ASHRAE Leadership Recall (formerly Leadership Recalled)

Transcription

Interview of: Ole Fanger

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Interviewed by: Bruce Johnson

Bruce Johnson

This is Monday, June 25th. We are here at the ASHRAE annual meeting here in San Diego. I'm Bruce Johnson, member of the host committee and also a member of the historical committee and it's my honor and pleasure to interview Mr. Ole Fanger. Did I say that right?

Ole Fanger

Yes. Ole Fanger.

B.J.

And what we like to find out is more about your background for the record and you're on tape right now, videotape. And we like to hear from you like where you're from, some of your family background, and some of your growing up period to start out with.

O.F.

Okay, thank you very much. Well I'm Danish. I grew up in Copenhagen in Denmark took an engineering education there and specializing in heating and ventilation and air-conditioning. And then I continued up the University as an instructor studying literature and I came gradually more and more into the fundamentals, of whys of insulating in heating and cooling in our buildings in our vehicles. And I thought there were so meager information on the basics of human comfort and human response to the environment. So I started looking into that in the literature and then I got fascinated with what was happening here in ASHRAE. At that time they had a climatic chamber where they could study human beings exposed to all kinds of indoor environments. And that was moved from Cleveland to Kansas State University and that was announced in the ASHRAE Journal. And I got very eager and got a grant to go there and work for in 1966 and 67. And at that time that had a very, very fine team of researchers. Ralph Nevins and Preston McNall, and Fred Rohles was there. And while they were setting up huge studies where they started thousands of human subjects and how they reacted physiological and psychological to the environment they were exposed to. And I have the opportunity to participate in these studies. It all resulted in a very ? model where you can predict, that's of course always handy. The dream is to predict things before they happen and we got for the first time a model where you can predict human responses in insulated heated and cooled spaces as a function of people's activities and radiation. You had velocity and humidity. And so when I came home that became my doctoral thesis and that was a defense for that. And in Copenhagen at the University with Pres McNall came over and one of the judges and another was Pharo Gagge who just the other day he was elevated to the hall of fame in ASHRAE. He was a giant inside and a mentor for me together with Pres McNall. So there was a very, very good start and then we came home to Denmark and we set up climatic and climatic chambers

and continued her studies on the environment, the impact of the environment on human beings based on what we found what was required for the practical engineers. So that's the whole thermal part of it in gradually paralleled with that, then came the standards. Standards in ASHRAE, where I participated in and came often to the states afterwards to ASHRAE meetings. I think I've been participating in 45 meetings or something like that since then. So I followed very closely ASHRAE and all the things happening over here. We've had a close collaboration between Holland and Denmark and laboratories here in the states and many researchers here.

B.J.

You've pioneered the early research that went on to the comfort chart that we have now in the ASHRAE handbook. That part of your effort?

O.F.

Well others will have to judge who are the pioneers and so forth but sure we have made our contributions for the handbook into the standards, ASHRAE standards and also there's an international standard that came in 1984 which is quite similar to the ASHRAE standard and where we also made our contribution in terms of predicting human comfort. And also an important part was the predicting when people are feeling a draft. We found one thing that was very fascinating. That was that the people found not only air movement but fluctuating air movement was particularly unpleasant. People don't like turbulence or things that variate. All our senses are cured to give signals to the brain when something is changing. So we feel changing velocity whether you're sitting in a hotel room or an airplane or whatever. It bothers people in particular much. And we found a new model for a draft and that model is included in the REHVA standard and the international and the ASHRAE and the German and so forth all over the world. So that's the thermal part of it.

B.J.

I know that humidity is a little bit more subtle effect on comfort, people say it's stuffy or too warm in here but they're really saying the humidity is high. Or if it's too low you get another effect is not desirable. How did you address that? Just by varying humidity on test subjects?

O.F.

That's again, you have to expose subjects to the, and not only a few but really hundreds to get the statistics all right. So you can say, here we put the limits and there are only very few ?

B.J.

How did you select subjects? The handbook used to list the difference between, you know age groups, metabolism, gender, even economic status went into it, into the comfort range. Did you get into that deeply?

O.F.

Sure, we had different groups in Copenhagen and they also continued studies at Kansas State and at Pierce and Vienna University where we had parallel studies. And we have studied a lot of persons and very young persons, people from the tropics just after they came to Copenhagen to see adaptation and so forth.

B.J.

Different racial groups and so forth.

O.F.

Yeah, different racial groups. It's surprising to see how small the differences are among these groups but there are huge individual differences of course. We knew that already.

B.J.

Even the rule of thumb seemed to be if it went up, 80 percent of the people aren't complaining or if only 20 percent are complaining you're okay. Or how does that, you've heard of that no doubt?

O.F.

