.

With this exercise we complete the training.

Timing: 4' of high intensity, one bar rest between each set and 30" of recovery period before we play it again.

HIIT glissando connections

♩=60

Manel Igualada

6 gliss

12 gliss

18 gliss

23 gliss

29 gliss

TOTAL 4'30"

Play it twice and rest 30" before you play it the 2nd time

It can be quite difficult to play the exercises with the tempo written, especially for people who struggle with the high register. Another option could be to make the HIITT shorter; this would be in case the student chose to avoid the final sets due to low endurance.

The goal of the exercises mentioned above is not to play a specific high note as can be the high F. Even more important than the fact of playing one note is the way you reach it, and there are two ways to get there; the bad (pressing and being tense) and the good way (trying to make it as smooth as possible and with the least effort you can make).

It is not vital that you play the whole HIITT at the beginning. That is why I divided the exercises into three different steps. You can also choose to avoid the last sets when you feel crossing the line of the ease and pressing.

¹¹ NOTE: The total amount of time put on HIIT has to be really close to 15 minutes and 10 seconds. It should not last longer than this unless is for a good reason like: slow down the tempo to learn the good mechanism in order to play the exercises as they have to be in the end.

4. PERSONAL REMARKS

Under my current perspective it feels really fun for me as I think back about the mistakes I made while I was a student. While the HIITT training method I developed to be able to play as I do now helped me a great deal, but not all my improvements are due to my research.

First I am going to start introducing what I found out because of stopping practicing bad habits and also due to my work on HIITT.

4.1. Personal remarks concerning bad habits:

In order to know my story first you have to know where I come from. I am not talking about Spain in general, but Valencia (middle east-coast in Spain). There we have the biggest concentration of brass players per capita, and as you can imagine in this “brass culture” we have developed our own way of playing. This way of playing demands double effort since the first moment you start with the trombone (in fact, any brass instrument) you will be playing in a band and surrounded by many wind players.

In a context like this, the first thing you try to learn is how to be louder than the person sitting next to you. This is the perfect environment in order to develop bad playing habits. One major effect of trying to play louder than my neighbor was using too much air and over-blowing the instrument.

I finally found out that too much air can cause a problem as big (or in fact, even bigger) as if we do not use enough air. So that is the reason why I had problems with the high register and endurance.

The second thing I learned is that nowadays I am able to spend a great number of daily hours with my trombone. But this is not only a matter of hours; it also means more time practicing.

During my bachelor I used to study every day three hours consecutively until the point that I felt tired every single day. Finally, by trying several ways to distribute my routines, I found out that it is healthier to divide your daily practice in 2 or 3 spots of 1 or 1’30 hours each, and keep doing other things in between (it helps a lot to keep your muscles fresh and ready the whole day, together with a mental peace).

The fact of staying completely focused during the practice is something essential to me, but it is also really important to know how to disconnect after a lesson or practice session in order to keep the bad thoughts away.

4.2. Personal remarks concerning HIITT:

As I said before, the HIITT was not a miracle that could solve all of my problems; it is simply one tool that can help if someone is struggling with high register and endurance. In my case it helped a lot.

One of the biggest discoveries of the HIITT for me was that high register was actually not as difficult as I used to think –indeed it is not tiring. I realized that my concept of how to blow and construct the embouchure muscles was wrong.

Since the first lesson with my teacher Alexander Verbeek he made me conscious that I needed to reproduce a smaller opening between my lips, and that I would probably needed time to get there because it is not something that happens automatically. Then I start using the HIITT. In order to be able play with less effort, I trained my embouchure muscles just by making a smaller opening between my lips.

5. DEVELOPMENTS & RESULTS

During these two years of master I have developed the HIIT applied to trombone practice, which means that I had to create a method composed by several exercises that recreated the same effort and benefits sports. The HIITT is based on three important points:

- Extreme exercises that demand a big amount of stamina
- Specific timing
- Fast workout and improvement

As well as it happens in the sports world, this method will help us to improve the endurance of the muscles and it will make them stronger. The type of exercises that we use depends obviously on which muscles or part of the body we want to train.

So the HIITT exercises for trombone are basically made to train the lips and the muscles located in its surroundings which help to keep them together.

Due to the incorporation of the HIITT on my daily practice I also developed a healthier way of playing that allows me to perform twice the time I used to play, in a higher way and with the half of the effort done before.

In general, everything is more efficient for me. I do not become as much tired as before, I am able to play way longer and to handle a much more difficult repertoire than the one I was playing two years ago.

This would not be possible without patience. As my teacher Alexander Verbeek says “improve in high register is not something that you can feel in days but it is something that will take months or even years”.

This way of thinking together with my continuous practice of HIITT led me to my current way of playing.

If you pay attention to this second result you will realize the higher difficulty (in terms of endurance) compared to the first reference recording¹².

All the aforementioned instructions needed to reach the results are documented in the following sections, in which I show the explicit steps I took for mastering these new skills.

After trying the HIITT during almost one year and realizing my improvements I wanted to test it in my colleagues and students. You can see the details of this quasi-experiment in the 2nd Intervention cycle (pg. 26- 32).

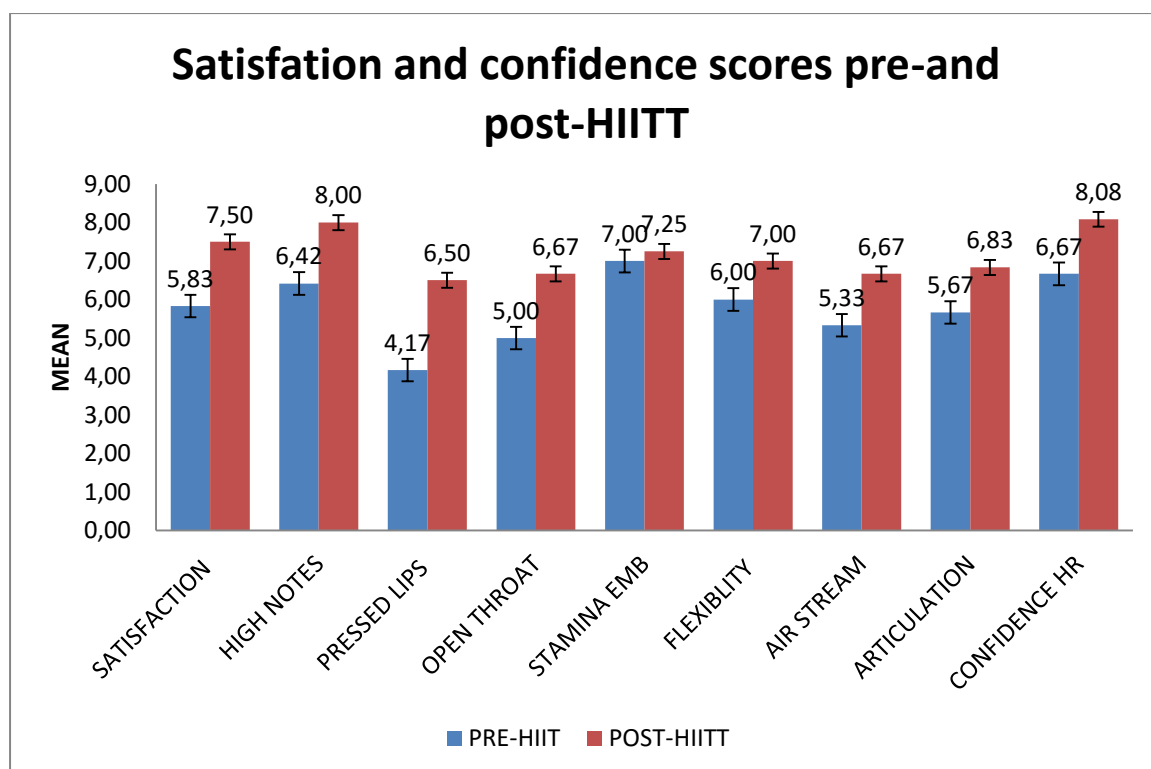
The HIITT has been tested with six trombone students of Codarts Hogeschool voor de Kunsten as participants. They ranged in age from 19 to 27. All of the participants were male. They were asked to play a challenging orchestral excerpt and to complete a questionnaire before they began the HIITT exercise regime and then also another one after a week of HIITT practice. In the questionnaire there were questions related to endurance, high register and playing comfort.

