Goodbye to the VDU Headache

Remedying eyestrain and headache in the office

by David Brown, B.Sc. M.A.

Consultant in Ergonomics and Occupational Safety

This book is copyright © David Brown 1992 - 1997. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the previous written permission of the publisher.

Published by David Brown, Group Occupational Health Centre, 427 Ross Smith Avenue Mascot NSW 2020. Tel (02) 9317 5233 fax (02) 9693 2659. This revision 9 July 1997 with minor updates in 1999 and 2003.

Most of the material from this book has been incorporated, in appropriately reworded form, in David Brown’s software “The Road to Comfort”.

Important disclaimer: This booklet has not been significantly updated since 1997. On that understanding, it is being provided on the Internet without charge. If you are thinking about making serious decisions based on the information contained here, you should check to ensure that the recommendations made here are still valid. At some stage during 2003 this booklet might be revised and re-issued as a commercial publication.
Table of Contents
What is eyestrain, and what causes it? ................................................................. 3
Eye specialists ........................................................................................................ 3
What kind of visual problem do you have? .......................................................... 4
Red, dry, gritty or sore eye surface ........................................................................ 5
  Red eye ................................................................................................................. 5
  Chemicals ............................................................................................................. 5
  Low humidity ...................................................................................................... 5
  Air flows too quickly and dries your eyes .......................................................... 6
  Keeping eyes open wide for too long ................................................................. 6
  New at the job .................................................................................................... 6
Sore behind the eye ............................................................................................... 6
Close reading ........................................................................................................ 6
Perhaps you need glasses? ................................................................................ 7
  The problem with bifocals ................................................................................ 7
Photogenic epilepsy ............................................................................................. 8
Glare & reflections ............................................................................................. 8
  Glare on the screen ............................................................................................ 8
  Reflections on the screen ................................................................................ 8
  How your screen can help ................................................................................ 9
Light in your eyes ............................................................................................... 9
  Anti-glare coatings and filters ......................................................................... 9
Screen flicker ........................................................................................................ 10
  Why Windows is a special problem ............................................................... 10
Screen brightness .............................................................................................. 11
Field of view ....................................................................................................... 11
Refresh rate - the most important factor for visual comfort ......................... 11
  What does a high refresh rate look like? ....................................................... 12
  What refresh rate does my computer have now? ....................................... 12
Less blue, fewer headaches ................................................................................ 12
Fluorescent light flicker .................................................................................... 13
Light tables ......................................................................................................... 13
What is eyestrain, and what causes it?

Eyestrain is among the most widespread of modern discomforts. The term is used loosely to describe any soreness of the eye, or any visual tiredness or discomfort. Eyestrain can be divided into three categories:

- Discomfort of seeing ("asthenopia"), involving not only the eye but also the visual cortex of the brain. This problem could just as accurately be called “headache” or “stress”. To solve it, you probably need to increase your viewing comfort AND reduce your stress levels.
- Sore eyeball surface, for instance as a result of excessively dry or dusty air
- Pain in or behind the eyeball, for instance as a result of tension in the muscles which surround the eye.

Most people with eyestrain have nothing wrong with their eyes, and do not need glasses. However, there are eye problems that require medical treatment, so you should know about two specialists who can help you:

Eye specialists

An OPHTHALMOLOGIST is an eye doctor. Medically qualified, this is the person to see if your eyes suddenly “go funny” in any way. The eye doctor deals with both the outside of your eye and its interior workings. See the eye doctor for dry eyes, black spots in your vision, distorted vision, or for any unusual condition.

An OPTOMETRIST is an eye technician, qualified to measure the sharpness of your vision and to select correct glasses. The optometrist may also perform simple eye testing for signs of medical problems, and will suggest a visit to an eye doctor if there is reason to suspect a medical eye condition.
## What kind of visual problem do you have?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Common causes</th>
</tr>
</thead>
</table>
| Sore on the front surface of the eye  
Also called “red eye”, “dry eye”, “gravelly eye”, “gritty eye” | Keeping eyes wide open for too long; low humidity; dust; solvent fumes. |
| Sore behind the eye (deep pain, or the eyeball itself hurts) | Tension in upper neck, or in the jaw or face; working for too many hours without rest. |
| It’s just hard to keep looking (blurry, tired eyes, headache, feeling stressed, feeling washed out) Also called “Asthenopia” | Close reading for more than an hour; VDU or documents hard to read due to glare, reflections, or poor image quality; VDU or fluorescent light flicker; working with excessive activation; unclear job; working for too many hours without a rest; perhaps you need glasses for that task |
| Flashes of light, black spots, missing areas of vision, vision deteriorating | See your doctor for these ones! You might just have migraine, but it needs a doctor to diagnose the problem. |
Red, dry, gritty or sore eye surface

Red eye
Bright red eyes at the end of the day could be caused by a dust allergy. This is more an aesthetic problem than a medical one. Red eyes don't hurt you, but look rather strange. Dust only effects some people - small consolation if you're one of them.

But red eyes don't prove that there is too much dust about - you might be keeping your eyes open for too long, perhaps because you are unsure of the job.

Chemicals
If the film of tears which protects the eye surface is disturbed (dries out, or is effected by chemicals) the eye is very likely to feel irritated. Solvent fumes are a particular problem, as is ozone from photocopiers and laser printers. Better ventilation and replacing filters is the answer!

