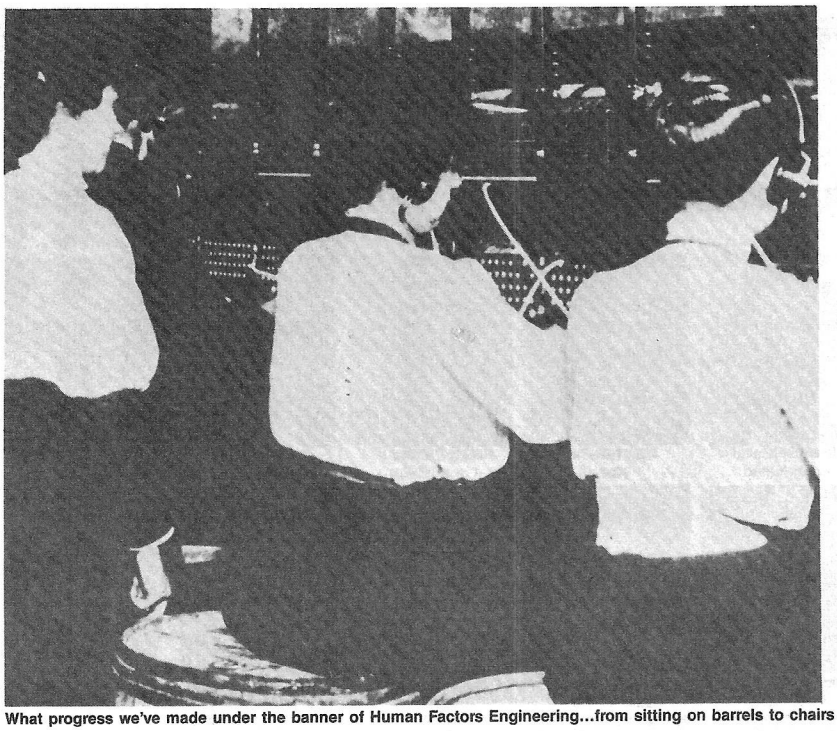

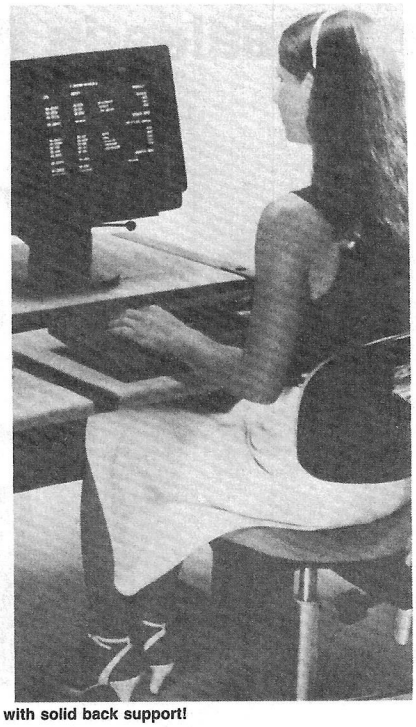

What progress we've made under the banner of Human Factors Engineering...from sitting on barrels to chairs with solid back support!

Area Rep Report

Answers the simplest question

Human factors (ergonomics) apply to many new technologies

Jerry Murch, Chief Scientist
TeK Labs

Today I want to answer the simplest question you can envision, "What are human factors and why are we working with them?"

Although human factors apply to many of the new technologies today I will focus specifically on how human factors apply to video display terminals.

The motto of my group is "create your products to match the design specifications of human beings." That sounds a little odd, but if you think about it for a minute, all human beings' characteristics, their size, shape, thinking capacity, hearing, and vision can be considered to be an element that's been designed. It's complete and we can't change it. Our job, if we're building any kind of a product, is to configure it in such a way that it matches the way people are built.

History

Historically in our industry we've not been concerned with the human side of developing new equipment. The concept was that humans are adaptable. So you build the equipment any way you want and people will get used to it.

An early sensitivity to human factors came into being during the World War II when we started to train pilots to fly airplanes. They had little knowledge of airplanes and didn't have any "feel" for how an airplane worked. Many tragic accidents occurred; at the time they were called "pilot error"—the pilot made a mistake and crashed the plane.

A study of the crashes revealed the most frequent pilot error was pulling up the landing gear just as the plane was going to touch down. Examination of the cockpit showed a series of big bars with identical knobs on them. Some were used to raise and lower landing gear, others were used to accelerate. When landing this type of airplane the pilot had to accelerate slightly to get the plane in the right position just before touching down. The pilot would be looking at the airstrip, reach down and pull the lever to accelerate and get the wrong one. The landing gear would raise instead and the plane would crash.

A series of human factors experiments revealed an optimal shape of the landing gear handle. When the handle was modified the number of accidents was reduced to almost zero.

Ergonomics/human factors defined

Ergonomics refers to the study of natural work laws—how to structure the work place and equipment in the work place so that people can work comfortably.

The term human factors initially meant productivity—how to get more out of the worker. Today the terms are used interchangeably to refer to comfort, health and safety and productivity.

