

APPENDIX 3

Arnold Jacobs Master Class Lecture

1973 International Tuba and Euphonium Conference, Bloomington, Indiana

Hosted by Harvey Phillips

Transcribed and edited by David Kutz from www.chisham.com/tips/index.html.

Subject headings added by David Kutz

I assume that the bulk of the group are tuba players, am I right? I see that they let in a treble clef player! He's a friend so that's all right! We have two short clinics to do, and I will try to be of some use so that you folks can get something out of this, I am going to keep this informal. I want you to feel free to raise your hand, interrupt anything that I say. I want to start out-- usually, when I am doing a clinic with younger groups, and so forth-- I find that I have to do a rather elementary type of clinic and go to the basic grounding of tone production. I am not sure that this is required of a more advanced group, but I am going to bring my horn out. I found that it is really easier to play than it is to talk anyways! You know, we do so much of it and it's a good way to get started, and as I say, I haven't played yet today so-- we'll just make this a test. It'll be A, B, C or you can flunk me! I'll be right with you. [Jacobs goes to get horn]

Warming-Up

I am not going to use music at this point-- I'll just start by warming up as I haven't played yet today. I don't know which mouthpiece I will use; I've got about six or seven of them here. You see, this is what happens when I am at home and I start to practice. I think that this type of approach is not a complete waste of time because you actually are in an art form--you have to communicate and you communicate with sound. I am communicating with words, but my art form is primarily one with sounds. Now, we talk about warm-up. Actually, my wife was a ballet dancer-- in fact I used to work her

act and that's how I met her originally-- I used to watch her warm-up, it was very interesting. She would go up to a wall, put one leg up to the top of the wall and the other leg she would still be standing on the floor-- she would just press right up close. This is very important for ballet dancers to do, but for tubas, I could not achieve anything like that! [laughs] I wanted to say that warm-up for us, the words warm-up in a physiological sense are very interesting because if you take an actual temperature sensing device, you take an athlete before he starts to warm up and put a sensor on the knee-- you'll find that as this gentleman does his warm-up exercises, the blood supply is increasing in the region the tissues become flexible so he is not going to be as apt to tear fibers with a large blood supply in the knee or the other parts of him. It is very important [for him to warm-up] because he can create the physical damage if he fails to warm-up. Now on a brass instrument, a warm-up is extremely important also, but for different reasons. In other words, the lips actually-- these beautiful red-lips, mine are not so beautiful-- but when you meet certain people you'll admire the nice red lips-- usually they are red because they have a very thin membrane covering them. There is a marvelous blood supply in the lip and as a result, if you were to use temperature-sensing devices on the lip, you will find very little difference before and after warm-up. What I am trying to indicate is that we do warm up we couple ourselves to the instrument for music making. Those of us in the professional sense rarely cool off enough that we would require a massive stage of warm up. In other words, we had a difficult program to play last night, and I am sure that I can be functional on the instrument when I start out right now, more or less. Now, I will just play a moment. Hmm, the valves don't work; we should really do something about that! Well, we will play open notes then.

[Jacobs warms-up]

No--I don't think I will use that mouthpiece, I think I will se a different one. That's my regular one, let's try something else.

[Plays *Greensleeves*]

Three Variables in Playing

I suppose you might have noticed a great difference in tone when I switched mouthpieces. Actually, the one I am using now is a rather bowl shaped--oh you might say, a cup similar to what the trumpets use but in a greatly enlarged sense. In other words; it is a mouthpiece that has a very definite cup shape, a small throat, and a fast tapering backbore. With a large horn of this type, it gives it a little more response. It moves it somewhat in the direction of the smaller tuba and in, you might say characteristic works of the French school. If I don't oil this valve, I don't think I can play fast enough to do anything anyway.

[Plays]

There is a much faster response. You can get much the same think on the cone shaped cup--but with the contrabass tuba, in other words, if we wanted to bring out the fundamental in the tone, we would be using more of the cone shaped mouthpiece and a rather large one. What I am trying to indicate to those who are playing in the audience is that you have three variables: You have the variable of the horn, you have the variable of the mouthpiece, and you have the very large variable of the player. I am trying to indicate some of the more mechanical variables before I get to the player. If I could have someone would bring a nice shiny baritone--instead of a baritone I will call it a piccolo tuba, and demonstrate a little on that. With a special mouthpiece which has the tuba rim--but in the relation to what we do on the contrabass tuba, you might liken it to what the trumpet player would normally do with his normal Bb, or C trumpet and his trumpet an octave higher, his piccolo trumpet. We do very much the same thing with the tuba and the terminology sometimes gets a little out of hand so-- we'll call it a baritone or whatever you choose. What I want to indicate is that those of you who are playing in ensembles will say that if you happen to have a very large tuba and you need to lighten the tone-- of course an excellent means is to use different mouthpieces.

I have here a little F tuba mouthpiece, which fortunately fits into this. Let's hear what it sounds like when it is played in a big tuba.

[Plays Puccini: *Un bel di*]

I suppose most of you would recognize that from Madame Butterfly, a nice little soprano lady sings that, but that doesn't mean we can't play it on the tuba. If we happen to like it, we can go home and play it in our studio. I think you can hear that the introduction of the variability of the mouthpiece right away is altering the tonal characteristic of the instrument very much

[Plays *Greensleeves*]

That makes a nice little test piece for mouthpieces. Instead of running out and-- my friends from the instrument manufacturers are not going to like what I am about to say-- but instead of writing out a very large fat check sometimes for a new tuba, many a time you can merely take your rim--it's advisable to keep the same rim if possible so that the musculatures remain the same-- and then by using an altered cup, you can very definitely increase the strength of the overtones and decrease the strength of the fundamental. If you use wave analysis on one of these instruments at the time I am using this mouthpiece, you would find that the fundamental has lessened dramatically and the overtones have increased. Now, this is an F tuba mouthpiece designed primarily for the F tuba. The one I used, the second one, is an adjustable cup-- I can adjust the length to anything I want except I dropped it and its jammed so I can't budge it-- but when it works, you can adjust it for maybe a ½ inch and there is then a considerable change in tone quality.

Now, those who are using very small instruments can do the opposite. In other words, by going to a larger mouthpiece, you will introduce stronger fundamental and immediately begin to lessen the overtones. Sometimes the bandmasters will be very happy because at that time you will be simulating the sound of the larger contrabass tuba and you are using the variability of the mouthpiece that costs far less than the variability of the other tuba. I haven't gotten into the variability of the player because that is a can of worms--we have to take a lot of time when we go into this one; but again, lets see, I have all sorts of them here....Mr. Phillips would be interested in this one because it is a Conn #2 but, we changed it. Again, if I had the normal Conn #2, I'd like to hear the

difference in this. Dr. Fred Young-- he is a tuba player in Pittsburgh and he is a physicist; a very brilliant man and a very fine tuba player. He does not play professionally but sometimes his insight is to the challenge he has to meet, in the concert band that he plays with, or in the work he is doing personally with the tuba. Sometimes it doesn't quite follow that this would be a satisfactory answer for the professional musician. Just recently came to see me in Chicago and he said "Jake, what do you need a backbore in a mouthpiece for?" I couldn't answer him--I don't know what we need it for. Through empirical observations I've always had a backbore, a throat and a taper and we've always used that. So he had a mouthpiece with him and had drilled out the backbore and just had a cylindrical pipe. I sent this Conn #2 to Pittsburgh and it came back with a hole I could stick my head in! I think because it's the same size in the throat, in the cup of the mouthpiece as it is at the tip, we have quite a change in quality. I felt that this mouthpiece tends to bring out the overtones—the overtones tend to be emphasized and the fundamental is de-emphasized. These mouthpiece's-- I am using a Conn-Helleberg, and the Conn #2, they are both practically the same so you will hear again the difference the mouthpiece can make....

[Plays theme from Richard Strauss' *Don Juan*]

Now I will take the cylindrical throat. It is so strange that when I look at it I have to pause because I can hardly believe it. You think it wouldn't play at all.

[Repeats excerpt]

Very definite change don't you think Harvey? Whether it is good or bad I wouldn't say but it is a very comfortable mouthpiece to play-- it bears investigation and since this is a University I thought I would bring it up. There are certain characteristics in playing that are very interesting. I think that tone production is somewhat easier with the large throat, and by removing the backbore, I think we lose a certain amount of the character in the

sound that we are used to with the smaller throat and the large taper. Intonation holds well but goes to a different level. It does change the intonation, but within itself it is quite good. Now as I say, mouthpiece as a variable is something very good to consider.

Playing by Feel

Now there are people who will not alter a mouthpiece or change a mouthpiece, they have a statement: "It doesn't feel right." If you play by feel--and there is a basic aspect of feel when playing--in other words, recognition by feel-- you can not change anything. If you are going along fairly well, hopefully you are going to remain in good shape in playing because the feel phenomenon will be the same. Unfortunately, I think this is a very poor way to be; you cannot play by feel.

