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You know, one thing about sitting in the back row, and then being in front, there's quite a psychological change that you have to go through for that. At the age of eighty, I'm beginning to understand what it is and I like it. I should have found this out sixty years ago or sooner!

I can't see you, but I'm sure that you folks can see me. I'm not blind. I have lost a good deal of eyesight through glaucoma and found out that I had it some years ago.

We were touring in Japan, and I found that the music began to look very old and brown. I think we were doing the Mahler Fifth Symphony, and I called the librarian in and said, "Don't we have some newer parts?" and she took a good look at me and said, "I'll take care of it" and disappeared. She brought back paper written on high contrast paper. I could see good black and white and it was fine. It went on that way for a couple of years. They kept having to enlarge the parts.

The doctor didn't know that I had glaucoma. I have what they call an unusual type-low pressure, a low tension glaucoma. Glaucoma is usually due from elevated interocular pressures within the eyes rising very high. Mine were completely normal, so it sort of set everything back.

Because it wasn't recognized, as a result, I would go on the stage. I'd notice that I used to be able to see my wife fairly well in the first balcony at Orchestra Hall in Chicago, and then pretty soon she began to look like a comma. There's a tall man on one side, and tall people on the other, and there's this little comma between [Gizella].

They [the doctors] finally recognized it, and I had to go to Sir Georg and tell him that as much as I hated to, I was going to have to pull out of the orchestra. He wanted me to stay until 1991 when his official retirement came in from the Chicago Symphony, but I knew by then that it would be a little ridiculous to even try to play. Not only couldn't I see the music, but I couldn't see his beat.

I can still play the tuba, but I just don't know what I'm going with it. It's also getting harder to lift it up.

I look back on those years with really great pleasure. It was so nice to have a job that when you wake up in the morning, you feel like going to work. You're anxious to sit down and get the horn out and join your colleagues and make some great music. I did have that.

Most of my life was based on doing this sort of professional playing, and enjoying it thoroughly. I miss it very much today. But we do have seats in the balcony of Orchestra Hall, and I see my colleagues doing it. I feel a little strange about it sometimes because I feel I belong on the stage and not off. My horn is still there representing me. I sold it to the orchestra before I left, and Mr. Pokorny, the very fine tubist that they have today, enjoys it so much--he's playing it now. So I feel a little bit of me is still on the stage.

I must tell one story before I start my talk on the clinic aspects of playing. This was told to me by a young man from the Minneapolis Symphony.

I was telling him the nostalgia I felt about watching the orchestra, my friends and so forth. He told me about a man who had been in an orchestra quite a number of years and had to retire for some reason, and he was sitting out in the audience watching the concert. At the end of the concert they gave the violins a special bow and he stood up!

Here he is in the audience in the balcony and he's standing up with the violin section of the orchestra; he couldn't let it go, either! So, this is something that happens when you play with this group for so many years--I recommend it.

Now, to get to other aspects of playing. I just wanted to start by saying I'm being noted today as somebody who favors song and wind as I express my approach to music. Now, this is getting to be recognized more and more as a very important thought, and there are several reasons.

One, is the simplification about it. Song and wind immediately begins to delve into the clutter of individual thoughts that tend come about how to create song, how to have and control wind. I found that this was very important because, as you study the human being in structure and function, which has been a hobby of mine since about 1944, you get into utter complexity. It is a terribly complex subject, and, as you can see, we function in a very simple manner.

It doesn't take a great genius to be able to play a little song on a trumpet, or do any musical thing, dance, or just simply to walk. But what we are is a very, very complex structure with enormously complex controls.

In the head, you might say, we have what I like to call a biocomputer, a living computer, simply because it acts like that. It follows certain rules that computers have to follow when you think of the ability just to stand, walk, and to play a trombone. You usually plan what you're going to do, and then do it!

What I want to say is simply that one part of the brain will accept what you order as you go through a period of conditioning. In music, we would call this practice--conditioning studies, scales, intervals, drill forms, and so forth. We are actually creating a programming that goes in the brain where these things can be absorbed to become a conditioned reflex--a reflex that we're not born with, but it becomes a reflex simply by the fact that we have the repetition.

