Furloug, William Barry, SEASON WITH SOLTI, MacMillan, NY, NY, p 296-307

In a corner of the players' quarters one day, Arnold Jacobs was tinkering with mouthpieces and tubas. "I own fourteen different tubas and forty different mouthpieces," he says. "In our trombone section" - which he sits next to - "and in our hall, we have quite a large range in our dynamics. So my choice of instruments and mouthpiece is equated together. It's based on whether I need a certain strength in the fundamental of the tone because if I use a mouthpiece that makes a horn too bright when the trombones intrude into the overtones I'm not left with anything. I tend to disappear. So I have to find a mouthpiece that tends to bring out the fundamentals and lessen the overtones a little bit. Otherwise the balance in the sections would be lost." He slipped one mouthpiece into tile tuba and said: "Light music. General work. " He tried another: "Berlioz any of the bright - sounding works. You'll hear a thinner sound. On the stage it would be close to the trombones and it would be more articulate." Then he tried still another: "This one is even lighter. On a wave analysis you'd see very bright overtones and very small fundamentals." Still another: "This is for the larger more massive tones. " And still another: "This is rounded out a little more. " He blew a few notes. "See that changes the color. " For Mahler. For Bruckner. "For organ sounds. The heavy sounds. If we went on the stage with that big ceiling you would hear primarily fundamentals. In other words you can vary the wave analysis by taking the same instrument and varying the mouthpiece. Or you can take the same mouthpiece and vary the instrument.
Whereas Jay Friedman might be called The Skeptic in the orchestra, Arnold Jacobs is The Scholar. He does not merely speak to a subject; he explores it like a speleologist, carefully probing its corners and deepest recesses - no matter how dark and unlikely - and developing coherent theories that apply to life as well as to music. He has never had any trouble wondering what else he might do with his life. Since 1945 "when I had some physical troubles" - he has been exploring the biological/physiological aspects of music. Today he is not only the world's foremost tuba player but the foremost "musical biologist, " if you will. He has his own laboratory in a building near Orchestra Hall, and doctors and musicians from all over the world send him "cases" - students, patients - to analyze, discuss, help if he can.
He is, in a sense, his own best "case."
For in this season he was running a very subtle race against time - the time when his own career might end.
Part of it was because of a case of bronchial asthma. "Incapacitating," he says. "I've been on steroids for my third year now to control the symptoms. I have no air to work with" - he has, in fact, less air to blow into the tuba than do any of his students. "In other words, my vital capacity is down. When these attacks become incapacitating, playing the tuba - you can forget it. " It is particularly bad when the skies lower over Chicago and the pollutants from autos and steel mills and the wretchedness of urban living concentrate in the air. "When you breathe massive volumes of air unfiltered in or out of our lungs, as we do in heavy playing, continuous blowing - well, I almost think they should pass a law prohibitive of playing, because you're taking unfiltered air and moving it in or out. " Yet none of this inhibits him when he has to play something like the Mahler Sixth ("the most demanding of the season in terms of physical endurance"). But he is not about to give up. "I'm still competitive." He is more than that; he is one of the world's great virtuosos on the instrument. "But when I get ready for the performance now, I'll use bronchial dilution before I go on the stage. "

There is another reason he feels in a race against time - which will inevitably win.
"Usually the life of a brass player in the symphony orchestra is not as long as a string player, " he says.

Brass players tend to give out in their early or middle fifties, whereas string players can - and do - continue well into their sixties or until they're seventy. That may be the reason that there are younger men in the brass sections of the symphony than in the strings; there's greater turnover because age begins affecting the players of brass instruments earlier. "There's a deterioration that occurs in the aging process that affects the playing of the brass, even of the wind instruments, " he says matter-of-factly. "There is a loss of elasticity in the lung tissue, and the flexibility of the function of the bellows system [in the body] begins to lessen." For the brass player is dealing with air and how much he can deliver at any one instant - what his capacity is for air flow, and what his habits are in delivering that capacity into the instrument. The vital capacity lowers without the individual realizing it. If he's using limited amounts of fuel" - air - "say he's used to taking half a breath, the air that he may draw from that fuel supply may be adequate to play his instrument at the age of twenty, but not at forty-five or fifty or fifty-five. When the fuel supply lowers, the half that he gets is a smaller quantity than it was at twenty, and you can run into very severe problems of playing. "