After the group experiment I compared all the students' marks and I made a group average mark of each question dividing it in **pre-HIITT** and **post-HIITT**.

¹² See Nino Rota 1st reference rec. <https://www.youtube.com/watch?v=ipts1p-WBgA> and the last two recordings of my research Frank Martin's Ballade Boléro <https://www.youtube.com/watch?v=V2YMjkPYsac> and <https://www.youtube.com/watch?v=3oh-yv8fn1Y>

This is the final result of the pre- and post-HIITT questionnaires. As you can see further below, after one week of HIITT the participants reported overall more positive results with the high register.

Taking into account the demanding characteristics, the participants played the same excerpt before and after the HIITT, and they were also evaluated by two blind judges. Both judges scored five out of six participants with a better grade in the post-HIITT. The results of these assessments can be found in Intervention Cycle 2 on pg. 28.¹³



6. INTERVENTION CYCLES

In this section of the report I describe all the steps I have followed to reach the final result of my research. Here you will find videos, interviews, internet links, interesting books, the feedback from the experts', my own reflections and the result of my trombone playing through the final recordings.

I have divided my whole work in two different intervention cycles and conclusions.

6.1. 1ST INTERVENTION CYCLE

The content of the 1st Intervention Cycle is a collection of all the needed data from both the trombone and the sports world in order to figure out how I should apply the existent sports training methods to the trombone, always with the only goal of reinforcing the embouchure muscles. First of all I included my reference recording No.1 to show you how I was playing when I started in The University of Codarts. I also will show you how I created the HIIT applied to the trombone practice based on all of this information.

6.1.0. Zero Reference Recording

In my first reference recording <https://www.youtube.com/watch?v=ipts1p-WBgA> made in November 2014 I chose Concerto for trombone and orchestra by Nino Rota.

¹³ In the 2nd Intervention Cycle you can find all the personal information of each student as videos, questionnaires, etc.

I decided to play this piece because, on the one hand, I really enjoy playing this concert with passion and I in my opinion it is one of the most beautiful concerts that has ever been made for trombone. On the other hand, it was really challenging for me because it demands a really high level of self-control and really good endurance skills. It would be a really good chance to test myself on this specific area of trombone playing.

(Video No.1 USB) 1ST REFERENCE RECORDING.

As you can notice, the sound quality of the high range notes is not really centered, especially from the 6th bar before **13**. Since everything starts to feel tough for me I press the embouchure more and more and consequently I forget the most important thing: the airstream.

The high B in the number **13** does not have a good quality of sound, neither the B flat in **14** and the high C one before **16**.

This was an obvious problem at the beginning but it completely disappears in my last recordings.

Handwritten musical score for trombone, page 3, year 1970. The score is for a piece by Nino Rota. It features ten staves of music with various annotations and markings. Red circles highlight specific areas: the first circle is around the end of the first staff (measures 12-13), the second circle is around measure 14, and the third circle is around measure 15. The score includes dynamic markings such as 'f', 'mf', 'p', 'cresc.', 'poco f', 'piu f', 'Poco sost.', 'rall.', and 'A tempo, animato'. It also includes performance instructions like 'espressivo' and 'f'. The key signature is B-flat major (two flats). The time signature is 3/4. The score is numbered 1 through 18, with some measures grouped by brackets and numbers (e.g., 5, 6, 4, 1, 2, 2, 3, 4, 5, 6, 4, 4).

Fig No.1 Concerto for trombone and Orchestra, Nino Rota, Ed: RICORDI & Milano, page 3, year 1970.

6.1.1. FEEDBACK FROM EXPERTS

Alexander Verbeek (trombone solo in Rotterdam Philharmonic Orchestra, new trombone collective and trombone teacher in Codarts).

1. Could you give me feedback about my reference recording?

Alex – In general the recording sounds good. There are different things to say about your playing, but I think that the recording is a good tool for listening back to yourself.

2. I made the recording in one take. Should I keep this way of recording? Why?

Alex – It depends on the purpose of the recording. If you have practiced and you want to know how far you are in playing the whole thing, or if you for instance want to simulate a stage performance, then you can do one take recording. It is also possible to record smaller bits, just to listen back if what comes out of the instrument is what you have in mind. There are obviously more possible examples, but like I said, it depends on the purpose.

3. Which ways of my playing did you like the most? And which ones did you like the least?

Alex – I like the drive and the power of your sound and performance. What I do not like so much is the musicality (both the big line and the fine sound tuning), articulation and especially the endings of phrases and notes. Endings are too abrupt.

4. In which ways could I improve it? How? I have been working on my resistance. What do you think about it?

Alex – It looks like you are strong enough, so if that is what you mean with resistance it is okay. Talking about the music itself, my feeling is that you are not very aware of what comes out of the instrument during performing. Recording and listening back carefully helps a lot with this. Also the fact of listening to other recordings of the piece could help to establish a good opinion about the music. When the music is strong in your mind, it is easier to play like that.

5. Do you think that my sound is bright in the recording or does it change depending on the high of the notes? Is my sound bright enough in the higher register?

Alex – In this recording it sounds quite bright, also in the high register, but I do miss different colors and flexibility in your sound. Of course, this could also be the quality of the recording.

6. I started really motivated. However, in which aspects do you think that the attitude of the performer can affect his/her playing?

Alex – In a performance the attitude has a big influence on how the audience experiences the music. When you look motivated, sad, with your eyes open or closed, standing straight or whatever, it all matters.

7. What do you do to motivate yourself before a performance?

Alex – I do not have to motivate myself for a performance. The motivation is there as soon as I come on stage, see the audience and taste the atmosphere.

8. What would you do in order to work on expressing yourself in your playing?

Alex – It helps me a lot to be in the moment I perform: like feeling the mood, the color, the sound and feeling relaxed in quieter music. So I would really be aware of the moment.

9. Before the recording I tried to follow a special training plan for the specific days I have to perform. Most of this training is about taking breaks during practice. Do you think that taking breaks helps in order to make a really good performance?

Alex – I never take a break as part of the practice plan. I rest when I am tired or when I have to do something else. I make practice plans, but that is about what I am going to do and when. It is not about when I rest. The only thing I make sure of is that I do not play too much time the days before an important performance. This is to make the muscles flexible and feel okay. I do powerful exercises way before the performance moment.

10. I would like to know your opinion about my work on High Intensity Interval Training applied to the trombone practice.

Alex – I think it can be very interesting if you do a proper research about that: How muscles react on certain exercises, how much time they need to recover, what you can do to be in the best shape on a certain moment, if it is generally the same for every person or if everybody needs his/her own plan, etc. So I think there is as a big medical aspect in this as well.

11. Could you give me more advice in order to receive more information about this topic?

Alex – Talk to physiotherapists, work together with Erasmus University, search for studies that have already been done, try out different preparations yourself and be very aware of what it does with your body.

6.1.2. MY OWN FEEDBACK

After watching and listening my first recording I have to admit that I was being quite good but I still needed to improve some points on my playing:

- Articulation: I have already improved since September but the fast scales and fast groups of notes that should be *staccato* are not enough clear in some points like the first scale in the beginning or the fast groups in the end.
- Tuning: I think it is quite ok. I always try to listen to the piano.
- Sound: It is quite good in general and I am really grateful to Codarts about the provided equipment.
- Interpretation and expression: In general I think I could have played it with more emotion or feeling, and of course I would also like to work in my corporal movement because in my opinion it is really important and I look really rigid.
- Endurance: Actually this is what I really miss. This movement is quite hard and although I would be able to handle it, there are some points where you can realize that my sound is losing quality, especially in the higher register.

So I decided to do this research in order to solve this problem. I have to arrange a meeting with my teacher to talk about the project and the practicing method I would like to start with.

6.1.3. THE CREATION OF THE HIIT EXERCISES

It is in the 1st Intervention cycle where I started with the creation of these exercises. At the beginning they were obviously not as good as they are in the chapter 3.1. This is a first version of my process and therefore there are a few mistakes within the red circles.

If we compare the first version with the final one in chapter 3.1 we can find some mistakes on the right part of the score (for example, the extra bars rest). The underneath the timing is also not specified properly.