The feel phenomenon is really a very inadequate way of telling you when things are right or wrong, it's much better if you go by the sound and keep the artform of communication dominant so you are actually talking to your audience with your instrument; not talking to yourself. So what I am trying to indicate is that if you were to alter the cup of a mouthpiece, there is going to be an altered feel and some altered intonation. I assume most of you are advanced on your instruments--as soon as you alter a mouthpiece in depth or in contour, you will alter intonation. As you practice on that mouthpiece you have to very quickly search out the direction of alteration. In other words, you do this by finding the quality of tone, not the exact intonation-- you have to find out where it went and where it changed. You will find out where the qualities in the note that match are so that the qualities of the tone are even on the instrument; you raise or lower pitch from that point after you have established where you have the correct sound. In other words... matching qualities of tone. If you try for the intonation before that, you will never know if the horn's sharp and you're lipping it down and vice versa. You have to find where the instrument will have proper resonance. Once you do that, you will find a freedom in changing cups. It's not a terribly important factor.

When you take players as old as I am, and as old as most of the players in the Chicago Symphony Brass section, we get so bored that we deliberately walk on the stage

with different mouthpieces. You've got to do something you know-- when you are playing Tchaikovsky's 5th; how often can you play that and still keep inspiration at a high level? So, you see Mr. Herseth come out with a strange looking trumpet sometimes and, strange mouthpieces--and I do the same thing. I will come out with altered cups, variable cups. Once in a while we put them away and reach for the old one when there's a disaster--but most of the time things go well. Now, when you alter a mouthpiece, it should be not for the personal comfort but for your ability to express yourself. In other words if you are looking for specific qualities in tone--when I play, oh I'll say a work that requires a little more the French type of playing...

[Plays Berlioz: *Hungarian March* theme]

This type of articulation is not quite as good when you do it on the large mouthpiece.

[Plays again with a larger mouthpiece]

Sometimes its better! Actually, there is a difference. What I am trying to indicate is that as you sense the need for altered qualities of tone: you can do it by alterations in your own embouchure, you can do it by mouthpiece, and of course you can do it by instrumental change-- and more frequently would be the proper thing to do. But what I am trying to indicate is that there are other methods.

Variability of Instrument

Now I want to, I can't show the variability of the instruments, I only have the one on the stage--oh, you have the baritone? Good, let's try this. We won't call it a baritone, that's poor terminology--the Piccolo tuba! First thing we do is take this mouthpiece out. As I say, If you don't play by feel it is amazing what you can do—you can play other instruments, other mouthpieces--but you have to play by song.

[Jacobs warms up on Baritone playing theme from Bolero by Ravel]

That gets the trombone players sore!!!! (Laugh and applause)

[Plays *Greensleeves*]

I keep going back to that old warhorse but you know-- you need something stable that you can test the horn on, and I like to do that. Now-- one of the things that I do like to suggest to a student when I teach, which is a great deal-- I find player after player coming to me all hung up because of the constant search for high notes on the tuba. If I had to pick any single phenomenon I would want to do combat with, it's the tremendous tendency to extend the upper range-- upward and upward and upward. I see the same thing you see in the young bass fiddlers; they are all playing down here [in the high range]. We tell them--get down into the money range, get back here, ya' know?

What I am trying to indicate is that a person playing a brass instrument-- there are certain things that have to be taken care of as you develop the ability to express yourself musically with the instrument. I think if you were to take an Arban's trumpet book or any of the simple trumpet methods, you'd almost find the key [answer] for the tuba. I am speaking now of the elementary stage, where we don't want a great range to be established immediately. I have a reason for it in the sense that most of us who have learned to play on the tuba learn without very much instruction. I grew up in a little desert town in California and started out as a bugler. I switched to trumpet then finally trombone. I lost the trombone, and some bandmaster took advantage of the loss and handed me a tuba, so I was kind of stuck with it--but I did primarily learn to play without instruction. Now, I learned the tuba by just repeating what I had done on the trumpet and the trombone. There's an orderly development about that which has to do with the lip musculature, which has to do with the physical functions of playing where actually-- great range does not have to become a great hazard because of the amount of time that was spent in the normal activities on the instrument in the mid-range, and then the lower mid-range, and then the low range.

Now I have player after player that comes to me with hang-ups and a sense of malfunctioning embouchure-- malfunctions in the breath, and they are always trying to play the Vaughan Williams Concerto on their B Flat tubas, and many of them can do it!

Also, many of them begin to lose the mid-range. There will be segmentation in the embouchure, a rattle in the tones; this is the way it will make itself noticed. I would like to suggest that along with the contrabass tuba, the player should consider actually getting a mouthpiece--I don't think that there is a commercial mouthpiece made--Schilke made mine for me. He merely copied the Helleberg rim and made a special cup that would fit into a Baritone and was contoured more for the Baritone-- it gives the Baritone a very nice round quality of tone. But musically, it is very acceptable to the player. In other words, it sounds quite good when you play a simple B Flat scale...

[Plays a B Flat scale]

Of course that scale would be an octave higher on the large tuba in relationship to it. The embouchure form-- in other words, the positioning of the embouchure or what would be the proper terminology: the hypertrophy and enlargement of various small fibers would have to do with the shaping--the strengthening comes in a situation where music is more compatible with the Baritone, and can be transferred back to the big tuba. I always insist that whatever is learned on the small instrument is transferred back. I do this when I work with trumpet players frequently. If I see a struggle going on in the B Flat trumpet, the normal large trumpet, I might ask for the piccolo trumpet and start a musical development on the piccolo. Everything that is done on the piccolo, I always ask that it is re-done on the big trumpet so that we don't have the phenomena of high notes on one instrument and low notes on a different instrument.

Now, I am suggesting this only because I think this is a marvelous--bypassing some of the distortions that come with playing very high notes on some of these large tubas. The smaller ones aren't so bad but these monsters go flat in the high range-- some of them will go sharp, but the youngster is trying to play it in tune so he's liping the notes around-- he's establishing all sorts of efforts which really do not belong, and I would think that by working on in conjunction with an instrument of this type, it would be more compatible, and they would enjoy it more and I think the instructor would enjoy it more, because they would make much faster progress.

I am going to get into the heart of the clinic I suppose. I have to, rather than work with a composer; I have to work with the person who plays the tuba, which is so much of what I think I was actually brought here for. [Person hands him a Besson F tuba] The trouble with the Besson F-- I know this horn is pretty nice a he may never get this back!

[Plays Siegfried's horn call (Wagner) and Berlioz: *Romeo and Juliet* excerpt]

This is quite a substantial tone for a tiny little horn of this type. I will put the F tuba mouthpiece in it-- I use the large mouthpiece deliberately to enlarge that tone.

[Plays the Berlioz excerpt again]

What I am playing is of course from Berlioz' *Romeo and Juliet*, the opening recitative for brass. I don't know the number of our recording but if you want to go out and buy it, why, fine and dandy! It is typical writing for the F tuba, and you get the same range on the C tuba -- it's just as easy to play up there but the sound characteristic is of course not what it should be; in fact it is not at all proper--it's too wide, too thick of a tone, too much fundamental for this style of writing. All we do is go up to the extreme upper range of the contrabass tuba.

The Variable of the individual: Communication

Now what we are dealing with of course is a human being, a person: a man or a woman, who wants to play a brass instrument. Now, where I go into this, I always feel that we are talking about the tuba player, the trumpet player. We should be talking about the man who plays the trumpet, the man who plays tuba; the man who is in an art form where he has to communicate to others. All art forms have certain basic characteristics; otherwise they would not be an art form. It is the ability to express yourself through the media of your choice. I could be a paintbrush and a canvass, an actor or an actress on the stage. It's obvious how they [the actor] express themselves; they interpret other parts, other person's lives, but they do it and they become very believable. In a sad scene you

might go away crying or in a happy one you'll smile or laugh if it is funny, but all art forms are forms of communication. Now basically they must be to somebody else, not to yourself. It is so very important that this is understood because it establishes a pattern that should be there from the time a person enters it. I dare say that the very successful tuba player, I am now thinking of Harvey, and I am thinking of many other young tuba players; I am thinking of myself as a child; we loved sound. I can remember myself as a youngster playing the bugle, I got into trouble--I would go from my Scout meeting playing my bugle at nine in the evening, playing the bugle all the way home. The neighbors would complain, people would come out and tell me to be quiet, but there was a tremendous extroversion there. I was communicating, but in a sort of nasty sort of way. But what I want to indicate here is that from the time you start playing the instrument, I always consider the most elementary player the most elementary performer. I didn't know why I felt this way until the middle 1940s when I started to study biology. After I had gone through structure and function and stayed with human biology I found many interesting things after the fact such as what people do and why we do things as motivation and what their physical meanings will be. Some very interesting things I think; insights came out of this type of study-- one of course is the habits of thought that are very strong in each individual; the way we tend to think-- Now what we are dealing with in playing a brass instrument, we are dealing with an acoustical device set up by a factory. This device has basically three valves you can add a fourth as an extension valve for intonation, additional range; you can even add a fifth, but it's still basically a three-valve instrument. Any fine player can play three octaves easily on his instrument, some will do four, and some will do more than that. It is obvious that the three valves on the horn is not giving us the pitch. In other words it is not like with a piano where our cat sometimes runs down the keyboard and it plays; it's not very good music but I hear it. On that basis, I want to indicate that with a brass instrument we have something quite different than the woodwind player, the percussionist, or the pianist.