Arnold Jacobs's own vital capacity - his fuel supply, so to speak - is to draw on 3.7 liters of air every minute. He uses about 50 percent of that - say, 1.5 to 2.0 liters of air - in the first second of the actual playing of a phrase. And all that is a considerable drop from what it was at his peak. Then his vital capacity was at least 4.7 liters. He not only had more but he could use more of the air supply in the past; not every bit of air is expelled in playing the tuba - but Jacobs was able to use a surprisingly large amount - as much as 80 percent in the first second. The amount of air he is actually able to deliver at peak needs has been cut by almost 40 percent in recent years. "They used to have a pension arrangement in the Chicago Symphony where a brass player would be eligible for a pension at the age of fifty-five because so many brass players break down at that age." Jacobs is aware of the breakdown because of his age, but his playing doesn't reflect it. "I'm working quite hard" he says of his playing and practicing. "Nature's unkind in one way. And that is the skills that we have, if we don't keep them constantly used, are going to lessen and gradually disappear."

Few men in any field - much less men in a symphony orchestra - have had as dazzling or diversified a career as Arnold Jacobs. He's been scientist as well as aesthete; he's played jazz as well as classics; he's been accomplished in so many different forms of music that he won scholarships to the Curtis Institute of Music in Philadelphia in both tuba and in singing.

"I started out in a little town in California as a bugler," he says."

The town was Willowbrook, a hot dusty little place in the 1920s on the edge of the California desert. His father was an accountant; his mother had been a pianist in vaudeville - on the old Pantages Circuit - and later a pianist and organist providing background music in the silent film days. "She was involved in the picture's, in the atmosphere on the lots while filming," he says. And so it was natural that her children would be involved. His sister was offered a contract by a movie company, but his mother wouldn't let her take it ("they had this Fatty Arbuckle scandal"). Arnold himself remembers "getting paid $ 5 once to appear in a picture that Mary Pickford was doing. I remember eating an ice-cream cone in this scene. I was about five years old and it was the first money I ever earned."

When he was ten, his parents gave him a bugle and a book of instruction. He worked on it, and listened to his mother when she picked out the bugle call notes on the piano. "I won a silver bugle in Boy Scout competition even though I was not fully a Scout - one had to be twelve years old to qualify for the Scouts. "They put me in a uniform anyway and I entered the contest and won the silver bugle," he remembers. Then his father bought him a trumpet but he forgot to get an instruction booklet. "So again I had to learn everything by ear. " He won a school competition on the trumpet. But he got discouraged

about it. "I was working on the Carnival of Venice at a very early age, and doing a fairly good job at it. But we had a record of Herbert Clark doing it. He was a marvelous cornet soloist, and my dad was always saying, 'You don't sound like he does. You're not doing so well.' He kind of put me down and it turned me off the trumpet." So Arnold scraped together $10 and bought an old trombone-"But I loved that instrument." He worked long and hard at it and perhaps he might still have been playing the trombone, except for the disappearance of that beloved old instrument. "One year we were touring Texas on a vacation in one of the old-time cars - they had running boards - and we had the trombone strapped on the side, and it disappeared." He was heartbroken.