From that point on, once you have a reflex, all that it takes to bring it into being is a stimulus, a thought process in the brain that says, for example, "I want to touch my nose." You reach up and touch your nose--it's not a big deal. Somebody throws a ball and usually, if you have eyes, you catch it and maybe even throw it back to them.

These are done without thought of musculatures, or planning of what to do with various parts of your physical structure. They're in response to the stimulus of catching the ball, or touching the nose, or whatever we have to do in a physical factor.

Now in playing [musical] instruments, there are physical factors involved as we all know so well. Some of them are quite complicated, and actually, they're very serious, and we have to do them well. What we're dealing with here, in the art of playing, is the series of developments that come through taking a musical instrument, going through the course of training with the teacher and student relationship and so forth.

Do this. Do that. I want this. I want that. The student listens, the teacher advises and guides. You see that this conditioning starts based on a repetitive type of maneuvering.

Now if you play a C scale, and then you repeat, and play the C scale a second time, then a third time, and maybe in one day you do it five times, then play some music that involves the same notes, you are getting many, many repetitions. Now the brain is absorbing this.

It does not just imprint in the memory banks like it would on our modern computers today, the human biology requires repetitive maneuvers before it becomes a permanent, neural pathway in the brain.

The reason I'm saying this is simply that right from the time we start to play, we are actually developing these reflexes whether we realize it or not. Now, if you do this, in the study of music, it's a very, very beneficial approach.

If Phil Smith has a young student, he may pick up the student's trumpet, maybe even take the mouthpiece that the student would use, and plays a beautiful scale. He may say, "Now listen to this." That doesn't mean the student can imitate it right away. But he hears it, and he tries to do it. By trying to do it, he has in the brain a development of recall, and a recognition of what he wants the audience to hear. He has to sound like Phil Smith. But Phil is a much better trumpet player, the boy's a beginner.

This is what we're up against. We take a young mind, we take somebody who is just learning something new, but we're showing him excellence, not musculatures in terms of activities, but results. Here's your trumpet, here's your mouthpiece, and it can sound just beautiful. Imitate by trial and error. Be willing to make a mistake. It's no big deal if there's something wrong. But have a very definite concept of what you want the audience to hear. It's a very important type of thought to have.

What I want to get across, of course, is simply the fact that as we're developing, we have to develop based on the song. Now, that doesn't necessarily mean a tune, it could be a scale, it could be us telling the story of music to whoever is going to be listening. That could be a scale, it could be a single note. It can be anything we choose, but it's a message that's coming from the player to the audience.

Here's the critical part of this. As human beings we move about, we influence the external environment through motor activity. Psycho motors--thought processes that stimulate motor functions. They go down a very special type of nerve from the brain or the spinal cord, to what we call an effector. Maybe it would be a finger. Maybe it would be the embouchure, a buzz. Or the violin bow being effected by what you do with the bow affecting the string on the violin. These messages are motor messages. They are not sensory.

The young person has a tremendous gift of learning through the sensory nerve system. The ability to gather knowledge in a young person is just enormous. Biologically, we're equipped so that this is a very active period in our lives where acquiring knowledge is given every possible chance that it can get and is favorable to a person at all times while he's growing up.

I think at my age I can still learn, but it would be at a slower pace than when I was young. But you have these two types of nerves, and they are like one way streets. When you have a motor nerve, it's a one way street from the brain to the lips, or to the effector, whatever we're going to do. If you're a ball player, you want to hit the ball with the bat, you have to see the ball and you hit it with the bat. That's motor activity. Anything that influences the external environment in any way is motor. When I talk to you, I'm using motor systems for me to communicate messages to you, but you're hearing through sensory nerves coming through the ear going to the brain and so what your hearing, your brain is asking a question. It's receiving information based on sound waves impinging on the ear, visual aspects of what I may be doing here on the stage, but the senses are

picking up information. Now when you play a musical instrument, you are sending information, not receiving.