Now, let me establish one thing right from the beginning: when I talk about a pianist, I am talking about an extremely difficult instrument to play. I am speaking about

a brain that has to be extremely adept in the art form of communication. In other words, they have challenges that are far beyond what we will ever have on an instrument like the tuba. I respect the pianist as I come from a family where the piano was dominant--I was the black sheep of the family playing a brass instrument. What I want to indicate right away is that when I say that when the pianist has a tactile sense; in other words when he touches, he feels. He is getting his feedback through his fingers, he is getting an awareness of function and a connection with the keyboard where he can express himself in his art form, and a very complex one at that. But, he has a sense, an extra sense that we do not have on the brass instrument. Now what I am trying to indicate here is that I studied voice for 12 years, giving me a little insight into this, also having studied anatomy, structure, and function. I find the similarities with the brass instrument are just as enormous in many respects--the applications are somewhat different but there are basic similarities.

Avoiding analysis: We Play by Song

One thing is that we never know what we are doing. Now, we have to know what we are doing as musicians, but we will never know what we are doing in the sense of physical structures at work. We can only get signals from a small number of muscles that are functioning, missing all sorts of signals from other muscles that we cannot know about; we just don't have the appropriate receptors. We don't have a nerve in many of the muscles that are going to feed to the thinking part of the brain; it will feed to the brain but to other levels. The part that we are conscious with will not be able to perceive in a physical sense what we are doing. In other words, some aesthetic analysis would be the term that we use. Now, we are not going to know what we are doing--I think this is so important that people realize that in this art form, we do not have to know what we are doing. We have to know what our message is going to be, we have to have fuel (air), we have to use it, but we don't play by air. I am here to give a clinic which will probably be dominant on respiratory activity, but I have to indicate even before we get started; that we never play a brass instrument by air, we play by Song. We use air, but we don't play by

air, we play by Song. In other words we go by the complete product, the message, not by air.

By blowing breath, our embouchure does not have to respond [blows]--you can do that all day and not have a sound; there has to be another element added for the embouchure to function. When we do add this message, the breath becomes fuel. It is a very important phenomenon, but it is not the end product; it is not the art form that we are working with, it is only a segmented part of it. So, I want to stress right away that the relationship of the clarinetist, his connection to his instrument in terms of phrase dynamics and so-forth, is through his breath. Now, he has a wooden reed, his embouchure helps the ligaturing aspect of the reed--my friends tell me this, I am not a clarinetist but I work with good ones and they gave me this information. Their embouchure has to do with certain aspects of the reinforcing of the ligature aspect of the reed. He uses his breath as the motor force in order to vibrate the reed-- the instrument has to do with the resonance of that vibrating reed. Now part of that is sympathetic-- part of it is forced, it's primarily a forced resonance compared to the brass instrument, which is primarily sympathetic. Now what I want to get into is a recognition that the woodwind player, in the aesthetics of the art form; he can be very much alerted to the use of breath and speak about the breath. You cannot do that as a singer, in other words you must be altered to the song. You must be alerted to the communication to your audience-- though it is not just a sound it is also how you express yourself; the facial activities, gestures, body language in other words, it's all involved. On a brass instrument where our reed is flesh and blood, we have to be aware that we do not play by breath. At the same time we cannot neglect the breath, but we can play by sound, we play by Song-- I much prefer to put it to you that way.

Our embouchures do not have to respond to a flow of air. If you stand in front of the mirror and you make funny faces in front of the mirror, you will find that you can take your lips and twist them all around. In other words, we have various muscles that will pull the lips inward, protract them outwards, elevate them, and depress them. They are very complex structures and these complex structures form, as I like to say it, vocal

chords for the instrument.... Now, what's involved here is that in a human being-- the part of the brain that you do volitional thinking with is not in charge of what your functions are. It's in charge of what you do with your body to influence the external environment, but it is not in charge in direct wiring hookups to the internal environment. It goes through emotions; it goes through all sorts of other states to influence the internal activities. What I want to indicate very strongly is that I have many students that come to see me that are very much involved in self-analysis. Now the part of the brain that we think with is the part that permits us to ask questions or to issue statements, but it does not permit us in itself to allow my arm to raise it up. It has to signal that says I want my arm up in the upper position and then the many muscles throughout the body go to work. In other words, my Scapula has to fix back there: the arm in this position has altered gravitational factors; the electromiographical readings all over the body would show activity. In other words, a simple maneuver is enormously complex from the machine aspect of the human body and function and yet, it is very simple if I throw up a ball to catch it. It is very simple to do that, but I have to throw the ball up and I have to catch it. As soon as I go by the chain of command that allows my arm to be in a position, I am going to spoil it. I have to get the hand under the ball and I've got it. As soon as I go to the procedure to get it there, we are in the way and we are in all sorts of trouble. What I am trying to indicate very strongly is that the part of the brain that asks the questions is also the part of the brain that issues the statements. Now we have other levels of the brain that have to do with firing up the muscles, giving us the coordinate phenomenon. I know this is not a simple subject for musicians, but I am trying to give the proper analogous situation where it will make some sense to you.

When I speak to you, I have something to say. In order for me to say it, I am using articulation; I am using tongue, lips, laryngeal activity, respiratory activity, and body language.... Many parts of me are working based on conditioned response to stimuli. Now, the very fact that I have something to say is making it very easy for me to do it; I merely present my pitch to you. I will very frequently take a student who is turning inwards and I will ask him to give me a very complex discourse on any subject--

but a complex one, and analyze his respiration, phonation. In other words, question him as he is making the speech. Very frequently he has nothing to say, but I have people on brass instruments doing this all the time. Well, you can't do that. In other words, you influence the phenomenon, even the things that are wrong, you don't make them right-- you abandon them.

Habits and Nerve Pathways

You substitute new habits for new ones; in other words you don't fight old habits to correct them, you substitute new habits for the old ones. The new neuropathways form, and the old one, through the lack of stimulation, will finally quiet down as the new one develops.

In order to make this thing a little more sensible to you, I want to say that we have two types of nerves. We have *motor nerves* and we have *sensory nerves*. You all know the sensors; when I talk, you hear, that's an auditory nerve, that's a sensory nerve. You want to feel whether the water is hot or cold, you put your finger underneath the water, there you have a sense of temperature; you have the tactile sense. You have the various senses that carry the senses inward. Motor nerves are quite different. A nerve in a human body is a one-way street. A motor nerve carries a message from the brain to the effectors; to the muscle which is going to contract. A sensor carries the message in the opposite direction. In electronics we use a wiring hookup where we can send a message along a wire either way; you cannot do that with the human nerve. In other words, it goes only one-way. Now, we play through the motor systems, not the sensors. The sensors are important-- I am not putting them down, but the emphasis in the musician must be always on the art of communication so that one part of the brain is acting like a piano player roll; the keyboards are stimulated into their proper function. We don't go to the corrections of the keyboards we go to the correction of the controls. It's like the study of machine systems. All machine systems have controls, and all controls have to be programmed. When there is a malfunctioning embouchure, first you have to go to the brain which is controlling the embouchure, you don't correct the shape of the lip as the

dominating factor-- you make sure that there is a musical message that's supposed to come out of the lip so we will have something for the lip to say. Now, that doesn't mean that the lip shouldn't be in a proper form. It's simply that the proper form in itself is not the end product. In other words, proper form--if you take for granted that the music student has a musical thought then-- he will function with proper form. Many students at that time do not have a proper thought, they are going by the feel and the shape of the lip and they have nothing. You must make sure that there is always a sound in the head that instead of registering on vocal chords here in sound, they register here [lips] as vocal chords in sound.

[Jacobs sings a trumpet fanfare (*Reverie*) and then buzzes it]....

Now, for the lip to have something to say, the [idea] must always be in the brain to be in the lip. You cannot take that for granted for those who teach or those of you that play, that it's in the lip because you might have thought of it a minute before you started playing. As you play, you have to sing. You do not sing with the vocal chords, you sing with the lips; but you do sing. That's the closest analogous situation that I can think of. I have seen this writing from many fine brass players before my time. They would say 'learn to sing', not as a physical application of going onto the stage with the human voice, but to sing on your instrument. As someone who is well versed in structure and function, there are physical reasons why this is valid. In other words, we must consider the piano player roll so we can have the keyboard activity; or you could liken it to the punch card for the computer, but we must have the message so that the physical activities can function.

The subject is complex and I would like a lot of questions from you on this because this should be clarified for you to get any benefit out of it. I like to teach it as a simple subject and I will very frequently ask my students to sing a part, and then play it. Now many times they will sing it and when they go to play it, the mind blanks out. They've sung it a moment before but they are not singing in the brain at the moment they

are playing it and as a result there is still improper guidance. At that time, I will make up words, in other words, if they are playing I will:

[Jacobs Buzzes a tune and sings the words “*How dry I am...*”]

Then I will have them actually concentrate on the words and pitch--invariably it begins to come with greater ease and comfort and they will find entrances that they couldn't get a moment before. They come quite easily when they stop trying to develop the attack as a formalized procedure, but substitute the pronunciation of a word, the whole psychology of it changes, and the organization of it cerebrally alters.