Sure, that has been the aim to try to have a modest, although the substantial majority as it's expressed in the standard should be comfortable, when people are exposed to the same cause in the long run, I think we are moving at that direction. You have individual climates. Or even when you're in the same room you can have work stations where you can tune in the climate you exactly want at your work station or your office. Like you, you're not wearing the same number shoes, there is a difference. That helps a lot for the comfort of footwear and that's the same with also the climates, individual control. I think that's a great future for that.

B.J.

Did you find indoor air quality or even odors somewhat might contribute to the feeling of comfort? Was that something you had to address in your studies?

O.F.

Well this is then the other line that started. With the thermal comfort, I had the, my book was published already in 1970 and republished several times at McGraw-Hill and so forth. That was thermal comfort part of it and then in the late 70s, early 80s we started with intensive indoor air quality studies. Where the idea was to find out fundamentally what is fresh air and what is it that bothers many people in many places in the indoor environment. Why are so many buildings where people, where all standards are met, still unpleasant and stuffy and you have all the complaints of headaches, irritation and so forth. That was peak frustration, hence is still a large, a great frustration for the engineering profession. That although all standards are fulfilled, there can be a quite many people who are complaining. A few studies show that so there's still a good deal that we don't know. But we started exposing people to…so there was a long history in this again that is quite fascinating study that for more than 200 years the philosophy we had in ventilation theory and thinking has been that people are the only sources of pollution in normal spaces, in homes, theaters, offices, and so forth. First you must believe that people were exhaling, for more than 100 years they were exhaling poison. Simply poison. It was deadly poisonous for other people to inhale what has been exhaled by others. First it was believed it was CO2, and it was after the late 1800s then it was believed there was a special material that you exhaled called anti protoxin that was highly toxic to people. That was the French that came with this theory. And it was never demonstrated chemically that there was any substance so finally in the early 1900s there was a change. A paradigm shift, a great paradigm shift. It's interesting to see. From the early 1900s there was a, it was contagion. It was the transfer of disease from one person to the other that should be decreased by generous ventilation. And there was a Mr. Billings in ASHRAE, a medical doctor who proposed very high ventilation rates to decrease the rates. So that was the next 30, 40 years. We were ventilating to avoid transfer of disease from one person to the other. Tuberculosis, or common cold, or flu, or whatever. Then in 1930s the Yaglou came in, he was a big name at Harvard University that made large studies and now it was comfort but again it was assumed that people were polluting the air and nothing else. He made his classical studies at Harvard, paid by ASHRAE. And we

have all studied these papers, you know for every single detail in those. We then repeated them in Copenhagen and there were similar studies at Yale University, at Pierce and also Japanese studies and they showed very similar, an updating simply of the old studies. But the big new thing that was found was that there were, which was really quite obvious but it had been ignored before, that there were many other things that contributed to pollute the air. Furnishings, building materials, office machines, and so forth. So all the thousands of building materials that have come in, and even HVAC systems. So that was the new development. And we had the first time we arranged in Copenhagen, with many important ASHRAE members, the first international indoor air conference in 1978, with key persons you know here from ASHRAE and United States. These types of conferences then gone on every third year. Recently there was one in Finland with 1,400 participants. And so the whole indoor air subject has been taken up by ASHRAE and others. We then modeled and introduced new units, Olf unit and Decipol unit. Which was units for perceived air quality. We said we had to acknowledge that we had many other materials that bothers people and irritated them and provides odors so it ruins the freshness of the air. And this has been what we've been working with since then to model the whole thing. Again predicting air quality before the building is built so we can avoid all the dirty materials and things that, carpets, whatever, you know.

B.J.

That's interesting. The comment to your equipment contributing to the problem like the Legionella problem here in this country, I'm sure in Europe you have something similar. The growth of micro-organisms in water towers and maybe even on filter mats or spray coils. And then here the tobacco smoke problem. We're almost in a hysterical mode in that. I don't know if other countries share that, is there a similar concern in your country over smoking in office buildings and similar things?

O.F.

Sure but I think in many respects, North America is leading the way in terms of the tobacco smoke and maybe it's more frequent here with banning tobacco smoking and so forth. On the other hand there's been, the last ASHRAE standard 62 for instance, allows tobacco smoke and without any penalty in smoking and I think that's now being changed. And that was an obvious error made and everybody can see that now. Of course tobacco smoke contributes too, everybody knows that.

B.J.

Years ago the old standard was what, 7.5 CFM per person but if you're smoking or in a conference room it went up to 15 and now what the allowable is 20 CFM minimum or somewhere. I'm talking English units of course.

O.F.