HIIT Dynamics

Manel Igualada

$\text{♩} = 120$

1 bar rest

5

1 bar rest

9

1 bar rest

13

1 bar rest

18

1 bar rest

22

1 bar rest

27

1 bar rest

80" TOTAL.
REST 30" BEFORE TO PLAY IT AGAIN

After receiving feedback from the group experiment I realized that **80** was too fast to work properly on the second exercise. The essence of this High Register Reaching is to make us aware of the process we follow in order to reach the high notes and if we work it fast we can create bad habits. That is why there is a tempo of **55** seconds in the final version.

Obviously the fact of changing the tempo is something that would affect the timing of the exercise, extending it from 3'10" to 3'40" in the final version.

Although it is a well-known exercise, nobody has created a name for it before so that is the reason why I called it **HIIT High Register: Reaching**.

HIIT high register reaching

Manel Igualada

TOTAL: 1'20"
REST 30" BEFORE TO PLAY IT AGAIN

The third exercise remained in the same tempo because it is important to be able to speed up scales, especially when we talk about high intensity interval training. We can always work slow scales during our daily practice and routines but should not include them in the HIITT as a slow version.

During the process the only thing I have changed from this exercise was the specification of the timing. At first it was a little bit confusing because the total amount of time (including the 30" rest and the second time) was not written as in the final version. I called this exercise **HIITT High Register: Scales**.

HIIT High Register Scales

play first time legato and second time portatto

Manel Igualada

♩=80

TOTAL 1'30
REST 30" BEFORE TO PLAY IT AGAIN

If we compare it with the last version, the last exercise is the one with more changes:

As you can see the tempo of the exercise was at the beginning **120 the quarter note**, which makes the jumps really difficult. In *glissando* connections the most important thing is the way how we connect the notes instead of how we reach them. It is not the same difficulty for everybody, and therefore after the group experiment I decided to slow down the tempo to **60** (half tempo). It takes more time to do it but in the end it is worth it because it allows us to work better on the *glissandos*. We will have more time to process all the information happening in our embouchure.

There is also another important change suggested by Alexander Verbeek and a few students who were involved in the experiment. Well, the strategy is to divide the exercise in three parts, and as a result the exercise becomes easier to play by younger students who have less endurance. They can decide where to stop depending on how pressed and tired they feel. The divisions are made just before we start playing the next harmonic in the 1st position of the slide: 1st part goes until Bb, 2nd part goes until D and the 3rd part goes until high F. You can see them because I made a red line in the exercise below.

Finally I also adjusted the total amount of time underneath the exercise.

I called this exercise **HIIT: Glissando Connections**.

HIIT glissando connections

Manel Igualada

The musical score is written for a single melodic line in 13/4 time. It consists of five staves, each containing a sequence of glissandos. The first staff begins with a tempo marking of quarter note = 120, circled in red. The score is divided into measures by bar lines, with measure numbers 6, 12, 17, 23, and 29 indicated at the start of their respective staves. Each staff ends with a red double bar line and a circled '25"' indicating a 25-second duration per staff. The word 'gliss' is written below the notes in each staff. The notes are primarily in the lower register, with some higher notes appearing in the later staves.

TOTAL 1'15.
REST 30" BEFORE TO PLAY IT AGAIN.

6.1.4. SELF-EXPERIMENT

I started to practice these exercises in order to figure out how helpful they could be. At the beginning I just played them once every two days because my embouchure was not strong enough, but after one week I started to see the improvements, mostly with the endurance.

After two weeks I was already able to play them every day and the endurance was not the only improvement but also I got a clearer idea of how to set the muscles in order to play higher notes. This was possible because my muscles were stronger than before, so they could create a smaller opening between my lips.

However, the most important point was that after one month of HIIT practice I felt I was a few steps further than one month ago. I realized that I was able to play a third higher, when the reality was that I had spent a lot of years trying to improve the high register without any result.

Finally, after a couple of months practicing the HIIT applied to the trombone practice I recorded the final recording of Nino Rota (AR2 exam). Link to the video: https://www.youtube.com/watch?v=VH3_WrrBDbk

6.1.5. MY OWN REFLECTION AFTER THE FIRST CYCLE

I am really proud of the results that I have already accomplished. As I said in my first own feedback, at the beginning of the academic year I used to have problems with my embouchure muscles but now, after practicing these HIIT exercises, I realized my big improvement. I am going to try to explain how I felt in some spots of the piece I am working on (Concerto for trombone and orchestra by Nino Rota), before and after the intervention cycle:

I chose this piece because (speaking in terms of resistance) it was really difficult to handle and I wanted to solve it. The few first weeks, after the first reference recording, I felt a bit frustrated because the bright sound that I had in the normal and lower register disappeared in the higher. I also felt really tired just by playing the first movement. Then I thought “perhaps it could work if I apply this method of training muscles in a high intensity to the musical practice” and I started asking experts about it.

After receiving assessment from them I made these HIIT exercises for trombone practice and just in a few weeks I felt the results.

If you see the second reference recording you can perceive that my sound has better quality in the high register, although the recording equipment is just an iPad instead of the good equipment that Codarts provided us in the first reference recording. But not only that: I was able to handle the whole piece perfectly. Furthermore, I was able to play notes that I was not previously. However, the problem now is that I have to connect this way of playing with my old one. That is something I would like to do in my next intervention cycle.

It is true that I have to keep working on articulation and expression, but by now I have reached what I wanted.

6.2. 2nd INTERVENTION CYCLE

Before starting this Intervention cycle I made sure I asked for my trombone teacher's advice (Alexander Verbeek RPhO) regarding how I could plan the idea of trying the HIITT with other people. As in the sports world, there is a potential for injury with any exercise, so I wanted to make sure I was being particularly careful with trying out the HIITT with other students.

During our interview¹⁴ we highlighted a few points to take care of before putting the HIITT in practice with other people:

1. The hard exercises (especially the ones you normally take more time to recover from) have to be played in the last part of our daily practice.
2. The HIITT can be a tool to improve the endurance and high register but it is not the only method in use.
3. The improvement of my endurance and high register in one year was already proved.
4. Split the exercises in easier/harder parts depending on the student level.
5. Try the HIITT applied to the trombone practice in other students to figure out how helpful it can be.

After the interview with Alexander I selected 6 trombone students from The University of Codarts in order to take part in it. They were all master students. They all received the following information:

6.2.1. Quasi-Experiment Explanation:

This study lasts 10 days long. You will be asked to do specific warm-up exercises explained by Manel Igualada (the researcher). These instructions will be provided in person and handled on paper. Please complete these exercises once you have finished your daily practice so you do not have to play more after the HIITT. This is extremely important: You can injure yourself if you play such hard exercises and keep practicing after them or even the same day.

The exercise takes 15 minutes. You are also asked to complete a short questionnaire before and after the exercise. Manel will occasionally ask to record you while you do this exercise for his own records. This will not be shown publically outside of the Master's research committee.

STEPS to follow:

1. Play Bolero (Ravel), Zarathustra, Schumann 3rd or Fantastique symphonie excerpt.¹⁵
2. Complete Questionnaire 1.¹⁶
3. Complete the 15 minute HIIP exercise
4. Play Ravel, Zarathustra, Schumann or Symphonie Fantastique again (same piece you played before)
5. Complete the questionnaire again

¹⁴ See the whole interview with Alexander Verbeek in Appendix 3.

¹⁵ See in Appendix 4

¹⁶ See in Appendix 2

The students taking part in this experiment are: Alejandro Antiñolo, Alejandro Luque, Fabian Vos, David Parádi, Salvatore Cuccaro and Petar Stoykov.

STEP 1

The first step in this experiment is about checking how the students play before the training on HIIT. In order to do that, they must pick one of the four orchestral excerpts I mentioned above. Why these excerpts? Because they are really challenging in the way of how to reach them (high register) and how you handle them (endurance). So basically, if you want to test your high register and endurance in a fast way, the best option is to play those excerpts.

STEP 2

After the first recording they are going to be asked to fill a questionnaire with marks¹⁷ (from 0 up to 10, when 0 means the worst and 10 means the best). This questionnaire is composed by 9 questions related to the endurance, high register, and the way they are using the air, the muscles and how they feel about it. The last point is actually not a question but it is meant for me to receive feedback of the whole process.