I hesitate to go into how complex we are in structure and function. You have no idea unless you have studied years of--you can't just study anatomy. You have to go into the physiological concepts, the chemical aspects. You have to go into enormous study to get the concept of truly how complex the human machine is, and then when you do you realize that, the only hope of success is to keep it simple. Now I always played in my own life, I learned to play by ear when I was a youngster because I didn't have a teacher or an instruction book. My first trumpet my father bought me was a little Wurlitzer trumpet but he forgot to buy an instruction book so, all I had was the trumpet. Since I had played bugle before, I learned to play by ear. I played a solo in our school in California with my sister accompanying me on piano-- I hadn't played a year on the trumpet when I did this solo. I remember after I started studying the trumpet I couldn't play that solo anymore. Well, it wasn't the fault of the teacher or anything; it was simply that I had let go of this certain aspect of playing. What I want to indicate is that learning to play by ear means that a region of the brain is becoming very adept at recognition and recall.

Now recognition and recall is going to have a great deal to do with what you have to say as an instrumentalist. Now, the physical factors demand that you do not play by segmented parts. The breath, tongue, embouchure, are the various segmented parts; you play by Song. Now after the fact, you can analyze all the separate parts and segment them, but to integrate them into proper function, you have to do it based on having a

message. Now, if I had to pick any particular fault I have found with many young players, I would say that only one out of ten has a musical inspiration. Usually they come to see me because they are in trouble. In other words, they will come the long distances and so as a result; a person in trouble worries. With worry, you tend to become hypersensitive to incoming stimuli. Usually with inspiration you would have a message to deliver and things go somewhat better. So often I would get people coming to see me who are in a rather worried or harassed state. I have to turn that young mind around and make a storyteller out of them right away; it is so important that I can't stress it too much. I like to phrase it as "You have a tuba in the hand and you have a tuba in the head" The tuba in the head has no valves and no embouchure. This is the one you concentrate on. You allow the one in the hand to become a mirror. In other words, it is the media in which you express yourself. Now I find that many players will use lip service to this type of thought, but when the horn is in the hands they don't do it; they don't have a message. They play by air, by fingers and by resistance; the various feel phenomena. I have to somehow break into that. I use the technique of Song, in other words; I may establish words.

I stood outside Remington's studio at Eastman one time when we were playing with the Chicago Symphony; the first thing I hear is that he's singing with his student; his voice sounded constantly. Well, the indication here is that you program the physical structures; you program yourself by two thoughts of thought processes. One is the imitative act-- the other is the creative; but one or the other should be in constant use. If I were to play the Stars and Stripes forever and ask a student to do it, we'll say on the mouthpiece without a horn, he can usually imitate very readily. He starts copying my voice right away. I will give him a few trick rhythms--very quickly, they are doing it on the mouthpiece. The imitative act is feeding signals along one level of the brain, programming other cortical levels where the physical structures are being responsive. I bring that into being very early because this is one of the chief tools that we use in an art form. The creative aspect is the ability to have something to say.

If I have a player, let's say he's a trumpet player-- I have him listen to someone like Bud Herseth and I ask him to play something simple. How would Bud sound like on this? Think a moment. What would Bud sound like? Demonstrate what you would think he would sound like on this phrase. The player will play way over his head. He begins to sound like Herseth because he is thinking of sounding like him; but you can see what I am talking about right away. Psychomotor activity, the programming of a motor system, is through the psyche and what we have to establish here are concepts of playing. Now that doesn't mean we neglect our other aspects of playing, but we keep a dominance of being performers, of having something to say to somebody else. Like the actor on a stage; you read a set of lines-- you read it with the idea that you are going to re-interpret it. If you want to express hate ("I HATE THAT!"), I can think of some conductors, I can turn that on like that! I love; yes I can do that too. Laughter and so on. You will find that when you think about a thought that brings about an emotional state, you've also brought about all sorts of physical response associated with it. I am trying to indicate the same thing when we play our instruments. It's not to have a question in the brain, but a statement. The statement should not be of the physical procedure but of the sound phenomenon. What we are dealing with is the conditioned response to a specific stimulus.

The stimulus should not be the spoken word; it should be sound. If we use the word Song, then we use the word Wind with sound-- it must be sound that will excite the embouchure into pitch (and) coordinate the various physical functions. We go right back into the art form where we belong. I have studied this subject for so many years and I cannot use measurement phenomenon in my own playing. In other words, I do not play by my knowledge of structure and function; I play as a storyteller with a tuba. Just like Harvey does, a great artist with his tuba. Any great brass player, any great musician--we are storytellers only we don't use words we use sounds, but we do bring in our physical structures then and in a proper manner.

Q: You are saying that if you have an image, and theoretically it should come out of the axe, what usually gets in the way of the tuba in the head and the tuba in the hand?

The first thing that you go to is the fact that the image in time may not be there as you do the physical maneuver of playing. In other words, the man with the poor attack-- if he had to play [sings *Ta* and then buzzes], he may have the idea in his mind before but when he sets up the embouchure and breath, it blanks out here at the instant it is needed; it's gone. Then I may ask for a word, or I may use the illustration of a bell and a hammer so it's synchronized; usually the note is right there. But I am working again with the brain rather than the structures because I permit a wide range of bad embouchures and bad physical techniques until we have the musical dominance, and then on through the musical challenges we correct many of the physical structures. Did that answer the question? Now would you like me to clarify any of this? Yes sir...

Q: Do you vocalize every day?

I haven't vocalized seriously in 30 years. I am giving my age away now. I do vocalize, I teach voice to a certain extent. Occasionally I have brass players for instance who-- after all in singing you have to have an open palette at times and so forth-- on Brass, if you had an open palette, the air would be coming out of the nose. So, we do run into some problems. Every now and then I will work with a vocal student and then of course, I will vocalize quite a bit just to get into shape. I do solfège quite a bit every day, but I don't do what I did when I was a vocal student. You know, extensive work for the stage or anything of that type. Although if I only had time, I would, I love it. Yes sir?

Q: Thinking about concept...how does one think about concept when one is drawing from one's own experience?

You can draw from other's experiences that become yours.

Q: That's what I thought. One must become exposed to so many, (inaudible)

This is the thing you know-- Imagination is a very important tool. Mike Russell right? I thought I recognized you there in the distance. Mike-- what we are dealing with here, it's always nice to hear a player in other words, go to concerts hear as many players as you can, but a tuba player can imitate a trumpet player and get marvelous results, you can imitate a violinist and get marvelous results. It does not have to be tuba; it has to be music. But, what I am indicating here is the imitative act for instance--when I am around the orchestra a lot with Beethoven and sometimes I have nothing to play I'll fool around, here's just a little passage.

[Plays Rimsky-Korsakov: Scheherezade theme]

And so forth and so on. I hear my colleagues do a thing so I go home and in the privacy of my studio I do them-- you can see right away that is programming the brain. Now with records, you can do the same thing-- you listen to other players. It doesn't come out of a vacuum in other words. I really feel that this is one of our big problems. I'll get to the composers that are here; one of our big problems is that in the past, the tuba has been assigned a very limited type of music to interpret. Of course Oompah's, we're all F clef here so; we know what that means you know! But we can also see that a limited musical challenge is going to create a limited musician. Now we have to of course, get out of that period and thanks to Harvey and Bill Bell before him, that much of that phase is behind us--but for many years the talented young tuba player had to imitate the trumpet-- he had to go to the school of trumpet horn or violin, but he could do nothing with the tuba. In other words, the actual taking home of tuba music, there was nothing there to challenge him that would really give him the ladder where he could he could climb to be an excellent interpreter of music and, as a person, we are not tuba players, we are people. To develop our brains and our abilities, we must be given the type of challenge that will give us the development. In the past, from my period, I primarily went to the school of French horn, school of violin, school of voice but I did very little with the tuba music.

Otto Lange, I will tell you a story about that. Do I have time Harvey? I had the Otto Lange method book when we lost my trombone while we were traveling in Texas. In those days in the 20s, we had running boards on cars. My horn was tied to the running board and it disappeared. At the time I was living in Santa Monica California, and the bandmaster gave me a trombone so of course I had to fool around with the trombone for quite a while...What was my topic? I was going to tell them a story about -- Oh, Otto Lange. Well, what happened there--it was so long ago, Otto Lange is so foreign to my thinking. At that time, they gave me the tuba book, the Otto Lange method for tuba and a big King Sousaphone. It said the low range of the tuba goes down to a low E and goes up to a high B Flat. So I had a ball with the tuba you know-- they put me in the *News Boys Band* right away. I was principal tuba because I had the technique you now from the trumpet, and trombone and range; it was great. They sent me to the Curtis Institute after a year for an audition. I had the Arban *Carnival of Venice* worked up-- I did the whole thing, as well as Herbert Clarke's *Stars in the Velvety Sky*, I had that worked up for my audition. I couldn't use a sousaphone so I had a little E Flat tuba with a fourth valve tied down and slides pulled out so I could use it as a B Flat tuba. I went up for this audition and I had-- the younger ones won't remember, Josef Hoffmann, he was a famous pianist of a different era and Marcel Tabuteau, the old first oboist of the Philadelphia orchestra, we had a very distinguished faculty there auditioning. I came out with this horn tied together with string and taped down. I started out with my solos; they let me play through them. And then they brought out the Flying Dutchman overture. Now the Flying Dutchman (he sings) goes up to I think a high C. I missed the high C and they said try it again and I said that I could only go to a high B Flat on this tuba-- they laughed. They said try it again.... I was given the scholarship and that was fine but the instruction book had put a handicap in my way by not indicating that there is range beyond high B Flat and low E; it said that's your range for the B Flat tuba.