When he got back to junior high school - "we were in Santa Monica by this time" - he hoped to get another one to use and play through the school band. "The bandmaster said that they didn't have a trombone, but they did have a tuba and they'd let me play the tuba." He didn't particularly care for the tuba. "There's relatively little motivation for anybody to play the tuba," he says candidly - even on the highest professional levels. The reason: "There's only one tuba in a major symphony orchestra" - so there's relatively little work to go around. Also, there are the size and grotesque shape of the instrument: if you could stretch out its metal coiling it would come to a total of thirty-five feet. But in the hands of a virtuoso it can be used to make beautiful music, something much more facile and stirring than the classic "om-pah, om-pah" that many people associate with the instrument. When Jacobs teaches the instrument now, he focuses on the fact that his students are musicians. "I never let them dwell on the fact that they're playing the tuba " he says. "I always have them dwell on the fact that they're musicians. They're learning to make music and to interpret the music through the medium of the tuba. But the challenge is the music, not the instrument, and so they get into a more comprehensive development as a musician. " For he knows and understands some of the reasons that people have for turning to the tuba. "Usually it would be like my case, where some trumpet player or trombone player somehow will be shanghaied and wind up playing the tuba. Rarely is it by choice."

His trouble was that he played the instrument too well. When he was fifteen, he won a scholarship for tuba at the Curtis Institute, and so his family moved to Philadelphia so he could continue his studies. But he was still pulled in other directions and, in his second or third year in school, he'd spend his free time playing the trumpet or trombone in shows, theaters, parties, and dance bands. "Some of the faculty members were at a party that I was playing and they mentioned that around the school. Anyway, I was called in and told I had to specialize. "

In symphony orchestras, unlike pop music groups, there is relatively little doubling-playing more than one musical instrument in the orchestra. "They told me all the virtues and values of staying on the tuba," he says. "That it pays more than a section instrument" - since the tuba is a principal player, he gets paid more than, say, the second trumpet or second horn. "In other words, you get sort of bonus to play the instrument and you get lots of time off. Such as when there are Mozart or Beethoven programs - Haydn. In other words, music written before the middle 1800s would not include the tuba; about 1835, it came into being, so usually, prior to that period, composers didn't involve the tuba in their music. They painted a very rosy picture. They didn't tell me about the problems of carrying it and purchasing it and the huge volumes of air that an aged player would need to have to cope with it. Well, maybe they couldn't very well go into those topics. Anyway, I did enjoy the instrument and I have a nice career as a tuba player. "

The restrictions imposed by Curtis Institute didn't totally inhibit Jacobs. "In those days" - the early 1930s - "they used tuba a great deal in Dixieland jazz," he says "They weren't using string bass because the old carbon mikes wouldn't pick them up. " So he went on working almost every night. "I'd do my Wagner