Right, okay. Well that's all the evidence we have is that tobacco contributes much more. And there's been extensive studies at Yale University and our university and Japan and so forth that we have to acknowledge that if tobacco smoke, if there is environmental tobacco smoke then we have to add some more ventilation. Every child knows that so we better get it into a standard again. And that's what happens now. I'm a member of the ASHRAE 62 standard committee and I've been there for several of the other committees also so. And of the European, there's a European committee too.

B.J.

You're at a university. Are you at a teaching mode there? Or research? Or what are your activities mainly right now?

O.F.

Well we have some teaching but it's mainly, it's mainly research. We have quite an international group with people from many countries in our research group. And it's sponsored by European Union and also we have done a number of ASHRAE sponsored studies at the technical university of Denmark in Copenhagen.

B.J.

Can you make any predictions on where this is all leading us? What do you think in the next decade or so will bring?

O.F.

I think we will see substantial changes in the components, the way we are making ventilation systems. All the components have to be checked, first of all, that they're not sources of pollution, filters and rotating heat exchanges. Whatever you have they should if anything improve air quality and not degrade that as it sometimes does today. So we'll have to consider it's not just a question of supplying air at a certain quantity. We have to be very careful how we treat it. It's a very easily, you can destroy air very easily. It should really be handled with love and care, fresh air. It's an important thing.

B.J.

California, you may be familiar, we have what we call title 24, which is really an energy conservation code but it did adapt a lot of ASHRAE recommendation on ventilation standards. You see the need for more regulation, government involvement? Are you involved in that end too, in getting legislative processes through?

O.F.

Well I think in what will drive it, I think the market will drive it as a strong interest, at least in Europe and also here from many building owners even the larger automobile makers have the same things in the cars of course. They're ready to pay to get a higher quality but they don't want to pay and get low quality. And it's not necessarily that you get, there's a lot of know how that should be applied. For instance we are now developing data bases on building materials, on pollution sources, so I can take ? low polluting materials. But I can see the development like we had in the beginning, in large cities we had 25 or 50 years, we had a lot of pollution, more pollution outside I guess it's the same in California here. Fortunately due to source control, reduction of the sources we are getting an easier opportunity to get better air quality. We see the same tendency after we care much more about what we are putting into our buildings and the systems. We have to care very much how we treat the air. Filtering technology will need to be improved so we can filter the gases, which you perceive the gases the particles are not so important for the perception. The freshness that you can feel out in the, when it's best outdoors that's what we would like to recreate indoors. And that's difficult today. That's the real challenge for us in the future. And many are interested from a comfort point of view of course, everybody would like to perceive the fresh mountain air, that sea air, whatever you, when it's best out.

B.J.

I remember reading the article in the journal a few years ago and I was very intrigued by it. Kind of a different approach to what you call the Olf unit. Would you mind going into that, giving us some background on that.

O.F.

Well that was, as I said before the, after 200 years where all ventilation theory and thinking had been emphasizing that people were the only polluters and there was a lot of data then on how much should be ventilated to handle the pollution from people. What we found out was that all the, or many other materials are polluting and therefore the very simple approach was then to say why don't we express all other sources, tobacco smoke and building materials and so forth in terms of equivalent persons. How many equivalent persons would be required to pollute equally as much as that carpet for instance. Of course it's very complicated in chemical terms because it's very low emissions and even bio effluence from human beings, we're speaking about hundreds or thousands of chemicals in very small concentrations but enough to bother people. Same with a car, it's not one chemical but often hundreds and so we said one Olf is simply one equivalent standard person. And of course we had a lot of information on what was required to isolate the persons and then we just said there are that many persons in the room and then the rest of the room, the empty room was polluting for instance 20 corresponding to 20 persons. And how should be measure that? Well we should measure it with human beings. Still with panels, Yaglou used that at Harvard. And that has been the way we have been testing the air quality, the sensory, the perceived air quality. Then of course there are health aspects also, which are equally important. Normally what has been driving all ventilation standards has been the perceived air quality, the comfort aspect of it. And this unit has then gone into, we can measure that with panels still and do systematic studies where we measure chemically on all kinds of building materials for instance. Chemically and then sensory with panels. Of course the latest interesting aspect is that the electronic nose, where you have special, a lot of different sensors and you simulate the human nose in a way. That's a very interesting development. Instead of having panels going around, that's what we have been doing with panels. They go around in a hundred buildings in Europe for instance. We've had panels coming into the rooms and judging the air quality according to certain scales and then we can calculate. When we know the ventilation we can calculate the source strengths of the empty room. It's often most important to come through the empty rooms. To see how much the building in itself contributes. And even studying the air quality coming out of the, out from the system to see how much it may be polluted even before it comes into the room. So that's another. Where we really go for air quality, not just air quantity. That's an important thing. That's now in European guidelines for insulation requirements and it's also coming into a European pre-standard. They're again modeling, these units are important. It's in a way like the units, we have decibel and watts for sound and lumens for light. This Olf and the deviated unit is Decipol. That's for perceived air quality from the source strength.