STEP 3¹⁸

When the two first steps are done they have to start to practice the HIIT. They must practice it at least during one week in order to show the improvements¹⁹. After this week they will be asked to record one HIIT session with me.

STEP 4

After this week they have to repeat the two first steps to prove whether the HIIT have had any effect on them or not. So now they must play again the same excerpt they chose at the beginning of the process.

STEP 5

The last thing they have to do in order to finish the experiment is to fill up the questionnaire again with marks from 0 up to 10.²⁰

NOTE: if you want to follow the experiment in deep detail you can check the appendix 4 where I have included all the personal marks, videos and results of each student.

¹⁷ See the appendix with the marks in appendix 3.

¹⁸ See the HIIT videos in appendix 4

¹⁹ It is almost impossible to show improvements with less than one week of HIIT.

²⁰ This time the question 10 has to be complete (feedback).

6.2.2. GROUP EXPERIMENT

After the group experiment I made this chart in which I included the 9 questions of the questionnaire and the marks the students gave by playing the orchestral excerpts before and after the experiment. In the lower part we can see the average pre- and post-HIITT of the whole group:

QUESTIONNAIRE RAW DATA												
PPTS	TEST	SATISFACTION	HIGH NOTES	PRESSED LIPS	OPEN THROAT	STAMINA EMB	FLEXIBILITY	AIR STREAM	ARTICULATION	CONFIDENCE HR	FEEDBACK	
DAVID	PRE	4	7	5	3	8	6	4	5	6		
	POST	8	9	7	6	5	7	5	6	9		
PETAR	PRE	6	5	4	5	6	5	6	7	7		
	POST	6	8	7	6	7	7	7	7	8		
FABIAN	PRE	6	5	3	5	6	6	6	7	5		
	POST	7	7	7	5	7	6	6,5	6,5	7		
LUQUE	PRE	6	7,5	6	5	8	5	4	4	9		
	POST	9	8	4	8	9,5	8	7,5	8,5	9,5		
SALVATORE	PRE	6	6	3	6	7	7	6	6	6		
	POST	7	7	6	7	7	5	7	7	7		
ANOTNIOLO	PRE	7	8	4	6	7	7	6	5	7		
	POST	8	9	8	8	8	9	7	6	8		
		SATISFACTION	HIGH NOTES	PRESSED LIPS	OPEN THROAT	STAMINA EMB	FLEXIBILITY	AIR STREAM	ARTICULATION	CONFIDENCE HR	FEEDBACK	
	MEAN PRE HIIT	5,83	6,42	4,17	5,00	7,00	6,00	5,33	5,67	6,67		
	MEAN POST HIIT	7,50	8,00	6,50	6,67	7,25	7,00	6,67	6,83	8,08		

Let us have a look at the questions:

1. As we can see in the question **“How satisfied are you with how you played your excerpt?”** we can see that on one hand the average in the pre-HIITT round is **5,83**, which is not a really high note. A lot of them admitted they had problems with the high register and obviously they felt a bit uncomfortable with the excerpts they had to play. Furthermore, since they had just one chance to record it, the context was even worse. However, on the other hand, and after the one week of HIITT, the context changed a lot: the average mark now is **7,50** so it increased **1,67**. If the HIITT works on endurance and high register and the excerpts they played were extremely demanding in this area, it means that the HIITT worked out good for all of them, especially for David and Luque.

2. In the question **“Are you satisfied with the quality of the sound of your high notes?”** the average increases **1,58**. The difference now is that this question is just focused on the high notes. As we can see, for instance with Luque, is that his high register did not improve quite a lot. That is something obvious since he has got already a good high register before of the experiment, as we can see in his videos in the appendix 3 and 4. However, it worked really good with the students with a lower level, and even with another advanced student like Petar: he played a hard excerpt for alto trombone which is even a more demanding high register than the tenor, so he increased his mark in three points after the experiment.

3. The third question **“How pressed are your lips against the mouthpiece?”** is a little bit tricky because a lot of people considered that the most pressed the lips are, the better is the high register. However, it does not work like this at all: pressed lips means for me the amount of pressure we create against the mouthpiece, and that is something that avoids the vibration in the lips. We do not have to confuse pressure and tightness. Tightness helps to produce the vibration, so the goal is to make the lips tight instead of pressing them against the mouthpiece. There is just one way to play these exercises and it is by making the lips tight. In this question the average increased in **2,33**, which is amazing. In this case Luque was again the exception: his average decreased in 2 points.

4. As you can see in the question **“How open is your throat?”** the average increased in **1,67**. The throat works for the brass players as well as it does for the singers; it is not possible for someone to have a high register if he/she does not have an open throat. This aspect worked quite well for everybody except for Fabian: even though he has quite strong muscles, he did not work together with the throat relaxation and therefore he can have problems with the high register.

5. In the question **“How satisfied are you with the stamina of you embouchure muscles?”** the average just increased a **0’25**. Actually the endurance is what takes longer to improve, so if we only take one week as a trial period it can be too short to really notice improvements. For instance, it had more effect on me because I am already working on HIITT for one year. However, if they keep using the HIITT as a daily tool they will notice bigger improvements, even from the first month.

6. In the question **“How satisfied are you with the flexibility of your lips?”** the average increased in **1 point**. Flexibility is something we do not use to relate with the high register. Nevertheless, one can actually have more facility to play high register if his/her flexibility is good. Also, the first exercise demands a perfect control on this area, so the most you get used to it the best flexibility you will have.

I also have to admit that the students can give really different marks depending on the excerpt they chose to play, for example, those who chose the bolero (Fabian, Salvatore, Antiñolo and David) will not feel a huge difference because bolero is not really demanding on flexibility. However, those who chose more flexibility demanding excerpts as Luque (Symphonie fantastique +3points) and Petar (Scherzo Funébre +2points) felt it better.

7. As you can see in the question **“How satisfied are you with how you are using your air stream?”** the average increased in **1’34 points**. Without the airstream, muscles are just useless, and vice versa. So at the end it is about keeping both in a perfect balance in order to use as less energy as possible and make everything easier. The fact of having stronger muscles will allow us to manage the airstream better, so basically, those who improved the high register experimented how their airstream started working in a more efficient way.

8. In the question **“Are you satisfied with the articulations you have made throughout the piece?”** the average increased in **1’16 points** as well. Through this question I wanted to test if the fact of improving the high register also implies an improvement of the articulation, and as we can see I can conclude that it does. This has a lot to do with the third exercise (high register scales), in which we work the high register through different articulations. Fabian decreased in **0’5** because Bolero is not really a hard piece which requires a lot of articulation. However, Luque, who is a more stable trombone player, felt that his articulations became better with a score of **4’5 points** by playing Berlioz (which is really hard to articulate).

9. The last question is **“How confident did you feel when you went through the high register?”** and its average increased in **1’41 points**. Here is where we can really see how the students confront the high register in a subjective way. We could divide the experimental group in three parts:

Early students: Fabian (+2) and David (+3)

Middle students: Antiñolo (+2) and Salvatore (+2)

Advance students: Petar (+1) and Luque (+0’5)

This means that the confidence of the early students increased the most = **2’5**; followed by the middle students who still felt it but with a score of a half point less = **2**; and finally the most advanced students where those who felt less increase on their confidence, with just **+0’75**.

PRE- AND POST-HIITT VIDEO EVALUATION: BLIND JUDGES

In order to support the argument that the HIITT helped to improve the participant’s register quality, Alex Verbeek and Rogelio Igualada were asked to listen in a random order to both participants’ recordings. The judges were asked to indicate which recording was better in terms of high register quality. These are the results:

Responses: Alexander

	A	B
Antiñolo (2nd, 1st)	X	
Luque (1st, 2nd)		X
Salvatore (2nd, 1st)		X
Fabian (1st, 2nd)		X
Petar (2nd, 1st)	X	
David (1st, 2nd)		X

Responses: Rogelio

	A	B
Antiñolo (1st, 2nd)		X
Luque (1st, 2nd)		X
Salvatore (2nd, 1st)		X
Fabian (2nd, 1st)	X	
Petar (2nd, 1st)	X	
David (1st, 2nd)		X

The blind judges' responses showed that the post-HIITT video was selected as the best 5/6 times. They both found out that the same participant had not improved, which can be explained due to his tiredness after having a hard week without any rest. This also reminds us how important it is to take breaks as soon as you feel too tired.