and Brahms in the daytime and my Tiger Rag at night. It was a very rewarding experience for me."
It also made him one of the most articulate commentators on the difference between the symphony style of play and the jazz style. The music given one and the other will be exactly the same but the sound will be completely different. When you listen to jazz interpretations and have it noted down on paper, and give it to a musician who does only the classics and have him interpret it - you'll hear the difference. It'll be a completely altered performance, a completely different type of interpretation. " The people in the audience can hear the difference, he says, "but they wouldn't be able to define it - where the differences would lie." They lie in the subtleties of playing - "the pattern of rhythm, the duration of a sound, the attack and impact made on certain notes." For there is a different feeling, a different interpretation, on so meaningful a matter as how long a quarter note might be held - only if it's for the tiniest fraction of a second - where the emphasis on the note will come while it is being held. "Our quarter note has to have four-sixteenths; theirs may have five-sixteenths. " The jazzman may attack the note much harder than the classical player, he may hold it not only longer but give it a different kind of coloring and tone while he holds it; then he leaves it in a different way to attack the next note - also in a different way. " Nobody thinks about this in jazz; it is part of the culture of the music, the unspoken - and unnoted - interpretation that has helped create the sense of freedom within the idiom. Nor is there a sense of snobbishness about the difference within the Chicago Symphony in general or in Arnold Jacobs in particular. "Dixieland on tuba I'd be perfectly at home with, " he says. He'd also be pretty much at home with it on the string bass, though he played that instrument most notably with society dance bands, "like Meyer Davis."
Of course he had to learn to play the string bass. But that wasn't hard once he was given the motivation. "About 1937, the dance band I was working with said they wanted me to take up string bass because of the new microphones that were coming in " he says "They were using the string bass more and more, and they didn't want to let me go because he was a very good tuba player and there were some shows they still wanted the tuba in " So he got a fingering chart and an instrument at Curtis Institute and began teaching himself the fingering, enough so that he could play fairly easily in the band. "But then I started taking lessons on it and eventually I became quite a proficient player. I had another nice career on the string bass, all aside from the tuba. To the point that I became a staff bass player at CBS in Chicago. "
The string bass almost led him off into another and separate career - in fact two or three of them. For it led him into playing commercial dates with a combo called the Three Blue Blazers - violin, guitar, and string bass. One of their regular dates was at WBEN in Philadelphia where they played in several variety shows a week before the radio microphones. "It was very similar to what you have today - the 'Tonight Show', and so forth. " Soon Jacobs was doubling again, this time on voice. For the program producer asked him to sing in a quartet on the show. He was pretty good at it. Indeed, his singing was so good that he was offered another scholarship at Curtis Institute to concentrate on vocal work. But he turned it down - "I figured it would mean another six years of study," he says. At the radio station, the management liked his voice so well that they gave him some lines to read as an announcer-"it was during the summer months and they needed somebody to read the lines." He was so spontaneously skilled in it that the station offered him a full-time job as an announcer. He was very much attracted by the offer. "It appealed to me very much, but of course this was in the days before they paid big money," he says. He thought it over carefully. "It was one of those crossroads in life" - could he give up his scholarship at Curtis, and the vocal studies on the side, and go into full-time announcing? He decided not. "With that scholarship at Curtis, I decided I didn't want to branch out."
The trouble was that his success in music with the tuba and the string bass was so marked that he

couldn't afford to turn to talking for a living. Indeed, his all-around success was so great that, at first he couldn't afford to turn to a symphony orchestra for a living. When he was eighteen, and far from finished at Curtis Institute, Serge Koussevitsky heard him play and offered him a job with the Boston Symphony Orchestra. "At the time I was working a nightclub in Philadelphia and between salary and tips was making about $90 a week. He offered me $90 a week to go with the Boston Symphony. " But at the time, the Boston Symphony Orchestra was a nonunion shop; its conversion to a union shop would become one of the traumatic moments in the orchestra's history. "I would have gone except that I heard how tough Koussevitsky was - that he was hard to please - and I was so afraid that if I didn't satisfy him, I'd be tossed out of the orchestra. And I would have been out of the union automatically for joining the Boston Symphony at that time. So I turned it down at that time. " He also turned it down several times later, after he'd joined the Chicago Symphony. He also turned down bids from the Philadelphia Orchestra. Of course, all this didn't happen suddenly. He played in the Indianapolis Symphony and in the Pittsburgh Symphony, under Fritz Reiner, before coming to the Chicago Symphony Orchestra. That was thirty years ago, when he was only twenty-eight years old.

In the Chicago Symphony, he has won a unique stature not simply because he's a superbly talented musician - he's hardly alone in that - or because he's so cerebral a man - he's not alone in that either. It's because he thinks about, and investigates, such remote, and yet musically pertinent, subjects that he possesses an esoteric and mind-blowing pragmatic fund of knowledge.

His charm is that he can speak, albeit in somewhat heavy academic terms, on matters light and heavy, personal or distant.

A light, personal, and pragmatic example is his explanation for the reason that tuba players are usually heavy. Jacobs himself is a burly man: he weighs 215 pounds, stands 5 feet, 10 1/2 inches. But he was not always overweight: when he was young, he was quite slender - "skinny almost. " And the tuba weighed as much then as it does today: the C-tuba he uses weighs twenty-two pounds. Nor does he think it's an advantage to be overweight. "In fact, it's very disadvantageous for a tuba player - terribly so. It affects our respiration. In other words, were terribly crowded internally. It makes all our inner respiratory movement quite complicated. There's always some material that has to be pushed around to make space for air. "

The reason for the heaviness is many - dimensioned. Part of it is in the life-style of the tuba player. Just as he has more time off to study - because he does not play the Beethoven, Bach, Haydn numbers - he also has, says Jacobs with a very small smile, "more time to spend in the coffee shop."