B.J.

So part of your interest or work then is going into interesting buildings that have problems and doing a review or investigation to find out what's causing the problem or removing it or figuring out a way how to… I've seen some of that where they had a printing room or something without exhausting it you know. There's a whole series of equipment giving off fumes and nobody gave a thought to putting in an exhaust system separate from the ventilation. Is that typical, you find those things?

O.F.

Well that’s, our studies or research is partly in, let's say in the lab where we have everything well controlled. Then it's partly out in the field, in real buildings to validate the lab studies. And that's really been fascinating and the collaboration with ASHRAE and all the technical committees here, it's just been

a fantastic development. From the first time I came in '66, with all the thermal aspects and all the enthusiasm that struck me from the first minute I participated in the ASHRAE activities, so that was very encouraging. Always encouragement inside ASHRAE, that's been unique.

B.J.

Did you get into the industrial and commercial end of it a little bit too? Is that part of your interest?

O.F.

Sure, we have collaboration with industrial firms. Also in the US, in Europe, and even air quality in automobiles and so forth. We have a wide net of collaboration that's all on the scientific side of it. And of course then ASHRAE has been very generous in all aspects of taking in me and many others from outside and that's again the development of ASHRAE, from let's say a more, in the beginning or thirty years ago, from a North American society to ASHRAE international, widening up. ASHRAE is now much more international approach. I think I'm being a little bit, I contributed a little bit to that.

B.J.

Well I notice that you have the F. Paul Anderson award. Can you tell us a little bit about that?

O.F.

Well that's of course a very great honor. This is the highest award to give for accomplishments, scientific or other accomplishments that ASHRAE has. So it was very generous that ASHRAE selected me as the awarded in 1992, I think is the first non American recipient.

B.J.

And it's apparently not awarded every year either. It looks like there's gaps here in the award process. Maybe every five years they find somebody.

O.F.

I think that’s a recently, well I haven’t seen the whole record but it's way back from 1930. Paul Anderson was a really key person and a pioneer in comfort research by the way at Kentucky University. I studied his career.

B.J.

In addition to that you also have the Louise and Bill Holliday award. Can you tell us about that please?

O.F.

Sure. Well that was already in 1982 for that, Bill Holliday was very important person and is still in ASHRAE. He decided together with his lovely wife, they decided to establish this medal especially for fellows who had provided special accomplishments. I think that was in 1980 or so. So I was very privileged to receive that medal as well.

B.J.

You had a very impressive career. Would you recommend anyone to follow in your footsteps as an engineer researcher? What recommendations could you give a young fellow today?

O.F.

I think there are great opportunities still in our field. The consciousness and the interest for the environment. ASHRAE and other societies similar to that in the world and the HVAC world have great possibility to step in and take advantage of the public interest. And I think there's great possibilities and of course also great possibilities in the industry but they should really be, they can't just do things as they're done previously. They must be out on the edge of development and there's a lot to do. Many exciting things in the environment due to human requirements. Everything starts with human

requirements and people are ready to pay and ask for much better environments also indoors where they spend 90 percent of their time we know. And that's an international thing. It's not only ASHRAE, it's global. And I think that has been a tremendous development we have seen there in collaboration. I think when I first came over, that was the international part of it I think. I was invited in 1974 when there was first established a kind of international policy in ASHRAE. Part of it was to have a few advisors coming along and participate in key meetings in the R&D committee. And I noticed that was very little information on what happened in other parts of the world. The same, I was involved in REHVA the European HVAC collaboration between societies. There was also not too much information on the American scene so I tried at that time to get people together in the two parts of the world. After a number of years it became, ASHRAE it became a routine, which it is now, that ASHRAE president come to REHVA the European meetings. We established in Copenhagen the first world congress on HVAC&R in 1985 where ASHRAE was a very important partner. First world congress in our history so we're pretty proud of that. Since then there's also been more and more internationalization. ASHRAE has now I think some 35 associate societies and I think its routine now that many foreigners or non Americans participate in the meetings or contribute with papers. That's been a tremendous advantage for all of us. But still I think, and it's been a great inspiration for all, let's say similar societies to ASHRAE in other countries. It's been a great inspiration to see how ASHRAE was organized and the encouragement and the way that members became active and how ASHRAE gets all the thousands of members two times a year to come and work five days in all of the hundreds of committees. That's the goal for all other societies. They really envy ASHRAE, this excellent organization and everybody tries to learn and copy just on a much lower extent. That is very fascinating.

B.J.

Thank you very much. Thank you for coming, sharing your time and experiences with us. It's been a real pleasure.

O.F.

Thank you very much. Pleasure.