In my second year at the Curtis Institute of Music I was studying *Benvenuto Cellini*, which goes to a G above our high C. I was having a terrible time playing that note. Mr. Donatelli, my instructor, a fine tuba player, but he rarely played for me, but I

asked if he would play this part for me? So he took my tuba and he played it very well. But I noticed that right before he went to the high G, he shifted his embouchure on the mouthpiece. He moved down lower on the mouthpiece and a bell, a light went on in my head. I said aha! you broke a rule. He shifted on the mouthpiece there but he got the high G and it sounded good. I was a former trumpet player, as soon as I saw that and I broke the rules, I not only had high G, but I had G above high G...I haven't had a bad time with high notes since. But the Otto Lange method with its high Bb and its low E had me stymied for a while.

What I want to indicate of course by this is for a brass player; if the music is the dominant phenomena, and the procedure is a minor and you go for the art form of communication to others, and you don't set rules for procedure but you set rules of result; I think you will find a very happy situation develops. If you set rules of procedure, it fits a certain group and bypasses others. Now we read out all sorts of favorable things from the advanced player, but the person that has to learn it very frequently will be handicapped if he is taught to follow a certain procedure. For instance, if you do not allow a change of embouchure as conceived maybe a stabilized embouchure today, I don't have to make the changes that I did today that I did when I was fifteen years old, but until the musculatures go into hypertrophy and learn their tasks and so forth through the act of playing, then many growths and crude just like in athletics. The refinements come with experience and skill; they do not come until you have acquired the skill. And in any physical structure you have to let this period of development but if you set rules as to procedure, many players are going to be handicapped. If you set rules that the mouthpiece must fit a certain way on your lips--this is fine for the person with the neuromuscular pattern similar to the teacher and poison to the one with dissimilar neuromuscular patterns. In other words, the location of the nerve, the excellence of some of the tissues and so forth, it may be quite different. Jaw structure may be quite different. Allowed to find his own way, you might get an excellent result, but if he has to do it in a formalized way he may wind up in the insurance business or some other field, because she will be unable to cope with the problem but, I am trying to say is by

formalizing the art form, I really feel the player moves ahead very fast and I am making my little speech because so many players will come to me without actually being interpreters of music. They talk about music-- they write-- they use physical aspects of music, but they don't think in the art form of music, and I really feel that this has to be stressed. I guess I must be running out of time because I see something out of the corner of my eye.

(End of session 1)

Part 2

Respiration

I think in this second session I am going to bore you all with respiratory activity and a certain amount of anatomy-- and believe me, it's a dreary subject, I love it but I leave most of my audience when I go into it. It's interesting when you are dealing with a human being, if you had to construct a human being; it would be quite a task. You know, if you were to construct a tuba player-- that's quite a thought isn't it? You'd have to study an awful lot of physics, and you'd have to study many things-- but, Boyles Law would be involved. I don't know how many here are familiar with *Boyle's Law*. That has to do with gas dynamics and what happens with air under pressure.

What we are dealing with is the human being who is born to survive on this planet. One of the things that we must have is air. Now there is a great simplicity about this subject, or we can go into great complications; let's take it from both aspects. Could I have a young man come up, a volunteer? Somebody who might be interested in making a display of himself? I might even have him strip down to the waist; you never know....I met this young man outside the academy of music in Philadelphia. He's from the Curtis Institute of music right? Larry is going to be a very good subject when I get to him. Larry, make yourself comfortable, I don't know when you will be in use, but hang around. What we are dealing with of course as I say, is a person who is born into this planet without any knowledge of tubas, tuba playing, or anything about it but he has to breathe. What I am going to deal with on this subject, I am going to need to go to my

equipment and pull out some charts and I might have to draw a little. I want to go into certain aspects of respiration and how we apply it to brass instruments and particularly to the tuba. So excuse me for a moment while I fumble around with my equipment here.

I had thought that if I had permission from the orchestra to spend the four days here with you which I had originally hoped, I would have brought my equipment here with me to analyze and each day have a period where I could have some of you come in and work with you as individuals. Unfortunately due to the pressure of the season; this was impossible. Maybe at some later date I could do it. The next best thing is for me to try to indicate some of the aspects of respiration.

We have what we call VITAL CAPACITY. This has to do with a quantity of air each of us has as an individual that could be used in tuba playing or anything that we want in life. This particular phenomenon-- each of us is blessed by nature with a certain potential, we don't always use it; but we do have it as individuals. Now in a young man of this type, if I had the equipment here I would measure-- but I can almost tell by looking at him about what he would have. We use the term liters; I am going to convert it to quarts instead. In the average individual, about the age of 20, a young man of this type would have a lung capacity of--how tall are you? 5' 8 1/2''--what do you weigh? And how old are you?--So you at the age of 20 would have an expected vital capacity of about 4800 cubic centimeters of air. In other words he would have approximately 5 quarts of air that he would be able to take in if he first blew all the air out of his lungs that he could, and then after a pause, take a maximum inflation --a non-musical breath. All the air he could take in, he would have approximately, we would expect, about 4800 ml; 5 liters of air, somewhere in that range, plus or minus 20%. We can just about predict from his body size and the somatotype of the individual. Now, what I am indicating here that is tuba is what we call a high flow rate instrument.

I did several tests at the University of Chicago Medical School where I was hooked up to spirometric and analyzing equipment. They analyzed the flow rate of air that I would use from my lungs to excite the embouchure into vibration, and my vital capacity, unfortunately, is quite small. Short, fat people rarely have very large lung

capacities. As you get older, your capacity gets smaller and smaller. Unfortunately, it is part of the aging process and if you happen to have asthma with it, it still becomes more and more unusable. I qualify in all the negative aspects of it, but anyway, I still function so; it's a short bow, and I change it often and I get by.

What I am trying to indicate to you is that at the age of twenty or so, a person will have their maximum potential in terms of quantity of air as a potential, and it gradually reduces for the rest of his life. By the time that he's in his fifties, he will have considerably less. In fact, most of the people that come to me with embouchure problems are people in their forties and early fifties who have qualified in this respiratory reduction and as a result, are having reflex change on the upper end and it affects the embouchure. Were you going to ask a question young man?

(Any way of diminishing these effects?)

Well, you can cooperate with nature to the extent that you can minimize the amount of change, but you are still going to go down. You can by using, you might say, a quantitative type of inhalation-- you can ward off the undesirable effects and play until you are 100 if you want to. It's just that your bow gets shorter and shorter and as I say, if you change it often, there is no problem. If you try to make it [the phrase] exactly what it did when it was a longer bow, then you are going to be in a little problem here. Now what I wanted to indicate is; a variety of vital capacities that come with age and with size and with body type that come with the individual. I have a few papers here of vital capacities that I have taken from individuals. Now, I don't think this is all going to be visible when I hold it up in front of an audience. I just wonder if this line here starting at the top of the page and going all the way to the bottom is at all visible to anybody.... I will use one from Chester Schmitz from the Boston Symphony, that would be this vital capacity test here this line.... There's one by Arnold Jacobs, which I am ashamed of but you might project that and along side that is one by Roger Bobo, he likes it...I don't. Now, those are indicated. Now here we have a youngster and I want to put this on the screen also....This young man whose vital capacity I have tested, we have a piece of

equipment where if a person, some of you have experienced this and know what I am talking about, but it is a breath measuring device; a Spirometer. *Spiro* to do with breath, a breath meter. When you take a huge volume of air into the lungs, as much as you can hold, blow up like a big frog. You put a tube into your mouth and then blow out and empty the lungs as fully and as completely as possible--do this into a piece of tubing and a can moves up, a pen then moves up on the other side. There is a revolving drum that measures how much air you have moved out and how fast you have moved it out. Now the young man which I had on the first chart, if we were to make the chart--this young man in taking a full breath and blowing it out as fast as he could. These charts that I am using measure seven quarts, seven liters, and overshoots we can measure much more of course. But we are measuring a specific quantity. Now this young man had huge lungs, he could fill the entire chart. He's blowing his breath as rapidly as he can into the equipment to be measured. Now in all human beings regardless of the state of health, as you take a huge volume of air into the lungs and you move it out as fast as you can, you are going to find the velocity of the air out of the lungs is at a constant change. You move out very rapidly at the start, and as you get to the last 20-25% of volume that are usable on a brass instrument, there is a considerable slowing up, no matter what strength you may use to try and send it out, it will not come out faster. There are physiological phenomena involved. Actually, we are running into a problem where air, near the end of the breath, becomes very difficult to use in a high flow instrument. It can be used in an oboe which is a very low flow rate, but would not be practical on a high flow instrument like the bass trombone or tuba. Now, I want to indicate, if this were the seven liters that this young man had--you can see at the top of the page and the curve going down and down and down.

This young player was the former first trumpet player with the Minneapolis Symphony, a man who is all chest; short legs, long torso, an enormous lung capacity. Could you put on one of the others now? Let me pick one, I want to show you a sharp contrast--this is one of my favorites.