But there is another and more scientific reason. "The problem with playing the tuba is that there is a very moderate amount of hyperventilation associated with the instrument. " The hyperventilation usually makes the player hungry. "I usually have a tremendous appetite after a taxing concert. I become very hungry and thirsty after extensive playing," he says. "I feel like I've played a football game, or created some large, manual labor project. But we don't use the big muscles of the body and so, though we do burn up a great deal of energy, it's not used up on exercising the proper musculatures." So the energy loss is not enough to make up for the food intake of the tuba player after he's played an ardous concert.

The hyperventilation has another effect. "When you hyperventilate a bit, you actually alter the pH of the body. In other words, the alkaline/acid relationships are affected, and a person is apt to feel a little bit peculiar with very moderate hyperventilation. Usually it will start out as dizziness. How will I say it - a little leaving of the ground - you begin to float a little bit."

Why is this?

"The symptoms of hyperventilation are- due to a lack of carbon dioxide and its effect on the brain," he says. The carbon dioxide is washed out of the blood by the heavy pumping of the respiratory system - keeping the air flow into the tuba at the maximum - and the blood is soon carrying a higher percentage of oxygen to the brain, making the person feel dizzy. " It's not a dramatic effect; it's quite moderate. "A little light in the head," he says.

But Jacobs made studies with research scientists at the Pulmonary Functions lab at the University of Chicago, and every indication was that he should have been suffering from something worse. "According to their tables, the volume of air that I was moving in and out of the lungs, I should have been in massive hyperventilation." The question was: Why wasn't he? Why don't tuba players, as a rule, suffer from massive hyperventilation, particularly after arduous numbers? They perceived, of course, that the breath expelled into the instrument contained carbon dioxide - the carbon dioxide that he was exhaling. When he took a breath to replenish his lung supply, he'd get fresh air in through the corners of his mouth - that's how tuba players learn to breathe - but he'd also be regulping some of the air he'd expelled into the instrument. That air contained an excess of carbon dioxide and, when he brought it back into his mouth, it created enough of an excess of carbon dioxide in the breath going into his lungs - and then to his brain - to mute the pure-oxygen effect on the brain. "Now when I get into these huge, massive blowing episodes, like what they have in 'The Great Gate of Kiev' at the end of Pictures at an Exhibition, I will deliberately take the air back through the instrument to forestall hyperventilation."

Jacobs's investigations into the body impact of playing or singing involve some of the most sophisticated and abstruse physiological and biological theories extant. "I prefer to teach music, by far," he says. But he went into biology as a hobby and his mental drive, and his curiosity, carried him deeper and deeper into it. He got started in the most casual ways. Back in the middle 1940s, when he'd been in the symphony only a year or two, he began having some physical problems - nothing serious - and he phoned a doctor-friend and "told her I wanted to learn a little about the body and the senses. That was probably the motivating cause: I wanted to have a better understanding of what we're all about. " He has a very ordered intellect and the doctor gave him a very ordered list of reading. "I started out with the skeletal structure and went right down through the muscles and the circulatory system. I made quite a fair study of anatomy and I found I enjoyed it, even though it's a dry subject. " Then he plunged into physiology and other studies of man and his body. He went to summer school to audit classes; he worked at the University of Chicago labs; he opened his own lab to carry out investigations into the relationship between music and the body.

Those investigations have carried Jacobs into many exacting and improbable fields. The results have made him eminent in the field; he is now sought by medical men as well as musicians to explain certain phenomena. Just two of the facets he's studied are the flow rates of air demanded by the various instruments, and the capacity of the player - the vital capacity, as he puts it - to store and then produce that air.

Consider the tuba.