6.2.3. STUDENTS' SUGGESTIONS

As you can see in the questionnaire (appendix N°2), the 10th question is not actually a question but a request for feedback. I was really interested in the areas the students think I could change in order to make a better HIITT. For me it worked really well and I can always adapt it on my way of playing. However, what if it does not fit for other people?

I would like to make this training reachable to all the trombone players who share the way of thinking of an athlete. For that reason I received the feedback you can read below in order to make all the changes needed for the rest of the people:

Antiñolo: "I really like the exercises and the approach in order to improve stamina, flexibility and sound. My suggestion will be to adapt the tempos to your own feelings and level".

Luque: "In the 3rd exercise you should include *staccato* in order to complete it better. For my level I do not think that these exercises can help me to improve my high register but I consider them suitable to keep the muscles in a good shape and sustain the quality in the high register".

Fabian: "I really liked the experiment. What I liked the most is that I got exercises from you to work on for a week before making the second take. This way I can really work on your experiment instead of the usual 10 minutes exercise before making the second take".

David: "When I started the exercises I thought they were too heavy for me but I played them every day after my practice and I realized this would help me to play my pieces. After the process I feel more confident and relaxed with the high register. Besides that, I would like to keep practicing the exercises in the future, thank you".

Petar: “I think the first exercise is really useful for flexibility. The second exercise works well for moving through the registers. The scales (third exercise) are always useful but you could include more different articulations. The fourth exercise felt like the tempo is too fast and it does not give you enough time for the long range *glissando*. As a general remark, when practicing high register, try to integrate it better with the whole range of the trombone”.

Salvatore: “A general tip: try to make everything more progressive, for instance the ex. No.1 could be done first slower and the tempo can be speeded up. Exercise No.4 could be done slower and with more jumps progression”.

What I tried to do is to highlight in different colors the things they shared in common: the first thing we can see is that the group of **early students** was really happy with the experiment as it is reflected on the marks they gave to their own improvement.

Then the **middle students** also shared something in common: **the tempo** requests are highlighted in yellow and both students in this group asked me to change or let the student have more freedom to pick the tempo in which he/she feels more comfortable.

Finally the group of **advanced students** was the one that made more requests: we can see the new request (in green) where it is suggested to include more articulations in the third exercise (scales)²¹.

6.2.4. MY OWN IMPROVEMENT

In the meantime I kept practicing the HIITT almost every day, allowing me to go even further than the goals and improvements I stated at the beginning. In this second year I have not only been able to build up a better high register sound quality but also to connect it with the low register without any “click” in my lips.

From winter 2015/2016 I have started playing the alto again with such results that previously I could hardly imagine.

In order to prove it here, I attached a recording I made last December while playing Schumann 3rd with the alto: <https://www.youtube.com/watch?v=txApaYJdjEM>

The fact of being stronger with my embouchure muscles and having more endurance is something that encouraged me to take a huge decision: to buy a new, heavier and bigger trombone.

I used to play with a French trombone Antoine Courtois 420 legend before, which is a trombone that works really good (especially in the high register) because it is quite light but due to my broad airstream I used to overblow it, which put myself in a confrontation point with the instrument. A lot of times I felt a barrier between the trombone and me which did not allow me to play efficiently. As a consequence, my sound was not centered enough to blend with the rest of the ensemble or the section.

After analyzing multiple times what the solution could be, I decided to buy an Edwards T350. This trombone is raised in the American way of playing (they make heavy trombones which are capable to sustain abundant airstreams in order to create the fattest and roundest sound possible). All my doubts disappeared when I tried this instrument. It fitted better to my way of playing rather than the Courtoise²².

I would not have been able to do this change if I had not practiced HIITT and consequently improved my endurance.

²¹ NOTE: see point 7.3. for all the conclusions I made from the group experiment

²² I do not want that people misunderstand me: I am not saying that one trombone is worse than the other one. I am just saying which trombone fits better to me.

So after the adaptation process to the new instrument I made another few improvements as:

1. Better and more compact sound.
2. Blending with the group was not an issue anymore.
3. More efficient way of playing and use of the airstream.
4. Improve the endurance even more due to the new heavy instrument.

7. FINAL RESULTS

7.1. What did I learn from the athletes?

The athletes had the assessment of other professionals (doctors, physiotherapists, psychologists, engineers, etc.) who help them to work better and improve. But with musicians it is different: we just go to the specialists when we already have an injury or pain and I believe we should go to them more often than what we do nowadays.

Athletes are really conscious of the importance of their bodies for the activities they practice. They always warm up, stretch and relax. They try to keep healthy habits (healthy food, physical training or enough hours of sleep). Nowadays the number of musicians who practice these kind of healthy habits are increasing. However, not everybody is aware of how important this could be for their future.

Since years ago, athletes and sportive psychologists realized that the difference between being good or the best is not just a physical aspect but also something mental and emotional. That is the reason why they spend a big part of their daily practice in mental training. In our case, this kind of training is still an “unfinished business”, and we should include it in our daily practice.

7.2. The HIITT as self-experiment during two years

All the hard work that I have been doing for two years was worth it since the HIITT has become from now on a valid and proved methodology that helps to improve in a short period of time the endurance and high register of those who need it.

Nevertheless, it has not been easy for me. As I said, at the beginning (and also during the process) I had bad periods. These periods were usually caused due to tiredness, bad rest, or too long sessions of practicing. However, during the process those bad periods have been progressively getting better in terms of duration (before I had bad periods which lasted for weeks and with the time they only lasted just a few days) and also in terms of frequency (before I used to have bad periods really often, like once per month, and now I hardly have them).

Now, I have become way more confident with my high register. I am not concerned about hitting the note anymore. If I fail a note, it will surprise me right in that moment and not in the bars before.

It was also satisfying the fact of being the first one who adapted a training made for elite athletes to the trombone practice and made it extensible for everybody interested.

I made a final recording of myself in a session of HIITT after a typical day of practice in school: <https://youtu.be/HJSyOiuBRTU> (USB. Manel HIITT)

7.3. What did I learned from the group experiment?

The group experiment has been something really important for my research, and without the students involved it would have been completely useless. They proved that the HIITT works and they also made important statements that helped me to figure out the optimal profile of the trombone player who needs HIITT:

On the one hand, HIITT helps those students (with an average of at least 10 years playing the trombone) who struggle with high register or endurance. They will improve these issues and will be able to increase their high register range. The group of early students and middle students (pg. 31) can be included in the students who can improve by practicing HIITT.

On the other hand, the advanced student's group that has already reached a good high register quality and strong endurance will not improve with HIITT but it will help them to keep the embouchure in a good shape in their musical life.

7.4. ALEXANDER'S FINAL FEEDBACK

After the whole process I wanted a general feedback of my improvements during the master degree from my teacher Alexander Verbeek. I also recorded myself playing Bolero and Ballade by Frank Martin (one of my biggest objectives for the master). As I highlighted in red in the score below, this piece has one of the heaviest building up of the whole trombone repertoire: from the upbeat of **Nº2** the melodic line starts in **pp** in a really slow tempo till the **ff** high D in **Nº5**. Furthermore, before playing the high D we have to sustain for almost 3 bars an A which is already **f**, which makes things even more difficult.

Frank Martin Ballade: <https://youtu.be/V2YMjkPYsac> also in the USB.

TROMBONE—

FRANK MARTIN
1940

Largamente

mf

cresc. ed accell.

Andante $\text{♩} = 72$

f

mf

cresc.

Tranquillo $\text{♩} = 54$

f

dolciss.

meno dolce espress.

meno dolce

poco a poco cresc.

Poco allargando

ff

dim.

rit....

Allegro Giusto $\text{♩} = 116$

Copyright 1941 by Universal Edition

Universal Edition Nr. 11250a

(Frank Martin Ballade, Copyright 1941 Universal Edition, N° 11250 a)

Bolero: <https://youtu.be/3oh-yv8fn1Y> (USB. Manel Bolero)

Alexander's feedback on Manel's progress

"There are some points which have obviously improved during this year:

His sound has become clearer and blends easier with other players. It is not always there yet, but it is definitely better. His high register has improved and because of this, also did his endurance.