This is a twelve year old boy who is being taught by a professional trumpet teacher. This is the seven liters we'll say, and this is the 12-year-old boy or even less. In other words; the vital capacity on this youngster while it was normal for his years, his bow was extremely small. It becomes maximal at the age of 18 to 20 years in the individual. His teacher was giving him length of phrase similar to what he was doing, in other words proper musical phrasing. The youngster had run into severe difficulties in playing because he is trying to take a small quantity of fuel and stretch it out in time to do with what the large quantity of fuel that the teacher had to do. As a result, there was over activation of inspiratory musculature, over retention, the throat reflexes coming in-- severe problems developing in this young player who if he were taught quality of tone, sub-phrase within phrase so that the length of the phrase was not important because his bow is very short. At twelve years of age, it's going to be short in the small individual; it's going to be short unless their body type is rather unusual. But as an average, you can figure that a short person is going to have small lungs compared to the tall person. Now what we are dealing with, I want to go into this subject because it is very important.

There are two lines, one is a line of vital capacity of Arnold Jacobs, one is the line of vital capacity of Roger Bobo, the child like one is mine and the huge quantity is Roger's. At this time I was 4 liters-- today, it is considerably less. Overweight, and too old. They both enter into it, plus pollutants and other things. But what I am trying to indicate to you is a wide variety of fuel supplies for individuals. There's another giant, of course he fills the entire page, in other words, from the top to the bottom. These are people with enormous lung capacities. I always hate it when I see these big ones you know! It makes me very envious. Now I want to go into some of the ramifications of this. We have problems in respiration in individuals according to body type, according to age. We have musical requirements that we are supposed to fulfill as in my first clinic I stressed deliberately of always keeping a perspective within your art form regardless of how much fuel you have; we have to communicate. We don't necessarily have to have the same length of phrase. There is no reason why we cannot re-breathe when we are running out of breath. Many trombone players will be using the Rochut etudes which are

simply the Bordogni vocalizes-- now the Bordogni vocalizes have certain phrasing indications. The tuba uses approximately twice the volume of air in a given time factor as the trombone, if he is playing one octave lower. As a result, he is going to be running out of breath twice as fast. If he is trying to compete against the trombonist, he is going to be stretching and stretching his air, over activating the inspiratory muscles--he is going to be running into problems which are avoidable if he would instead work for quality of tone with shorter phrases. If he is a giant, he'll compete, but if he is one of the little fellas', then he can be in very serious difficulty by trying to extend the phrase equivalent to what the trombone player would do for good tasty phrases. We can have sub-phrases which are just as musical and just as valid, but we must be permitted the freedom of using our in a manner comfortable for the individual.

I want to go into this subject now. This is going to get a little complicated and I will probably lose half of you, but bear with me anyways. First of all, we have the vital capacity. Teachers sometimes use residual air as a statement; residual air we can forget. This is air that cannot be taken out of the lungs by any voluntary effort that we have. In the old days, the forensic test for medicine in a sense the legal test to see if a child was born alive or dead, was to take the lungs out of a youngster that was just born, if there was a doubt. They remove the lungs, they put them in water, and if the lungs floated, legally that child had been born alive. Then there might be an insurance problem. If it dropped to the bottom of the water, it was heavier than water; he had not drawn his first breath. Residual air is involved in this. Once you take a first breath, some of the air remains in the lungs. Now you cannot get this air out of the lungs by anything you do on a voluntary effort--so you can forget about residual air if that subject does come up. In other words, it is not something that can be utilized in playing a wind instrument. It will be there and it protects you always so there is a certain amount of diffusion of gasses, even if you have blown all of the air out of the lungs. It is a protection to the individual.

Now I want to get into the subject of quantity before I get into the structures involved. The average individual at the age of twenty, you might say the average male, will be able to take five liters, five quarts of air by maximum inflation. Now half of this,

less than half of this, is from the diaphragm alone. If you have ever had pleurisy¹ and had the chest wrapped, they immobilize the region to allow healing and remove the pain--you cannot move the ribs. If you are left by only the diaphragmatic activity alone, the diaphragm in the average individual is capable of moving about 45% of your usable vital capacity. Now this will vary in body types according to the individual. The somatotype is very important in analyzing this. By getting the average, we'll say 45% from empty to 45% filled can be done with immobilized ribs by diaphragmatic descent. 55% of that individual's vital capacity is there utilized by the expansion in the chest due to the rib activity. Now this will vary in certain individuals from 40% diaphragm to 60%, it can go 50-50, but it will be a variable. What I am trying to indicate is that the diaphragm in itself is only capable of moving half to a little less than half of your total usable lung volumes that we will call your vital capacity. The rest is due to the activity of the rib cage. Now, we don't have the skeletal charts here necessary and I am a rotten artist so I won't even attempt to draw it.

Over there in the upper right hand corner you will see a posterior, or rear approach to a skeletal structure. You'll note, I can't go over there or I will lose my voice. But if I were over there, I would point to the lower ribs and you will see that they are descending. --the angle of the curve from the spine is somewhat down. Now, this is a rather important point. In the left side you will see it even more clearly that there is a curving downward of the rib cage. Now in respiration--in taking a full breath, you will see that from a deflated position, I will never get small, there is just too much there. As I take a large breath (inhales), you will see a considerable enlargement in the chest. If you were to analyze the sternal activity, you will find that that sternum has moved upwards. You will find that it is hinged at the very top and if you liken it to a pump handle, which

¹ *Pleurisy (Pleuritis)* Inflammation of the pleura, usually producing an exudative pleural effusion and stabbing chest pain worsened by respiration and cough. Pleurisy may develop in the presence of bacterial lung infections, upper respiratory infections, tuberculosis, rheumatoid diseases, and lung neoplasms. The main symptom is pain over the chest wall at the site of the inflammation. The pain is increased by deep breathing, coughing, and chest movement. The normally smooth pleural surfaces, now roughened by inflammation, rub together with each breath and may produce a rough grating sound called a "friction rub" which can be heard with the stethoscope or an ear held against the chest.

is so often used in anatomy what we use to express the sternal activity. The bottom of the sternum, in other words the breastbone, the little bone running down here, it's complicated, it is in three sections, but we will just call it sternum. This bone, when you breathe in, to a maximal inflation (breathes) has a pumping activity like the old farm pumps. In other words, up and down.... When we go to the lower rib cage, which is no longer present, but if it were you would find that the lower ribs, I am going now down to the 10th rib. If you were interested and wanted to count down we would leave the 11th and 12th floating ribs, they are too low for the inspiratory activity-- they are fixed and they have to do with the expiratory states, not inspiratory. This lower 10th is one of our key ribs. You will find that these ribs are bound in front by cartilaginous attachments, it's bound to the breast bone, it moves up through a cartilage and they are all attached and hooks right into the sternal region through cartilaginous attachments; they are not free floating ribs like the 11th and 12th. Now, these ribs come down from the spine in a curve-- now when you are out of breath, the lower ribs become a low inward activity, they become very short. I would love to be able to express this with pictures but let me see if I can get it across from you in some other way. If you can just visualize my arm as one of the lower ribs--if you measure the distance from front to back, in an upward state, there is a distance between the arms in these curves that are quite large. The distance from my body forward is quite large. Now as I lower these arms, the curve comes in and the front goes down, you can see the distance between is getting smaller. The distance between my body in the front of the ribs is getting considerably smaller also. If I raise them up, they get larger. The space between increases, the distance from back to front increases. If we take the pump handle on top-- if it moves down, the space becomes smaller; as it moves up and out, it becomes larger. We have a motion of this type in the rib cage. Now, I will have to address myself to this quite a bit and somehow try to get a biological phenomenon across to where you can understand it.

In order to take maximal breaths, all parts of the respiratory system must enlarge. Most of you know about the diaphragmatic descent. I am not so sure that most of you know about the ribcage ascent, which handles the major portion of the lung volumes.

There's another point that follows, that's why it's important that we keep a sequence. We must recognize a follow through phenomenon that exists in nature wherever muscles are concerned anyways--we have to find what the potentials of minimum and maximum are. To understand respiration, we have to approach it-- if you want the mechanics of it by finding maximum as well as minimum. We cannot do it for finding just enough for instrumental playing.

This is the sternum [showing the skeletal model], the breastbone. These ribs are all bound by cartilaginous attachments. Under, we have two floating ribs, which I am canceling out temporarily because of their being too low for our activity. Now, when these rise up, you will find that they will have moved laterally quite a bit as well as up. In other words, the chest is in a higher position then when we are out of breath; it's low. We have enlargement in these various planes--we have increased the space in here as well as the diaphragm moving down. It is not just a diaphragmatic descent; it is a chest ascent. Now, so many people will think of it as a widening, but we must recognize for the chest to widen it must go to a higher plane. It does not widen by just pulling the ribs backwards--these are bounded. The 11th and 12th ribs can go laterally this way; they are too low to affect inspiratory activity. In the case of these, they must go up to widen. When you hear a person is taking a breath, the back must get wider, but you should also realize to get wider, you must also get higher. These ribs here-- I don't have a proper illustration of the back, but when they move into the spinal column, if you trace a rib here, it moves way up into the back. As we trace that back, these ribs attach to the vertebral column and rotate on a specific axis. Depending on the position of your spine at any given time, they rotate on an axis. They are now free to do all sorts of things. When you take a large breath, they come up and enlarge the thoracic cavity. As they come up, they rotate outwards; they do not rotate outward in a low position. It is very frequently taught that way, but anatomically that is not correct. They must come up to rotate and give you the increased dimension that is necessary for respiration. You can again see the curve of these ribs downwards. Now in inflation, this curve would have moved up--as it moves up it would have increased the width on both sides. We have a

tremendous enlargement potential. If you see anybody working for huge lung volumes, you will see enormous change. Now, I am not speaking in applied terms for any specific instrument, I am speaking of taking large, large breaths to capacity for measurement. Not as an application, I am going to get to that. But we have complications that come into this.