To play in the lower range, and play it at its loudest - "maximum fortissimo" - would consume as much as 140 liters of air in one minute. That's the flow rate - 140 liters per minute.

Now, of course, neither Jacobs nor anybody else can hold that note for a full minute. It's usually a matter of a second or so. For nobody has the breath for it: nobody can inhale 140 liters of air and then store it in the body's storage bins, to let it out on such a note.

In fact, nobody has anywhere near that capacity". In his younger days, Jacobs had a capacity of 4.7 liters of air. The highest figure he's ever recorded was 6.5 liters. It was for Bill Scarlett, a trumpet player in the

Chicago Symphony. That was most interesting because Scarlett demonstrated that it clearly was not a matter of size: he is nowhere as big a man as is Jacobs. "It's a matter of body type," says Jacobs. "He has a long body and short legs. It's a matter of the torso's shape" - whether the lungs have the room and the capacity for accommodating large quantities of air.

In any case Jacobs has made a deep study of what it takes to play various instruments in various modalities. On the tuba for example, Jacobs is not blowing all out all the time. He has found that "the average flow in mid-dynamic range" - just a broad average - "would run somewhere between 40 to 60 liters per minute. " And at the lowest, softest range - "minimal pianissimo, as soft as I can play - the flow rate is 5 to 7 liters per minute.

"In an extreme pianissimo on a low C on a trumpet, with a fine player playing, you have a flow rate as low as 4 liters per minute," says Jacobs. "In loud playing, the flow rate might go up to maybe 15 liters per minute." At the "maximal fortissimo," he would expect the flow rate to be 40 to 48 liters per minute. For the oboe, the range is much smaller because the flow rate is so snug, so small. "the flow rates in the oboe would average in pianissimo about 3 liters per minute and in fortissimo would go up to about 5 liters per minute."

From all this, it is apparent that a player with a vital capacity of more than 3 liters per minute could learn to play the oboe for a full minute without taking a breath - once he'd achieved breath control. Similarly, with the trumpet: a player with more than 4 liters of lung capacity could play certain pianissimo notes in the low register for a full minute - though he'd never be asked to do it.

Jacobs also went about measuring the vital capacity of a great number of players. There is no particular correlation, except the obvious ones: tiny women - without the huge lung capacity - are not often asked to play the tuba. "Some of these little ladies with extremely small lung capacity would be somewhat handicapped with a high flow-rate instrument like the tuba or the bass trombone," says Jacobs.

The irony is that a good many women are given, unthinkingly, assignments on the other high flow rate instruments. "They will so frequently assign girls to play flute, which is a high flow rate instrument," says Arnold Jacobs. "It takes a fairly good lung capacity. But it's a small instrument, very petite, easy to carry, and so forth. But it presents a moderate handicap because so frequently the little ladies just do not have the lung volumes to complete the phrases, as you might say, that the flute traditionally calls for. "

He's found the obvious: that women do not have the vital capacity for inhaling, storing, and using air that men do. "Their potential for moving air out rapidly from their lungs should be quite high, " he says, "but they don't have the quantity" - it's quality without quantity. "Take, as an example, a man five feet, five inches and a girl five feet, five inches - most of the time you'll find that the girl will have quite a percentage less lung capacity - due to the contouring of the ribs and the general smallness of their structure, compared to the male. You could express this maybe 20 percent less vital capacity - for the persons of the same heights, age, and general body type, as far as we can equate the female and the male."

Thus there is some intelligence needed in picking a player - particularly a woman - for a particular instrument. "If they're using low flow rate instruments like the oboe, there's no harm done," say's Jacobs. For most women will have a vital capacity that can accommodate the flow rate of the oboe. "Woodwind instruments in general, outside of the flute, have a low flow-rate and not much harm is done. On trumpet there's usually adequate fuel supply. But when they get into trombone and tuba, the smaller girls can run into problems, particularly if they use limited respiratory activity. "

One of the difficulties, with men as well as women, is that the player rarely, if ever, uses all the air in his lungs. He may have a vital capacity of 4. 5 liters per minute: that's his capacity, but that's not what he

literally uses. He uses only a fraction of that capacity. The person trained for this might use 75 or 80 percent of his vital capacity; others will use half of it or less. Of course, the time of using the air is also important; it is important to use as much as possible as soon as possible, and bring the other out in reserve.