Anthropometrics, a part of ergonomics, refers to matching the instrument to the physical requirements of the operators. It's the physical device—the position of knobs, dials, and buttons. The data base for that is the size and shape of people.

We have a tremendous collection of data. Human beings vary tremendously from each other. The problem is how to build something that is comfortable for people that vary so much from each other. That is the primary task of anthrometrics.

The first thing we have to be aware of is that in designing any kind of a work station there is no such thing as an average person. We can't design something that will fit everybody.

Jerry Murch, Conference Speaker

What we've learned with the video display terminal is to try to design things that will be adaptable. That's why you see so many displays with detached keyboards—they can be moved around to accommodate people of different sizes.

Ultimately any piece of equipment should be useable for people who vary between the 5th and the 95th percentile—the smallest female to the largest male. This means that the VDT has to be configurable, changeable, and adaptable. People should be able to adapt their work stations to meet their particular specifications.

Depending on the type of the work you're doing the shape of the back of the chair and the adjustability of the chair can be changed. For example, a very tall person will probably want to sit farther back from the terminal because of their longer arms while a short person will want to move closer.

The end result of sitting at a work station that is not designed properly or adjustable is problems for the user.

All over the world today you'll see advertisements using the term ergonomics. In many cases it is just as important to be aware of the fact to shift things around to be comfortable for you as it is to have the capacity. If a workstation is uncomfortable, do something about it, change it, adjust it so it's more comfortable.

In the future the area we'll be most interested in is cognitive ergonomics—designing equipment in such a way that it matches the way people think. When you go to do a job on a piece of equipment you should be able to say "I want to do this, and the machine can say 'certainly.'" There is only one minor problem—although we have a lot of data on sizes and shapes of people, we don't have a lot of data on how they think. If we knew how the brain worked, the idea would be to build equipment to match how you think about a problem. Until we understand exactly how your brain works that's going to be a little tricky. But we do have some ideas.

Video Display Terminals

The video display came crashing into the workplace at a tremendous rate. There have been very few technologies that affected as many people at the same time. Literally millions of people have had their jobs restructured and changed. Over the next few years millions more will have the same ex-

(continued on next page)

perience. We're trying to learn from our past mistakes and develop new equipment that is built to the design specifications of human beings.

The video display emits light which is very different from the piece of paper we worked with before. That paper was a reflective surface—it was reflective light falling on the surface.

Glare is one of the most bothersome factors on video display terminals. Anything reflected on the surface of the screen that makes characters more difficult to see is called glare.

There are some very specific principles we can use to avoid glare. They are basically physical principles of where we locate light sources to keep them from shining on the surface of the screen or shining in our eyes. You can work them out for any kind of a work station. Obviously, if the light is located directly overhead it shines down and illuminates the surface but doesn't shine on a vertically oriented screen. Another simple rule is to orient your video display terminal so you aren't looking out the window and so the light from the window isn't reflecting on the VDT screen.

There are a number of facilities used to cut down on glare. Some manufacturers use what's called an etching on the surface. Unfortunately the more the surface is etched the more fuzzy the characters are.

There are also some after-market solutions available such as the micromesh filter. It cuts down on glare but it also collects dust.

There are expensive solutions, too. One is to use an optical coating which goes on a filter which is bonded to the front of the CRT. It gets the reflection down to about .02 percent but is very expensive.

Another problem with VDT's is flicker. If you're looking at the screen and look off to the side, the characters appear to be sort of shimmering. That's because the screen is written at a 60 gHZ pace. Often that isn't quite fast enough. The human visual system can still detect that.

We have done some research and found that if you're looking at a VDT with the phosphorous currently in use, it really should be run at about 65-68 gHZ. We're looking at going to a high rate for future products.

The future

The challenge for human factors people in the future is cognitive engineering—designing systems that complement the mental capabilities of the user. It's exciting to think about trying to learn the way people do a job.

Here's an example of something we're doing here at Tek. In mechanical engineering a lot of systems are being designed to allow people to do mechanical engineering and layout as well as modeling design on the computer. However, the systems are so difficult to use that it takes an individual up to six months to learn how to do a job on the computer before it is even comparable to what they can do on a drafting board.

We're trying to find a way to understand the person's skill set, what he knows, and build that into the way the computer works and cut down on the training time. If we could get it down to, say, two months, imagine how much a customer would want to buy our product.

There is a whole series of issues that fit into cognitive ergonomics. Time to learn is one, ease of use is another. That refers to how easy it is to use without stress. It is common for automated systems to be very stressful to use. They are very demanding. As soon as you make an entry, the terminal does one of two things. It either immediately comes back and says 'I got it, what do you want to do now?' or it sits there and looks at you and you have no idea where it went. That can be very stressful.

If we do the job right as human factors specialists, then it's love at first sight when you meet a piece of equipment. It will feel good, be easy to use, and customers will want to buy it.□

Questions from the floor for Jerry Murch

How are cognitive ergonomics related to Artificial Intelligence?