The young person goes to school every day growing up with this tremendous ability to learn. He frequently tends to pride himself in every way simply by the fact that he's trying so hard to learn how to play his instrument. If he would fight to learn how to play music with his instrument, the psychology of it would move immediately to the musical factor, the art form of music, so he could play for his father, or his mother, or in school for his colleagues, the people he wants to entertain with his playing.

If you're an actor, this is what you do, too. You don't express your own life. You may have to imitate somebody else's life. But whatever it is, it has to go into the brain and come out of the brain. It affects the various musculatures. The programming is in the brain, but the effectors are receiving information on how to do based on what you're trying to accomplish.

It gets very complex when you study the biology and anatomy of what we're doing. But if instead, you simply study the art form, it becomes very, very simple.

When I say song and wind, I do it for a specific reason. Song, to me, involves about 85 percent concentration of your intellectual input into playing your instruments based on what you want your audience to hear. If there is no audience, what do you want somebody walking down the corridor to hear? But what you want to compete with, your colleagues or professional players, or so forth, what do you consider great sounds, great music, and whatever you do, you try for the results of great sound, great music, great phrase, so we have with it the study of emotion.

It is very important that we study emotions in music, style characteristics in music, the art form of music. You can make people laugh, you can make people cry, you make people want to come down and enlist in the Army, you can help them by the moods that the music can be associated with. You have all sorts of ability to communicate these thoughts through sound.

People are hearing music on television, radio, records, and other media. There is various types of music everywhere. If you want to enter this type of profession, you have to do it as a musician. I don't like the word "trombone player," "trumpet player," "tuba player." I know we play these instruments, but we're artists, we're musicians. We choose as a medium to express ourselves with these particular instruments. But they're stupid pieces of brass. They don't have any brains. And what you do with them, of course, is what really counts.

Song and wind. You can't get anywhere without wind, because if you think of an automobile, you have your car, you have your four wheels, you have an engine. Now, those wheels will not turn without an engine turning it, unless you're being towed or something. It has to have an energy source, and it would be from the turning of that engine. Now, that engine could have electricity, it could have gasoline, it could have methane, it could have several different fuels. For brass players, our musical engine is the vibration of the lips. It is very important that you make your music always with the lips vibrating. But like the automobile, the lips themselves, you might want to call them your musical engine, cannot do it unless there is a source of energy being fed to it. In this case it would be our breath. If we could substitute electricity to vibrate the lip, we wouldn't need

any breath. When I say "song and wind," I have this in mind, of course. If you had another source of energy to achieve vibration, you certainly would not require wind. But you could not do without the vibration. In other words, the horn must have a vibrating column of air in order to amplify and resonate so that we can have our character of sound. I give wind 15 percent importance compared to song.

I learned more about the lungs by not studying wind for playing my instrument, the tuba, or for singing, or for trumpet playing, but for defecation and the study of childbirth. The study what happens with breath pressure.

I took a considerable amount of time to study illness and health. What happens to our body when we're ill, what happens when we're healthy. I had the aid of some very wonderful physicians who were very happy to help me. Laboratories that gave me time to use their equipment for research. The University of Chicago is one, and I did quite a program there, and I have been doing this since 1944 and am still at it even at this ancient age.

The same muscles that we use when we blow we use when we're, you might say, using pelvic pressures--defecation, childbirth, any of the pressures that want to expel fecal matter, or help give birth to a child, and with that, there are certain reflexes involved. One of them will be the closure in the throat. There will be tension coming in the whole area of the tongue. There will be all sorts of problems in the neck region and many of you have experienced this playing your instruments. But it is simply the same identical muscles following a different order than it should be at the same time. It's fairly easy to demonstrate, and in a few moments I probably will demonstrate it.

You learn to differentiate between air pressure and wind. With wind, there is always air pressure. If you think about it, there can never be wind unless there is air pressure. If you have a piece of tubing, and you put your hand near one end and you feel a little air coming out, the air pressure can be measured. Where it enters the pipe you'll find it higher than where it comes out. In other words, when you use an anemometer, you can measure the differences in the air pressure, and you will always find that where there is wind, there are differences in pressures. So when you order wind, a gentle wind [he blows softly], a powerful wind [he blows hard], there's a great difference in pressure in those two that you actually measure, flow and pressure. So many people when they are playing are actually going by the scene of air as a pressure.