I want to indicate another step. If this line were drawn properly, it would be almost straight with a moderate curve. In other words; a healthy young man blowing his breath out as fast as he can, will have a maximum speed at the start and a gradual slowing up as he begins to run out of breath. It can become quite dramatic. In fact, in this one instance, here is a gentleman in one of the major orchestras--you can see a line starting here.... It's specific in its time but he is blowing as fast as he can and yet you can see a line curving and curving. In this example, this young man is a woodwind player in one of the major symphonies, I won't mention the name, but he has emphysema. Now a good portion of his breath is still usable which can keep him in his professional status but he cannot use the end of his breath. In other words, he has to be able to take a full breath and from full, he has to go down to half full and re-breathe or he would be out of his profession because the rest of the air is coming out too slow for use. Now, this is an abnormal state, it has to do with illness, so we don't have to consider this too much, but I do want to explain certain factors that do occur with all of us.

Now as I said, our respiratory functions are maximal between the ages of 18 and 20; there is a downward deterioration from that time on. It seems strange when you take a man 30 years old and say well, you are not what you were ten years ago! But this is true in respiration; there is this very moderate reduction. We have what is called a pressure-relaxation curve which I want to explain to you that ties all of this in, and will explain certain problems that will occur in playing as we get into it. I am drawing a curve very similar to an "S". Now, if a person has taken in as much air as he can hold--so we have Vital Capacity full lungs in this region, and we will have minimal or might say empty lungs as far as you can use it here. At about this point [midpoint-equilibrium] we have the rest position at night when you are sound asleep. The way that you all are right now, all

of you could blow out your air. If you suddenly had to cough, you wouldn't have to inhale. You would have enough air that you would be able to cough right now without first inhaling. That would be from this region towards empty. Now, we can call this a plus (+) and we can call this a minus (-). We have a factor due to the elasticity of lung tissue and muscle fibers, many of the tissues involved in respiration; we have a work potential without muscle contraction. In other words; if you take a deep yawn then sigh, and we use a water manometer or something very sensitive to pick up the movements of air, you will find that the beginning of that sigh for a man that, we'll say a young man with a five liter capacity, he will have started that sigh with about a $\frac{1}{2}$ lb of expiratory pressure, and in some of the bigger people it could be easily $\frac{3}{4}$ of a lb. This is without ever having contracted a blowing muscle, an expiratory muscle; merely by the letting go of what was taken in. Now, it never stays still--there is a constant curve so that this $\frac{1}{2}$ lb is in a constant varying state until he is down to zero in this region then, he has the exact opposite happening; he runs into a negative pressure. In this negative pressure, from the rest position on out, the relaxation of tissue would suck air in not move air out. Now in this region, a number of undesirable things happen. It takes much more air pressure to get it out of the lungs. In other words the intra-thoracic pressure, the pressure within the thoracic cavity, has to be vastly increased to try and force air out of the lungs at that time. As you begin to increase the pressure to force it out, you begin to collapse the small tubules in the lungs. You create a condition where it is very hard to take the second breath in. As you are forcing that air out, in the effort you will find the capillary beds begin to fill with blood. You have excessive quantities of blood in the tissues at this time; you have over-contraction of the expiratory muscles at this time. You handicap the ability to take the second breath. In other words, it becomes very difficult to really un-do some of the contraction states necessary to force this air out. Now as a person gets older, usually due to ill health or certain body conditions, this midpoint line begins to move up. Instead of down here, it may be up here. We have increasing negative pressure, decreasing positive pressure that can be used very readily in playing.

What we are dealing with here is a biological condition that is not very well known amongst musicians, but it indicates very strongly that you cannot play a high flow-rate instrument with shallow breaths. I like to always teach that you play for the end of the phrase, not the beginning. You must be comfortable at the end so you can replace your breath for the next breath unless you have plenty of time and in a high flow instrument like tuba or trombone, especially bass trombone where the flow rates can be easily 60-80 liters per minute and even higher, then it is very important that you have plenty of air in the lungs or you can't get it out. Now, I am going to open this for questions right away.

Q: In the first session you were talking about warm up...then shouldn't you also warm up your lungs? Do, specific exercises?

It's very wise; that is a good question. You don't warm up in the sense of increasing the blood supply or anything like that but by taking several very large inhalations and exhalations, this would be very wise and a very good thing to do in a practical sense. If I am permitted with time, I do want to get to some very practical applications, but I want you to understand that there are complications here and I wanted to get this in that. In the average individual, a young man, we expect 80% of his air to come out in one second blowing as fast as he can. 80% of his vital capacity should be able to come out and within three seconds he should be able to take the air in the negative curve out. Now, this varies greatly in individuals and with disease states and age that 80% can easily fall to 50% and instead of three seconds. I've had people with abnormal conditions; 19 seconds and they still haven't emptied their lungs. Obviously that slow air will have pressure, but cannot be used as flow in playing a brass instrument. In other words, if they go by pressure, they think that they are still working but they have no ability to move the air as flow and as a result, it is not a practical phenomenon. They can still play but they have to get into the air that can't be moved out. I can't spend too much time on this I see because of our schedule, but what I want to get into is certain practical

aspects of respiration. In a warning, I would like very much to warn against the tuba player using only diaphragmatic inhalation. In other words; the diaphragm in health is just great, the diaphragm in function is great, but diaphragm isolated from the rest of your function is a 40-50% item. On the tuba with your high-flow, we cannot get by, in other words, flow rates of 40/50/60/80 and at times 120 liters per minute, you must always consider the end of the phrase, so we cannot be having the person beginning to struggle for quantities because he is going to have all sorts of problems with his tongue and throat, and then gradually the embouchure, because the air cannot come out fast enough. We have sensors in the lungs that indicate pressure to the brain, but if you are to have pressure of air, but there is no ability to move that air, your throat will close do to the activity of a part of the brain. If your throat doesn't close, your tongue will raise up-- but somewhere you will take the upper end of a cylinder and choke it off. It is done instinctively; it is not done by conscious thought at all. It will free up when you have the quantities of air that you can use freely in the lungs.

So, what I am trying to indicate is, I would say the tuba above any instrument, the average person never has to worry about over breathing. In other words, I would say the average tuba player would have approximately five liter lung capacity. I have only slightly in excess of three now and when I was a young man, I might have had only slightly less than five, but nevertheless, this is not large. We have some players with over seven. Now, what this means of course is that if you start out with four liters and you have five, you start out with a four and a half liter inhalation, and you end with two, you are still in business. In other words, that next breath will be quite comfortable. You can use your bow freely; if you start out with two and a half liters and you are going down to empty, you are entering this region of malfunction at the bottom of the curve. Now you will see the player at that time turn red-- he will be distressed you will see the veins popping out on his neck, you'll find all sorts of contraction states coming in the muscle; but the air is slowing up. This can be tested in a laboratory-- this is not guesswork; in other words this can be very easily corroborated. As they enter into this negative curve,

they do run into problems in the upper end of the cylinder which we can like to anywhere in the larynx on up, and it will induce this.

Q: Have you ever advised that the tuba is the wrong instrument?

No. It's a matter of finding his true; you might say, a comfortably large breath so the synchronization of the entire respiratory system is established in a natural way. In other words, you can take your breath in a fraction of a second and then take it all in very easily [Jacobs does a breathing exercise. Blows out in eighth notes and then inhales quickly on one eighth]. I replaced my lung capacity without any problem whatsoever. If you do it by expansion of a specific part you will then take what that expansion potential calls for. But if you were to segment in any part of you, you will find that you have eliminated other parts of your vital capacity. Now, the key to it is to find the biological key to respiration and I have to explain this or it will be missed.

Nature has us protected in a way that, always in some part of us in the respiratory system, can take enough air to sustain life no matter what our posture is or what we are doing. Now, I am overweight. If I bend over to tie my shoelace and I am arched forward, the intra-abdominal pressure will increase to such a point that the diaphragmatic descent would be cancelled out. In other words, I would no longer have diaphragmatic activity, but I would have upper chest activity which doesn't take a great volume; but it is there. And all you need is a ½ liter to a liter every few seconds to sustain life. So nature has it so if I am bending over and all crowded up internally, I can still expand in the upper end. I have had many players come-- I had a horn player come and study with me whose horn was pushed into the right rib cage. As I analyzed the function, only the left lung was working. Due to the horn in the right rib cage, there was no expansion of the right rib cage. I palpated under the liver and there was no descent of the right lobes of the lung but the left side was functioning fine. That is still only a half of a breath no matter how you slice it. It could have been a whole breath by better posture and you might say, by allowing the freedom in the right lung. A very good friend of mine, a trombone player