What I would like is that Manel finds a way to use these skills to make more music. Although basic things have become better, it is a pity that he is not always able to use it in his performance.

So generally I am very happy, but there are still important steps to make".

APPENDIX

1. Examples of HIIT workouts²³

“Interval Workout treadmill: In the following link you can see an example of how to do HIIT in a treadmill, <https://www.youtube.com/watch?v=--OJNjnbHaA>

High Intensity Interval training is about challenge and recovery (over and over) for a cardio blast.

This particular workout was made by **Michael Banks**, (personal trainer and owner of Body by Banks in Salt Lake City) uses treadmill and you can add weights for an extra challenge:

Warm up: On the treadmill, with the incline set at a challenging angle, power walk at a speed of 3-3.5 for 7 minutes. Stop, get off the treadmill, and stretch.

Sprint: Drop the incline to 0, increase the treadmill speed, and sprint hard for 30 seconds. Aim for 90% of your maximum heart rate. To recover, bring your speed down to 3 and walk for one minute.

Get back on the treadmill and sprint for 30 seconds (no incline). The goal is to be at 80% of your maximum heart rate. To recover, decrease your speed to 3.0 and walk for one minute.

Tricep Extensions: Using weights, do one set of 15 or 20 overhead tricep extensions. Your elbows should point toward the ceiling, with the weights behind your head. Lift the weights directly above your head and back down again.

Pushups: Do one set of 15 pushups, with your elbows at a 90-degree angle from the body. Modification: Do the pushups with your knees on the ground, but do 25 instead of 15.

Sprint: Back to the treadmill. Sprint for 1 minute, aiming for 70% of your maximum heart rate. To recover, jog for 90 seconds.

Jumping Jacks: Do one set of 15 or 20 jumping jacks. If you're strong enough, add two 10- or 15-pound dumbbells. Lift up the weights when you jump out, in an overhead press position, pulling them back down to shoulder height as your legs go back together.

Finale: Incline your treadmill to an angle that really challenges you — but don't hang onto the treadmill's rails. Walk at a 2.0-3.5 speed for 30 seconds, aiming for 60% of your maximum heart rate. To recover, bring the treadmill down to a 1.0 incline and drop your speed to 1.9 or 2.0 for a 1-minute walk. Finish by stretching"

The exercise presented above is not referred to any special sport training but it is for a really fast fat-burning. As we can see, it works with all the important muscles around the body in a really extreme way.

“Quick CrossFit Series: In the following link we can see Doug Katona training a group of people for a 10K, https://www.youtube.com/watch?v=gGq2rh3A_dM

CrossFit workouts are about getting maximum effort in minimum time.

The following exercises come from **Doug Katona**, co-founder and owner of CrossFit Endurance in Newport Beach, CA. They can be done on their own, all together, or in any combination:

30-90s

²³ All this examples of High Intensity Interval training were taken from: <http://www.examiner.com/article/interval-training-regimen>

Warm up for 10-12 minutes, finishing the warm-up at 75% of your maximum heart rate or at 7.5 on the perceived exertion scale, in which 0 is no effort and 10 is your max.

Choose any type of cardio. Do it at your maximum effort for 30 seconds.

Stop and recover for 2 minutes, or for 90 seconds if you're already in good condition. Do not shortchange the rest period.

Do this up to three times.

As fast as you can, do 10 squats, 10 pushups, and 10 full sit-ups. Then do nine reps of each. Then eight, seven, six, and so forth, until you reach one rep of each exercise. Rest as little as possible between sets. Record your time, and try to improve each week.

HIIT if you run out of time:

If you only have a little time, try to do 100 burpees. If that's too much, start with 25, then move to 50, then to 75, until you can do 100.

Begin in a squat position with your hands on the floor, in front.

Kick back your feet to a pushup position.

Return your feet to the squat position.

Jump from the squat position into the air, straight above you.

Rowing or Indoor Cycling: In the following link we can see a session of 20 minutes indoor cycling HIIT workout. https://www.youtube.com/watch?v=RyLvzqxI_dM

You may be sitting down, but you will sweat when you try this workout of **Scott Nohejl**, head coach and program director of The Chatham Area Rowing Association in Savannah, GA.

Row or bike for a minute.

Sprawl with pushup. Run in place, with your feet just coming off the ground, for a count of five. Lower yourself onto your hands, and jump your legs backward to a pushup position. Do one pushup, then bring the legs back, tucking them in. Stand and repeat for 1 minute.

Squats. With hands on top of your head, squat so your knees are at 90 degrees — make sure they do not go past your toes — and then stand up. Repeat for 1 minute.

Side jumps. With feet together, toes pointed forward, jump from side to side for 1 minute.

Rest for 5 minutes.

Row or bike for 1 minute.

Scissor jumps. With one leg in front and the other in back, jump and "scissor" your legs before landing. Do this for 1 minute.

Sumo jumps. Squat down, then jump, bringing your feet slightly off the ground. Do this for 1 minute.

Jumping jacks. Do these for 1 minute.

Repeat the full set four times, nonstop, for a 16-minute workout. Cool down, and then stretch".

The last exercise it is also an example of HIIT for ordinary people who want to lose weight quickly. However the next one is specific for swimmers, made by **Craig Keller**, Ealing Masters swimming coach in London, she made several workouts for swimmers, including two that referred to injured people.

“Swimming: In the following link we can see an example of how to do swimming HIIT. <https://www.youtube.com/watch?v=qIkLQJdGFII>

Begin with two 500-yard (or meter) freestyle swims on intervals of 6.5 minutes. The quicker you finish, the more time you’ll have to rest. Then swim at an easy pace for 2 minutes.

Follow that with two 400-yard freestyle swims on a 5.5-minute interval, and another easy, 2-minute swim. Finish with two 300-yard swims on 4.5-minute intervals”.²⁴

2. ALEXANDER VERBEEK FULL INTERVIEW 1ST INTERVENTION CYCLE

Alexander Verbeek (trombone solo in Rotterdam Philharmonic Orchestra, new trombone collective and trombone teacher in Codarts).

1. Could you give me feedback about my reference recording?

A: In general the recording sound okay. There are different things to say about your playing, but I think the recording as being a tool to listen back to yourself is good enough.

2. I made the recording in one take, should I keep this way of recording, why?

A: This depends on the purpose of the recording. If you have practiced and you want to know how far you are in playing the whole thing, or if you want to simulate a stage performance etc., then you can do a one take recording. It’s also possible to record smaller bits, just to listen back if what comes out of the instrument is what you have in mind. More examples is of course possible, but like said it depends on the purpose.

3. Which ways of my playing you liked the most, and which ones at least.

A: I like the drive and the power of your sound and performance. What I don’t like so much is the musicality, both the big line and the fine tuning of sound, articulation and especially the endings of phrases and notes. Endings are too abrupt.

4. In which ways I could improve it? How? (I’ve been working on my resistance what do you think on it?)

A: It looks like you are strong enough, so if that’s what you mean with resistance it is okay. About the music, my feeling is that you are not very aware of what comes out of the instrument during performing. Recording and listen back carefully helps a lot for this. Also listen to other recordings of the piece could help to form a good opinion about the music. When the music is strong in your mind, it’s easier to play like that.

5. Do you think in the recording my sound is bright or does it changes depending on the higher of the notes? (It’s my sound bright enough in the higher register?)

A: In this recording it sounds quite bright, also in the high register, but I do miss different colors and flexibility in your sound. This could of course also be the quality go the recording.

²⁴ All this examples of High Intensity Interval training were taken from: <http://www.examiner.com/article/interval-training-regimen>

6. I started really motivated, in which aspects do you think the attitude of the performer can affect his/her playing?

A In a performance the attitude has big influence on how the audience experiences the music. When you look motivated, sad, eyes open or closed, standing straight or whatever, it all matters.

7. What do you do to motivate yourself before a performance?

A I don't have to motivate myself for a performance. As soon as I come on stage, see the audience and taste the atmosphere the motivation is there.

8. What would you do in order to work on expressing yourself in your playing?

A It helps me a lot to be in the moment while performing. Feel the mood, color the sound, behave active in exiting moments, and feel relaxed in quieter music. So really be aware of the moment.