I should have somebody up here and just work a little bit with this. Brian [Frederiksen], come here a minute and pull up a chair.

Just do this once for our audience. I want you just to blow out as wind, I'll demonstrate [blows out then makes choking sound] and then follow with the choke.

[Brian does the same]. Can you describe that feeling?

Brian replies, "it feels like I'm going to die."

Jacobs says, "well don't die--it's to hard to get volunteers."

There should be a choking sensation, a sensation in the throat. Try this in the audience.

Do you all feel the pressure in the neck?

You feel quite a pressure come up in the neck. Now when that happens there are changes in the diaphragm not just in the neck, but there are changes throughout the entire respiratory system. Now this is used in nature as part of the Valsalva Maneuver to

increase pelvic pressures. Those women who have had babies had to bear down [he makes a pushing sound] in order to get the infant out.

I've had players and players galore that use a form of that while they are playing the instruments. They can get the air out under high pressure but they can't use very much air. There is not much room for the reduction phenomenon that takes place with emptying the lungs or taking the air out of the lungs.

The psychology of wind is very different than the psychology of pressure. If you go by the psychology of pressure, you can have pressure with practically empty lungs.

The two biggest problems I have seen over the last sixty-odd years I have been teaching is 1) the tongue and 2) the diaphragm. Now surprisingly enough I rarely find problems with the embouchure. That might sound strange because people come up to see me because of problems with their embouchure but frequently it is the embouchure reacting to a bad set of circumstances and failing but it is simply cause and effect. If we change the cause of the factor, it is easy to clear the embouchure up. The embouchure was not breaking down, it was trying to work under impossible conditions, in other words when you are starving the embouchure for air volume giving it all sorts of air pressure but not quality it cannot work. Very quickly you will be struggling trying to produce your tone, just increase your volume of air not by blowing hard, but by blowing thicker a much thicker quality of air. Very frequently the air column is just too thin.

If you take your hand and try to put a little column of air by saying "SSSSSSSSSSSS." As you can see there is not much air. Now I want you to block the air with your lips then release the air. In no time you will find that you get much air on the hand.

Do this on the back of your hand [he takes big breath and releases it all], all sorts of air. Somewhere between these two extremes there are some good answers available to people who play our instruments.

I always check the for tonsils and the size of tongues. Some people's tongues take up most of the oral cavity. Now there are others with huge tonsils, some have moderate tonsils and a fairly big tongue, but frequently I find crowded conditions to the point to where even relaxed and properly used oral equipment does not work right simply because it is taking up too much space.

Many people that come to my studio do not let blowing air be psychological but rather based upon the anatomy and they move their bodies in order to blow. They are doing physical maneuvers but they are lying to their own tissues. If they would simply move air out by blowing, they would understand this right away and blow. If I do regional blowing like a bellows, when you blow something it gets smaller and when you breathe in something gets larger, but I can blow out. I can blow or not blow, this can lie like crazy. It does not help to tell the truth. If you go by the changes in the body, you may or may not be getting the results. You think you should because you might say, "Well, the body is suppose to get smaller when you blow." It does not have to, some other part can get smaller and make up for it. It can fool you, but if you tell the truth to your body that you want to blow wind, you have to leave the oral cavity and you go to air as it leaves the body. You hold a piece of paper and you blow against it, or you blow through a mouthpiece but always you make the study of wind, therefore song and wind comes.

(A question about raising the shoulders is asked)

Let the shoulders raise. In the first place, in a complete capacity breathe there is some shoulder raising. This happens because of the lungs being full of air. The deliberate raising of the shoulders should be avoided.

(A question about embouchure is asked)

To me, I never stabilize the embouchure. I never stabilize the meat, I stabilize the music, sound, result and art form. Don't lock into any, let's say, "This is my embouchure." You are dealing with small fiber and muscle groups. Some of them you can't even be aware of and as a result let the embouchure find its way through trial and error to where you sound the best.