I was working with; I happened to go behind him when he was playing and after a long concert and his left elbow was digging into the left rib cage and he is tilted like this. When I was watching his inhalations, only the right lobes were being filled. The left lobes were being inactivated. Now, they could have easily been larger breaths if he felt that he needed it, but he would have had posture. We are structured in such a way that no matter what bodily position we are in, some part of us can pull air in to sustain life. If I am doing work around the house and my arms are way back like that, the chest is at right angles to the spine, only the diaphragmatic descent is possible. They are already expanded; there is no place for them to go. So, I have diaphragmatic activity, and that's fine to sustain life. Now what brings them into use is not the *Hatha Yoga* system of low breathing followed by mid-range breath, followed by the upper. In other words the problem with that is that the diaphragm descends first and creates a rather great enlargement here, you will have an increase in muscle tone. All of the muscles in this region are attached into the rib cage and they have a combined pull that is downward and inwards. That means the upward out movement of the ribs must go under a workload which normally it shouldn't have. There would already be pulled down and in. For health, it's great, but for the rapid replacement of breath, it's not good. What is actually involved in this is a very simple maneuver; you have to learn to suck. By that, the biological of suction without friction [breathes in] you can actually hear that I am sure. Now as soon as you do that, I use sensors at home, I use measuring devices you'll see, or if you palpate with the hand--as soon as you pull the air in here, if psychologically you pull air into the mouth, another region of the brain fires up the regions where it must go. If you go by the mechanical principals and try to enlarge them by the thinking part of the brain, you are bypassing the wonderful computer aspects of the brain and getting in your own way. If you simply suck the air into the mouth, it goes so fast and in so doing you will find that the diaphragmatic descent will occur, the rib-cage ascent, and so forth. It is the simplest thing in the world to do but as I say, the key is to work with the air and pull it into the mouth but avoid the apparatus aspect that pulls it in.

We all tend to go to the machine study and by-pass the regions of the brain that would be competent to give it to us. In other words we have to stop controlling the systems by the muscles involved and instead go to the signals and life that control these. If you want to take a huge volume of air into the mouth; you merely draw it into the mouth [demonstrates], it goes somewhere. You will find that you will have the expansion. All you have to do is suck that air into the mouth with soft muscles. It will have enlarged and you will have it so easily that very frequently I will put a tube into a student's mouth. This upsets the old pattern of breathing habits. With the altered stimuli, I ask him to take in a large volume of air through the tube, they take it in and have everything I have asked for without ever knowing what they are doing. I am always against you knowing what you are doing where it comes to the interior of your body because there is no way we can know what we are doing. I examine other bodies to find it out: in dissections you get answers, observations, but you cannot get it through your own sensors. Long after it is right, you will get some awareness of what is happening based on a generalized concept. There are no details; you have no tools for analyzing. What I am trying to indicate now very strongly, is the psychology of respiration versus the mechanics of respiration. The mechanics, according to Boyle's Law--you would enlarge the various regions and in enlarging you would have lowered the pressure of the air below atmospheric, the air within the structures would be lower than the outside air, and it would rush in. Now theoretically this is great--and if you could do it this way, then great. Blowing out in reduction, you would have the same thing. But [by just moving the body in a similar manner], but I am not moving any air. In other words, any one of these can be simulated without function. This can be simulated without function, with partial function, the substitution of stretch phenomenon; the valid signal needs to be sought. The valid signal, you need to go to air, not the air apparatus. When you study a cadaver on a table you put a spirometer on the face, push on the chest and abdomen area, the air moves out of the lungs, if it is fresh. Enlarge him, air will move in. With a live person, you never do that. You always signal the brain what you want. You want to inhale, take the

air in. It's that simple, we have to find the simple answer and you must permit the enlargement that would come with the extreme.

In other words, many students come to me and say, "you must never elevate the sternum". They don't use that word; they say, "Never raise your shoulders." Clavicular breathing would be wrong. In other words, this is clavicular breathing [demonstrates by lifting shoulders up] This is of course a phenomenon which, it is not for the respiratory activity. However, if you watch a person who is ill with a respiratory problem, he cannot stay still lying on his back; he has got to sit up. In severe distress he will get up and fix his hands on a table or a chair so that the shoulder girdle will be elevated and the muscles will be in a higher position, better position to influence the upper lobes. I am not recommending this for the brass player you understand, but I am saying that even here there are certain elements that should be taken into consideration; this is just not a ridiculous phenomenon. But clavicular breathing in itself is something that we don't concern ourselves with. In full capacity breathing, there is enlargement of the sternum; there is enlargement of the rib-cage and lowering of the diaphragm.

Now, we know that there is a problem nearing the end of the breath. Our vocal people have resolved much of this by taking the large volume of air-- not so much the large volume as the expanded position of volume--the enlarged chest. Now if I talk like this [Jacobs speaks in a dark bellowing voice], going along talking with resonance and so forth, the diaphragm has already returned up, but the chest is still in the enlarged position. I have never entered the negative curve of respiration. In other words, by starting in the simulated full position of air, I am actually using quite a bit of air. There is a considerable amount of air in the lungs and due to the fact that I did not allow this deflation, I have also not entered this negative curve that would have influenced the larynx in a negative way. This is one of the techniques that many good vocal teachers use. However, that takes certain people-- I worked with a young lady, a singer who had a tiny little 2800ml capacity and was being taught singing by a large male, and she couldn't complete her phrases. This man probably had in excess of a six liter lung capacity, and

this little girl with here 2800 ml (2.8 liter), her fraction of air that she could use would be less than half....

Now, if I just talk and I allow my diaphragm to raise up-- in other words I am withdrawing the abdominal wall, I would be out now but I could still keep going as long as I lower the chest, then gradually as I hit this curve, I am in trouble. I could have gained another second or two depending on how fast I was using it permitting deflation so that all parts of you that expand in inhalation deflate or reduce in exhalation. The muscle activity is different, but what you see in enlargement actually is a return back due to muscles, but they definitely return back to their reduced state. Now any point that has enlarged should be considered potentially a region that can reduce in exhalation. I don't favor this type of teaching; I am discussing this because of a need for understanding. I like to always teach the art form of music and when you need air, take it. Take it in good taste-- become alerted to air as a phenomenon of motion, not the body. But to understand why you must do it that way, you have to realize that there are complications in the bodily activity and the ability of the body to lie is simply enormous....

Q: What I would like to know then is what would the conscious process be of taking a breath in?

As I say it is a matter of suction. I have the equipment but I don't have the time to demonstrate it here, but if you use sensitive devices near the mouth, you can actually see the air going in as you inhale so that you work for the air as you experience it external to the body moving inward. So as I say; suction without friction, we don't have the sound [a hissing inhalation] the sound of a fricative, but the sound of wind. If you blow out and you create a certain sound, that was too much, the sound in reverse would be very similar; it is a wind sound. When you become engrossed in the sound of the breath you will also find that you have the breath.

Q: *What about circular breathing?*

Circular breathing requires a big mouth. [laughing]. I am not saying this in a facetious way exactly, but what is involved is putting enough air in the mouth to where through the palate activity. You can close off the pharynx; in other words breathe through the nose for an instant while you are compressing the cheeks and elevating the tongue to continue the movement of air which would be momentary, while you would inhale through the nose and replace. It can be done in *pianissimo*-- I think Chester Schmitz does it quite a bit in Boston. I fooled around with it but I have a lot of friction in the nose. I am always having problems and I can't get enough air through it. I am not particularly enamored with it either.

Q: *Do you not go quite up to full capacity when you take a full breath?*

For playing, you would rarely go up to 100%, but 85%, 90% should be quite comfortable and you should rarely get down to within 20% of your minimum of air. In other words you stop when you are somewhat still functional so you don't confuse air pressure with airflow. There has to be a freedom of air movement with the air otherwise the wheezing phenomenon comes in.

Q: *Can you explain the relationship of pitch to pressure and how it works?*

Pitch and pressure are really not related in the way people tend to think. In other words if there is insufficient pressure, you will have pitch that is much softer but you can conceive that to go to a higher note will require more air pressure than a lower note. If you don't have the pressure, you will play a higher note softer. Pitch is primarily a phenomenon of embouchure and the little shaping musculatures, but there are requirements. In other words you could apply all sorts of pressure and never change pitch; it is not an end product. It is part of an overall system and as a result I don't quite approve of changing pitch by pressure I choose-- I like to change pitch by changing pitch, just like a song, and if that involves something else then fine and dandy, but don't fixate on it. If you can find what you might do, you might apply pressure and not change pitch,

then it is really not a valid—it is an immediate component, but it is part of a system in the sense that to retain a given volume between a low C and a C two octaves above. You are going to find increased air pressure and decreased flow. You see, you could actually have the same pressure and you would find that you are merely playing much softer up there. But pitch is an embouchure function.

Q: *Raising your shoulders, is that just because of the pressure of your lungs?*

It has to do with the accessory groups of muscles; it has to do with filling the lungs for your vital capacity. Now we have the ability to raise the shoulders without respiration. Every one of the respiratory muscles in life has other things to do than just respiration; there are other functions. The shoulder girdle is free to raise and lower and it is not really necessary in any normal breathing patterns. In maximal inhalation there is a very moderate use which should be minimized in the shoulder girdle. In other words; elevation of the sternum-- even that does not require the shoulder girdle. In maximal things, in terms of disease states and so forth, air hunger-- there can be a certain amount of this brought in, we don't recommend it for musical purposes at all.

I think I have to stop now or Mr. Phillips will have to run me off the stage!

Thank you very much; I wish I could have proceeded further. I brought all sorts of little gadgets and I can't even begin to explain them all today but-- a bunch of my students are in the audience, they will tell you. Thank you.