9. Before the recording I tried to follow a special training plan for the specific days I have to perform, most of this training is about taking breaks during practice. Do you think taking breaks helps in order to make a really good performance?

A I never take a break as part of the practice plan. I rest when I'm tired or when I have to do something else. I make practice plans, but that's about what I'm going to do and when. It's not about when I rest. The only thing I make sure of is that I don't play too much the days before an important performance. This is to make the muscles flexible and feel okay. Powerful exercises I do longer before the performance moment.

10. I would like to know your opinion about my work on High Intensity Interval Training applied to the trombone practice.

A: I think it can be very interesting if you do a proper research about that. How do muscles react on certain exercises, how much time do they need to recover, what can you do to be in the best shape on a certain moment, is it generally the same for every person or does everybody need his/her own plan, etc, etc, So I think there is a big medical aspect in this as well.

11. Could you give me more advice in order to get more information on this topic?

A: Talk to physiotherapists, work together with Erasmus University, search for studies that have already been done, try out different preparations yourself and be very aware of what it does with your body.

3. QUESTIONNAIRE OF THE GROUP EXPERIMENT:

On a scale of 1 (low) to 10 (high):

1. How satisfied are you with how you played your excerpt?

2. Are you satisfied with the quality of the sound of your high notes?

3. How pressed are your lips against the mouthpiece? NOTE²⁵

4. How open is your throat? NOTE²⁶

5. How satisfied are you with the stamina of your embouchure muscles?

²⁵ In order to avoid confusions (0= most pressure, 10= most freedom)

²⁶ In order to avoid confusions (0= the closest, 10= the most open)

6. How satisfied are you with the flexibility of your lips?
7. How satisfied are you with how you are using your air stream?
8. Are you satisfied with the articulations you have made throughout the piece?
9. How confident did you feel when you went through the high register?
10. Can you give me feedback about the experiment?²⁷

4. TALK WITH ALEXANDER VERBEEK ABOUT THE HIIT AND THE GROUP EXPERIMENT

Alexander – So, as I understood, you use your exercises just to improve your endurance, right?

Manel – Not just endurance, but also high range notes.

Alexander – Do you use it for a short period of time during your practice?

Manel – Yes, I do. They take 15 minutes to be done.

Alexander – should be treat them as a warm up?

Manel – No, not at all.

Alexander – Okay, that is good because I would always do these kinds of exercises in the end of your daily practice because then you have the whole night to rest and recover. On the other hand if you do these exercises in the early hours of your daily practice perhaps you can go too far and get tired for the rest of the day or even injured. So my approaching is that you should go for the HIIT the latest in your daily practice.

I don't know how this works because they are not regular exercises. Obviously you developed them yourself but they are more or less the same as we do already, so it is not really special in the sense of their content but it is special the way you treat them, the accurate timing, the order you put them and their goal as well. So, if you found out improvements in your skills by practicing the HIIT method, now you have to find out how it works with different people.

Manel – Perfect, that is what I suspected, because you are not the first saying that these kinds of exercises have to be done in the late hours of your daily practice. I am going to start testing it in other students.

Alexander – There is another exercise that it helps a lot with these issues: the crescendo/diminuendo long notes exercise, but also with this one, you have to be really conscious of how you are doing it, because your lips can start to hurt.

Manel – Because until now, this method has just been proved on me, what could you say about the improvement I have done since last year till now?

Alexander – Of course you improved endurance since last year, but I don't know how much it has to do with these exercises, because if you work more, you are going to improve your endurance automatically, not just with these exercises.

The problem I have with you is that, there are periods that you work and everybody can feel the difference but you also have bad periods or periods in which you don't practice that much, and then you can also hear it really good, specially, in your high register sound. So, it is difficult to say if there is

a relation in between you development and these exercises, but for sure I think they can help to develop these issues but now as the only tool.

Manel – Of course not. They are not made on purpose as the ultimate method to play like heaven or the only thing you must study. I am not talking about breathing articulation or speed with the slide. They are just 15 minutes of your daily practice that will help you to go one step further on the quality of the sound in the high range and your endurance skills as well.

Do you think it, could be dangerous to put this method on the hands of students that there are not able to play the highest notes included in the exercises?

Alexander – I don't have time to test it myself but it would be really interesting that you make a version that is up to be played by students that cannot reach notes like the high F, let's say until high C, then they have more chance to try out and you can also have a wider range of testers. Beginners and advance students version.

I would also try to get students from out of Codarts, because a lot of students base their experiments just with people from this school and that could bring us a wrong sight version of the real facts. You could try with people from Spain for instance. I could also help you with these because I know people in Japan like Takashi.

So let's say that your following objectives with this research are:

Try it with more people (also abroad if it's possible)

Make the two versions of the method (beginners and advance)

Manel – Yes, those will be my following goals. I would be really happy just with the students being able to play one tone upper after one week of the HIIT training.

5. QUESTIONNAIRES, SCORES AND EXCERPTS

QUESTIONNAIRE ALEJANDRO ANTIÑOLO (Bolero)

Before HIIT: https://youtu.be/_uvK-ubUwIE

After HIIT: <https://youtu.be/P4envYGTTzo>

1. How satisfied are you with how you played your excerpt? **7/8**
2. Are you satisfied with the quality of the sound of your high notes? **8/9**
3. How pressed are your lips against the mouthpiece? **4/8**
4. How open is your throat? **6/8**
5. How satisfied are you with the stamina of you embouchure muscles? **7/8**
6. How satisfied are you with the flexibility of your lips? **7/9**
7. How satisfied are you with how you are using your air stream? **6/7**
8. Are you satisfied with the articulations you have made throughout the piece? **5/6**

9. How confident did you feel when you went through the high register? 7/8

10. Could you give me feedback about the experiment?

- I really like the exercises and the approach to improve stamina, flexibility and sound. My suggestion will be to adapt the tempos to your own feelings and level.

QUESTIONNAIRE ALEJANDRO LUQUE (Fantastique Symphonie)

Before HIITT: <https://www.youtube.com/watch?v=T1rtQoDGfAU&feature=youtu.be>

After HIITT: https://youtu.be/IYDrylQ0_-s

1. How satisfied are you with how you played your excerpt? 6/9

2. Are you satisfied with the quality of the sound of your high notes? 7/8

3. How pressed are your lips against the mouthpiece? 6/4

4. How open is your throat? 5/8

5. How satisfied are you with the stamina of your embouchure muscles? 8/9

6. How satisfied are you with the flexibility of your lips? 5/8

7. How satisfied are you with how you are using your air stream? 4/8

8. Are you satisfied with the articulations you have made throughout the piece? 4/8

9. How confident did you feel when you went through the high register? 9/10

10. Could you give me some feedback about the experiment?

- In the 3rd exercise you should include staccato to complete it better. For my level I don't think these exercises can help me to improve my high register but I consider them suitable to keep the muscles in a good shape and sustain the quality in the high register.

QUESTIONNAIRE FABIAN (Bolero)

Before HIITT: <https://youtu.be/6qmSCe63pTk>

After HIITT: <https://youtu.be/7jw9ICFGsNQ>

1. How satisfied are you with how you played your excerpt? 6/7

2. Are you satisfied with the quality of the sound of your high notes? 5/7

3. How pressed are your lips against the mouthpiece? 3/7

4. How open is your throat? 5/5

5. How satisfied are you with the stamina of your embouchure muscles? 6/7

6. How satisfied are you with the flexibility of your lips? 6/6

7. How satisfied are you with how you are using your air stream? **6/7**
8. Are you satisfied with the articulations you have made throughout the piece? **7/7**
9. How confident did you feel when you went through the high register? **5/7**
10. Could you give me some feedback about the experiment?

- I liked the experiment, what I liked the most is that I got exercises from you to work on for a week before making the second take. This way I can really work with your experiment instead of the usual 10 minutes doing an exercise before making the second take.