Cognitive ergonomics is trying to understand how people think. Artificial intelligence systems is trying to take knowledge and build that into a system that allows you to query that system and solve a problem. Hopefully, cognitive ergonomics will help AI extract the knowledge from experts accurately and efficiently and make it available for use in an AI system.

How much radiation do you get when you stand in front of a terminal?

Walking across a parking lot subjects people to more x-ray radiation than standing in front of a video display terminal.

In your slide presentation you used a variety of colors. Is there a reason, ergonomically speaking, you used specific colors?

What I try to do on slides is use colors of different intensities so that people will look at the part of the slide that I want them to pay attention to. In other words I use the bright colors on the part I want you to be attracted to and a more subtle color to the other parts.

What is human factors involved with in terms of new products?

Until recently we have worked mostly on the visual aspects of our products. We have attempted to aid in the development of optimal displays for use in graphics, oscilloscopes, logic analyzers and so on. Now, we're concentrating more on the cognitive end—how do we figure out how our customer thinks about the job he's doing and then designing equipment to be compatible with that. It's fun, but hard too.

Is our emphasis on ergonomics the result of what the customer is demanding or the result of what we think they will be demanding?

We were heavily criticized once for not being particularly sensitive to ergonomics. We also recognized that there is money to be made in ergonomics. Our goal is to build an instrument that as soon our customers see it they will say it is exactly what they want. Good ergonomics sells the products because the customer doesn't even know it's there. All they know is they like the product and the way it feels.

How can we get ergonomics in our workplace at Tek?

Once we became sensitive to the fact that ergonomics was important to our sales and a prerequisite for our sales we also began an effort to put together some information that describes to employees what some very fundamentals of the workplace are. The first one will deal with the video display terminal. They are just some very simple sort of checklist things to go through and check out your workplace. Hopefully this brochure will be available this fall.

Have there been any studies on natural vs artificial light and how it affects people?

In both Germany and France there is a law that says no person can work more than 20 feet from a window. You have to have natural daylite in any working place. That is because of a very strong believe that there are some health effects associated with natural daylight. However, there is no data that really suggests there is any effect one way or the other.

Some brands of televisions had blue screens for awhile. Was there a specific reason for that?

That actually was a marketing gimmick and made no impact whatsoever.

Since all light is just a frequency variation have there been any studies that look at the sensitivity of the eye at different frequencies?

We've known for a long time that the eye is the most sensitive to the middle of the spectrum which is a greenish-yellow. What that means is you use less energy at that wave length to perceive it. It doesn't mean that it's better it just physically requires less energy. We also know that at night our sensitivities shift. In video display terminals we try to match the red, green and blues to the average sensitivities.□

Anne Taylor, Conference Chairperson

Manager of the year

Region 4 Area Reps pick Paula Furchner

Paula Furchner (Affiliate Order Management manager) was named Manager of the Year, Region 4, at the August Area Rep Conference.

Paula has been at Tek for 26 years. She's been in her present department for about 15 years, and 10 years as manager. The department processes orders for Sony/Tek and all of Tek's subsidiaries around the world.

Earlier in her Tek career, Paula was a manager in Corporate Distribution, and secretary in Marketing and Engineering departments.

For recreation Paula likes to spend weekends at the family beach house near Garibaldi where crabbing is the favorite activity. She also enjoys playing the piano and organ.

The Manager of the Year Award is given to region managers who, in the opinion of local area reps, best support the Area Rep Activity.□

Paula Furchner, Manager of the Year, Region 4.

Topic Questions

The Area Rep meeting on "Ergonomics" mentions more and more time spent in front of terminals. I get a backache from the chair I have. Why couldn't we all have more confortable and "health" supported equipment in this line? I spend all of my time in front of terminals, also I have a lot of eye strain.

Has Tek changed its views on how computer terminals affect the eyes?

I use a terminal 95 per cent of my worktime. I have problems with my neck bothering me and have eye problems which contribute to many headaches. My equipment for using the terminal is situated so I cannot maneuver around. It is hard to position it. Maybe someday we can get some better tables and can do something about the eye problem.

I realize that budget conservation is a big issue these days but we are using space age technical equipment, (terminals, PCs, etc.) along with ancient office furniture. As a result, many of us who are required to continually use a computer terminal end up with headaches, backaches, sore eyes, and sometimes bad dispositions. Are there plans to update the office furniture at Tek?

Is there any evidence that color and variety are less stress producing? Do color screens result in less eyestrain or soreness?

Why can Tektronix spend in the hundreds of thousands of dollars for equipment we use, and not purchase the corresponding (needed) chair at the same time to make working a computer terminal all day much easier. Or at least...have an Ergonomics expert come around and show us the correct way to adjust our present chair for comfort and lack of strain on eyes, backs, necks!

With the initial introduction of display based equipment, most of the concern in the engineering community centered on the electronic capability of the new devices. Literally, humans were left to adapt themselves to the new equipment. Subsequently, engineering has become much more sensitive to the human side as evidenced by the increased level of activity in human factors throughout the industry.

In particular, academic, government and industry experts have been writing an American National Standards Document detailing the requirements for

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