"I can only get about 50 percent of my lung capacity out in one second," says Jacobs, now hobbled by- asthma and age. "It takes me about nine seconds to remove the rest. In a normal set of lungs, you get about 80 percent in one second and in three or four seconds you've removed the rest."

So the trick is not simply in nature; it is not solely in having a large lung capacity. It is in using the lung capacity that's available. It is better to use 80 percent of a 4-liter vital capacity than 50 percent of a 6-liter vital capacity. But it is better to have the vital capacity- to begin with.

"I had one of the fine players in the Philadelphia Orchestra come in to see me," says Jacobs. "He had emphysema. " Jacobs made a test and found that "he was able to get about 40 percent of his lung capacity out in one second. Nineteen seconds later, he still hadn't emptied his lungs. Fortunately he had a very large vital capacity." .So he' undertook treatment for the emphysema and he understood instruction on how to increase his use of his lung capacity. "He's been able to keep the disease arrested, but he has to take in large volumes of air so that he can get into the position where air can be moved out rapidly. " Not in nineteen seconds.

Not all of the cases he accepts are so readily diagnosed. Or aided. He spoke about one young lady - an oboe player who was a talented musician - who was having problems with her respiration. He found that she still had her tonsils; in Jacobs's own youth, the tonsils were often removed as a guard against infection, and that tended to open the air passage more. But her biggest problem was that she had an oversized tongue - "her tongue in repose was taking up too much room in terms of what you think of as a normal person's oral cavity," he says.

His method of dealing with the problem was not to lecture her about her tongue. There was nothing that he - or she - could do about its size. Instead he started by giving her speech exercises. "We had to do it by opening up the airway. You can't communicate with a tongue. It will just stiffen up on you and be very uncooperative. But you communicate beautifully with it through speech. " He started by making the speech out of vowels. He also started by showing her how to compensate for an airway blocked by the tongue. "Take a drowning person, what do you do? He's choking on his tongue - you pull his chin forward and pull out his tongue. Just moving your chin forward will tend to open the pharynx. " So she could see right away that there were way's she could compensate for her tongue by opening her airway more. He demonstrated how it is done reflexively in speech by the use of vowels. Then bit by bit he built on this insight so that she learned over many, many months to tie into a vowel concept where her airway became subconsciously open. "

He is just as analytical about his own work. "Most players, by the time they reach my age on my instrument have either left the business or deteriorated to such a point that they're no longer competitive," he says. The way he stays competitive is by a varied system of programs. "I usually keep three programs alive constantly," he says.

One is a constant conditioning program of scales and finger drills.

Another is a "long-term program of recital where I spend one to two years developing maybe five or six numbers. " A recital for tuba? That is not improbable at all. He regards the instrument as a highly individualized force that can have the appeal, in a recital, of any of the brass instruments. In fact, he often practices etudes for trumpet in this period. Of the numbers in general, he says: "Usually you can read them or they're developed after a few weeks. But you spend the time after that in refining them

and interpreting them and tearing them apart and seeing if you can improve them. In other words, these studies refine all the neuromuscular patterns because of the connection between thought and physical response. You're going into a little detail. It becomes more and more a mentalization, which I think is very important. "

His third program is a "short-term period of solo and orchestral work, involving maybe one to four weeks on specific studies and general reading, and so forth. " In this period he prepares his parts for the upcoming programs if, indeed, that hasn't already been incorporated into his long-term program. The Mahler Sixth Symphony was, as we've seen a test of physical endurance - something that Jacobs is quite sensitive to. "But it's not difficult to play," he says. "It demands a certain amount of interpretation and development as a musician but I would not say, by far, that it's the most difficult I've played this season. "