QUESTIONNAIRE DAVID PÁRADI (Bolero)

Before HIITT: <https://youtu.be/ejZ5VDK1DP8>

After HIITT: <https://youtu.be/oNlx9lie4Lg>

1. How satisfied are you with how you played your excerpt? **4/8**
2. Are you satisfied with the quality of the sound of your high notes? **7/9**
3. How pressed are your lips against the mouthpiece? **5/7**
4. How open is your throat? **3/6**
5. How satisfied are you with the stamina of your embouchure muscles? **8/5**
6. How satisfied are you with the flexibility of your lips? **6/7**
7. How satisfied are you with how you are using your air stream? **4/5**
8. Are you satisfied with the articulations you have made throughout the piece? **5/6**
9. How confident did you feel when you went through the high register? **6/9**
10. Could you give some feedback about the experiment?

When I started the exercises they were so hard for me, but I played them every day after my practice and I realized they would help me to play my pieces. After the process I felt more confident and relaxed with the high register. Besides that, I would like to keep practicing the exercises in the future, thank you.

QUESTIONNAIRE PETAR (Scherzo funébre, alto trombone)

Before HIITT: <https://youtu.be/L70myJs09kQ>

After HIITT: <https://youtu.be/3phikoYgCfg>

1. How satisfied are you with how you played your excerpt? **6/6**
2. Are you satisfied with the quality of the sound of your high notes? **5/8**
3. How pressed are your lips against the mouthpiece? **4/7**

4. How open is your throat? **5/6**
5. How satisfied are you with the stamina of you embouchure muscles? **6/7**
6. How satisfied are you with the flexibility of your lips? **5/7**
7. How satisfied are you with how you are using your air stream? **6/7**
8. Are you satisfied with the articulations you have made throughout the piece? **7/7**
9. How confident did you feel when you went through the high register? **7/8**
10. Could you give me feedback about my experiment?

I think the first exercise is really useful for flexibility. The second one works well for moving through the registers, although it is pretty heavy. The scales are always useful but you could include more different articulations. The fourth exercise felt like the tempo is too fast and it does not give enough time for the long range gliss... As a general remark, when practicing high register, try to integrate it better with the whole range of the trombone.

QUESTIONNAIRE SALVATORE (Bolero)

Before HIIT: https://youtu.be/RjiJ_FCjT4c

After HIIT: <https://youtu.be/A1fnxuKJAvA>

1. How satisfied are you with how you played your excerpt? **6/7**
2. Are you satisfied with the quality of the sound of your high notes? **6/7**
3. How pressed are your lips against the mouthpiece? **3/6**
4. How opened is your throat? **6/7**
5. How satisfied are you with the stamina of you embouchure muscles? **7/7**
6. How satisfied are you with the flexibility of your lips? **7/5**
7. How satisfied are you with how you are using your air stream? **6/7**
8. Are you satisfied with the articulations you have made throughout the piece? **6/7**
9. How confident did you feel when you went through the high register? **6/7**
10. Could you give me some feedback about the experiment?

- A general tip: try to make everything more progressive, for instance ex. No.1 could be done first slower and then speed the tempo up. No.4 could be slower and with more jumps progression.

6. VIDEOS HIITT PLAYED BY THE STUDENTS

Alejandro Antiñolo HIITT: <https://youtu.be/Fz1OREyCvzU>

David HIITT: <https://youtu.be/pU-XnEreXOQ>

Salvatore HIITT: <https://youtu.be/AQIWw2TYZXM>

Fabian HIITT: <https://www.youtube.com/watch?v=le6OcJJrJE&feature=youtu.be>

Luque HIITT: <https://youtu.be/3J-lYly5Jng>

Petar HIITT: <https://youtu.be/4EWoGWeLA0c>

Manel HIITT: <https://youtu.be/HJSyOiuBRTE>

7. NETWORK LIST

Nicole Jordan (Singer, music psychologist and Research Coach)

Alexander Verbeek (Main Subject Teacher)

Bart van Lier (WMDC Trombone teacher, Metropole Orkest and clinician)

Rogelio Igualada (Spanish National Orchestra and clinician focal dystonia)

Manuel Ventura (2000 first prize in Master 40 IFBB International Championship)

Victor Orduña (3rd champion in 110m hurdles, National Spanish Trainer of Playas Castellón)

Janinne Stubbe (lecturer in sports management in the University of Amsterdam)

Joaquin Fabra (Focal Dystonia clinician)

8. REFERENCE LIST

LITERATURE

“A Musician’s Guide to the Alexander Technique” by Pedro De Alcantara.

It is a book which describes how to do Alexander Technique and apply it to our instrument practice. Really useful to be aware of the extra-movements we do and save energy. Better endurance.

“Awareness Through Movement” by Smithsonian

Another useful tool to save effort

“The Breathing Movement Reconnaissance” by Asti Karoline Ellann

Astri’s research; since her work is based in a practical methodology as well it has been really inspiring for me.

“The coordination Training Program” by Bart van Lier

Bart van Lier is a big icon in the trombone world and he has really good ideas and approaches about playing trombone efficiently.

“Zen in the art of archery” by Herrigel

One of the best books for mental preparation.

WEBSITES:

<http://www.reallifit.com/>

- Definition of HIIT

<https://www.youtube.com/watch?v=--OJNjnbHaA>

- Treadmill High Intensity Interval Training (HIIT)

<https://www.youtube.com/watch?v=YuQIWVGy-bE>

- Noosa HIIT Squad

<https://www.youtube.com/watch?v=ubx4vitxsPs>

- Strength Camp eCoach: Overhead Press

<https://www.youtube.com/watch?v=rATcnHf7Plg>

- High Intensity Interval Training Sprint

https://www.youtube.com/watch?v=gGq2rh3A_dM

- CrossFit HIIT series Doug Katona

https://www.youtube.com/watch?v=RyLvzqxl_dM

- indoor Cycling Workout HIIT

<https://www.youtube.com/watch?v=qIkLQJdGFII>

- HIIT Swimming

<http://www.examiner.com/article/interval-training-regimen>

- Examples of HIIT workouts

<http://www.hva.nl/over-de-hva/contact/content/s/t/stubj/j.h.stubbe.html>

- Janine Stubbe profile

RECORDINGS:

Antñolo after (bolero): <https://youtu.be/P4envYGTTzo>

Antñolo before(bolero): https://youtu.be/_uvK-ubUwIE

Antñolo HIIT: <https://youtu.be/Fz1OREyCvzU>

David before (bolero): <https://youtu.be/ejZ5VDK1DP8>

David HIIT: <https://youtu.be/pU-XnEreXOQ>

David After (bolero): <https://youtu.be/oNlx9lie4Lg>

Salvatore before (bolero): https://youtu.be/RjiJ_FCjT4c

Salvatore HIITT: <https://youtu.be/AQIWw2TYZXM>

Salvatore after (bolero): <https://youtu.be/A1fnxuKJAvA>

Fabian before: <https://youtu.be/6qmSCe63pTk>

Fabian HIIT: <https://www.youtube.com/watch?v=le6OcJJrJE&feature=youtu.be>

Fabian After: <https://youtu.be/7jw9ICFGsNQ>

Luque before: <https://www.youtube.com/watch?v=T1rtQoDGfAU&feature=youtu.be>

Luque HIITT: <https://youtu.be/3J-IYly5Jng>

Luque after: https://youtu.be/IYDrylQ0_-s

Petar before: <https://youtu.be/L70myJs09kQ>

Petar after: <https://youtu.be/3phikoYgCfg>

Petar HIITT: <https://youtu.be/4EWoGWeLA0c>

Manel HIITT Dynamics: <https://www.youtube.com/watch?v=QKmqNA98OMw>

Manel HIITT HR reaching: https://www.youtube.com/watch?v=1RGX_iLjg2A

Manel HIITT Scales: <https://www.youtube.com/watch?v=UaKR7gUAVNg>

Manel HIITT Glissando Connections: <https://www.youtube.com/watch?v=BYwNWx0Q4gQ>

Manel 1st Recording Nino Rota: <https://www.youtube.com/watch?v=ipts1p-WBgA>

Manel 2nd Recording Nino Rota: https://www.youtube.com/watch?v=VH3_WrrBDbk

Manel Schumman 3rd Alto Trombone <https://www.youtube.com/watch?v=txApaYJdjEM>

Manel Frank martin: <https://youtu.be/V2YMjkPYsac>

Manel bolero: <https://youtu.be/3oh-yv8fn1Y>

Manel HIITT: <https://youtu.be/HJSyOiuBRTE>