If you want to compete with great artist don't set rules as to how you are going to do it, set rules to what you want to sound like and by trial and error you go after it. When you use a mirror you'll find when you sound great you look normal and it will be good.

I know in my own experience in playing many different brass instruments these changes are easily corrected because they tie into your thoughts of tone production. There's too much attention paid to an embouchure as you might say to appearance and feel. There should be more attention paid to how you sound and to how you function. If you set rules you will limit the ability to advance. I still say and I'll stand by my statement that the embouchure suffers much more from being starved of air volumes and musical messages than it should respond to.

(Question - After making priorities in the musicality and song and not lying to the tissue of the body, do you find making a goal for your muscles to relax?)

I usually take the word relaxation out and use the word minimal musculatures. In other words, the muscles always have some type of activity going on, so we have to return to a minimal state of activity. Now when you have violent outbursts of energy, where your muscles have time to go, quite a bit of stress because of playing something like Ein Heldenleben or Also Sprach Zarathustra, depending on what instrument you play, all of us have changes where bodies are under going with quite a bit more effort than it would under normal conditions.

I do not use the word relaxation in the act of playing because we have a better term to use. It is called neural inhibition. I use this in my own playing without ever knowing that I did it, and nobody told me to do it. It is just simply that the challenge of music taught me to do it by the need.

When you're playing, when your body is under stress, for instance, when you are blowing hard and when you go to breathe in. If you have a sudden dramatic change of blowing, when you breathe in, you suck so that the stimulus for inhalation is the pulling of air into the space between the lips. It has to go somewhere, it goes straight into the lungs which is where it is suppose to go. Now when that happens, the brain will automatically deactivate the muscles that are moving the air out. Those are the muscles that make you small. They completely deactivate them to the point of even taking muscle tone out at the same time they activate the muscles that have to make you large, which will lower the air pressure and take the air in. It is done without any effort on your part.

You simply have to give the order of what you want to do with the air on the lips. You are blowing out and it is done so fast that you do not have to relax. If you stop and relax it is going to take you a few moments and you would not be able to do this. Now when you are not doing anything, you should be relaxed. There should not be any tension except the norms.

There is always a little tension for those of us in our profession. My wife is a professional dancer, I use to play her act and that is how we met. When she had to go on stage to do her numbers, there would be this little tension, but people feel that when they have to get up before the public to a certain extent, but this can be to your advantage too.

In music where you see this more than any place else is the term support. Support your tone where there is a constant tensing of muscles. In playing you want to have sense of ease, even in the most difficult work. The difficulty is in the air or function of the embouchure. On the trumpet, which is the highest pressure instrument we have, I've measured so many people, including Herseth in our orchestra and other great musicians that have studied with me and they hardly go up to three pounds of pressure. The average will be between one-half and one and one-half pounds and when they are working really hard they may get up to two to three pounds. One demonstration I usually give is I'll have somebody lay flat on the stage, then I'll have another person come and stand on their chest and stomach. The person standing may weigh 150 lbs. Still, the person on the bottom will support that weight with great ease.

Physically we have reflexes in each lung that will not permit us to use any of this kind of strength. Anytime you exert a great power in these powerful muscles this has to do with reduction. There would be an innervation of the muscles that make you large. That would cancel it out and this goes on all the time. It's foolish to use enormous strength in here when your dealing with one to two pounds. In my instrument, the tuba, I go anywhere from one to two ounces in the extreme softs, to never any more than maybe ten ounces maximal in very loud blowing. In other words why should I be working hard. The air goes out fast because it is large quantities but under very low pressure. The idea is to minimize these efforts because you want an embouchure that wants to vibrate easily where you do not have to work hard.

There will be some small ladies out there I am sure. Usually you will find a small young person and she has a lung volume of maybe three to four liters. When I get to men, depending on body type, it varies from individual to individual. This is why you can't treat the length of phrase the same for everybody. If it is short enough than you can take it for granted that the person with even with two and one half liters of air will get through the phrase comfortably.

If it takes one person that has a six liter lung capacity and he uses four liters on a particular page of music, then the next person that comes up may have only four liters. Well, he can't use the four liters for the length because some of the air near the end of the breath gets hard to get out of the lungs, which is impractical for musical purposes. There is a tremendous variability according to the height, weight, age sex and so on. Today we have measuring equipment that can measure this almost instantly.

Air becomes extremely important because we can sense so much about the embouchure. So often we actually are finding players with too much air pressure in the oral cavity in relation to the flow. Much of the resistance that's coming is not the embouchure. It's resistance of the air trying to get past the tongue that goes to the brain

and becomes recognizable not as tongue but as lip. You would swear that your lip was resisting. You want to have a reserve, which should be fairly large in the lungs. You want to stay away from being too low in the air supply. When you figure you don't go by how much air you have at the start but how much you have at the end of a phrase. You try to make sure you are comfortable at the end or you will have to breathe, unless it is a very special phrase to where you might have to go all the way to the end of it.

If you were to blow fast air you would get louder. The fortissimo would depend on faster blowing until the amplitude of vibration of your vibrating surfaces would increase. Now if you wanted an extreme pianissimo practice diminuendos. Start with the most beautiful mid-dynamic sound, then you practice playing softer and softer and you will find the amplitude of vibration is decreasing and decreasing, the breath is barely moving. The main thing about the study of dynamics and velocity of air, is tie them together by having a wonderful mid-dynamic sound and as you move it outward to louder extremes. You do this by carrying the quality of tone. By carrying the excellence of the sound so it is not just a loud blat or a useless sound. Always do it based on the product, the product of the sound itself.

Look at it this way, if you use ten ounces of pressure while you are playing then you go to twenty ounces of pressure for the next octave, just as I explained the embouchure is going to be more resistant. You are going to have a much greater need for pressure. Now that again is simply tied into the mass of air so that you blow with greater volumes of air--thick air. It will be that thick volume of air based on the resistance of your embouchure in that particular register. You can't use this as a blanket rule for the entire spectrum of notes on your instrument. It will be different in the bottom as well as the top register. Your mid-range is where you lock it in from there as you do your crescendos and decrescendos you will in a sense still be the same volumes, but they will be different than the notes in the mid-register because of the embouchure differences. If you go higher or lower you must find what it takes to make it sound like the middle register.

We did this research years ago. We did it actually for the whole brass family. We went from the trumpet all the way down to the tuba. As we were wrapping it up, the doctor in charge called me over and show me on his graph papers that wherever there were two brass players playing the same note enharmonically, we used the same pressure of air, the same flow rate and practically the same decimal. The work efforts were about the same. When Herseth would play a low "C," he was using five ounces of pressure while I would play a high "C" and be using five ounces of pressure as well. Farkas was doing the same thing on the horn. He played his "F" on the horn and I played the same "F" on my tuba and the same pressure was applied. It depended not on the instrument, but where we were on our pitch which comes back to what your embouchure is like.

When they auditioned me for the Curtis Institute of Music they handed me the Flying Dutchman Overture, which went up to high C. I had a little B-flat tuba and I had read that the highest note on the B-flat tuba was B-flat. I was fifteen years old at the time. I told them I could not play high C because this is a B-flat tuba. They laughed and said try it, which I did and missed the note. They asked me to play it again and I got it.

One time while I was in school, we were doing a piece of music that went up to G, one note below middle A. I had difficulty playing the high notes and asked my teacher,

Phillip Donatelli, to play it for me. He played and I noticed when he went for the high G he moved the mouthpiece down and I thought, "my god he is changing his embouchure" and I thought this was a big no-no. I was a former trumpet player, so I changed my embouchure and went back to my trumpet embouchure, except on the tuba. I had G above high C, but I also had the G above that and I never had a problem after that. It's a true story but it is a little weird.

It has been so nice to talk to you folks. I just wish I could have seen you, but I hope you got something out of this. Do not hesitate to call if you want some clarifications, and I'll be glad to see what I can do about it. The best of luck to all of you.