Low humidity

Low humidity dries your eyes, and also allows dust to travel much further. If you think this might be the cause of your problem, you can purchase an electronic temperature and humidity meter from the local electronics store. Humidity is most comfortable in the mid range (40 to 70%); if it is under 20% it will increase the risk of dry eyes, especially for new staff.

Pot plants are good for humidity control because people water them. A dish of water is just as effective in increasing humidity but there is little motivation to keep it topped up. Why not get a pot plant!

You can ask the building supervisor to adjust the humidity levels, but be tolerant because it might not be possible.

If you have a problem with dust allergy, check whether your VDU screen is collecting dust. Wipe the face of the screen with a damp tissue, and see if anything comes off.

To see why your screen might be attracting dust, place a small piece of paper on the front of your screen while it is operating. If it does not stick, you have a screen with an antistatic coating - a good feature. If it does stick, and you really have a problem with dust allergy, you can obtain a static-reducing screen for the VDU. These drain away the static charges from the VDU’s glass front and stop the dust from being propelled away from the screen (and into your face).

Antistatic filters must be fitted with an earthing lead to be of any benefit; check with a technically competent person. But they can degrade image quality, so before you rush off to order a roomful of antistatic screens, get advice - for instance, static and dust may be your carpet's fault, and have nothing to do with the VDU!
Dust is not the only source of allergies, for example if you use eyedrops regularly you may be allergic to them. Being allergic to eyedrops is quite common! The more your eyes hurt, the more drops you use and the more they hurt...

If your doctor prescribed your eyedrops, talk it over with him. If they were your idea, you could try not using them for a fortnight, or switch to a “Dry eye” formula, and see if that helps.

**Air flows too quickly and dries your eyes**

Check for draughts, as the movement of air can dry the eyes (just as wind dries the washing). Cold air can also give you a stiff neck.

- Cover windy air vents (you should talk to the building engineer first);
- Move your desk to a less windy spot;
- Put up a barrier between you and the draught;
- Make sure you discuss the problem with others in the office, as fixing air flow in one place can cause new problems in other areas.

**Keeping eyes open wide for too long**

Anything which leads you to keep your eyes wide open, or to blink less often, can increase the chance of red or sore eyes, because your tears do not wash the dust away often enough. Are you unsure of your job? Can't see the screen clearly? Under financial pressure? Anything stressful can reduce your blinking without your realising it. Try relaxing! Take breaks!

**New at the job**

A new person is more activated. They keep their eyes open for long periods, and their eyes go dry. Watch the most experienced person in the office, and model yourself on them. Read your job description, or get clearer instructions as to what is expected of you.

**Sore behind the eye**

Pain behind the eye can be caused by tension in the jaw, especially in temporalis jaw muscle. The diagram shows how large this muscle is.

If you have persistent pain behind the eye, you should seek help.

- If you have a sore jaw as well, see your dentist;
- if you are stiff at the top of the neck, see your physiotherapist;
- but if there is no clear cause, see your family medical practitioner.

**Close reading**

After looking at fine print or after doing any close visual work for an hour or more, your eyes might become blurry. This does no harm, but makes it harder to work. It is more likely to occur as you get older, because your eyes find it harder to focus at short distances.

Glasses may help if you are trying to look at something which is closer than your comfort zone. How far away do you hold a newspaper to read it? If you are trying to work closer than that, you may find that your eyes go blurry and tired quite quickly.

Dim lighting can aggravate the problem, and bright lighting can reduce it. So, first check that the lighting is bright enough. For fine visual tasks you need lots of light (1000 lux or more), much more than for general office work.
You do not really need to measure the light level. Take your reading material out into the sunlight, and see if that makes it easy. If it does, try adding more light in your workspace and see if that helps:

- Try a small desk lamp.
- If your walls are dark in colour, you can brighten your workplace with light-coloured wall hangings. These will reflect more light, and will reduce the difference between light and dark areas, making your visual workspace more comfortable overall.
- For extremely small print you may need both better lighting and magnification.
- Make sure you have a break from close visual work several times each hour. Look into the distance for a few seconds; this relaxes your eyes.
- If your vision becomes blurred, take ten minutes off from the intense visual task and do something else. Ten minutes away from that task will bring your vision back to normal sharpness. Make this a routine throughout the day.

**Perhaps you need glasses?**

By 45 years of age, 90% of people need reading glasses. VDU work does not make your eyes deteriorate faster than they otherwise would, but it is visually demanding. The first sign of normal ageing might be difficulty in using the VDU.

Try putting your screen further away; perhaps turn up the brightness as well. To read it at the greater distance, you will need to adjust it carefully and minimise glare to make the characters as clear as possible.

However there is a limit! It is impractical to spend thousands of dollars on a giant VDU screen that can be read from across the room if glasses will fix your problem. Don't be vain, lots of people look great in glasses!

**The problem with bifocals**

Many people who wear bifocals experience pain at the top of the neck when using a VDU. This is usually caused by sustained muscle tension from working with the chin slightly raised to see through the close-up section of the glasses.

The quick solution is to lower the visual task. The aim is to get your head balanced, so ask someone to watch your head as you raise and lower the screen. (If you share the workstation, remember to adjust the visual task up again for the next user.)

A better solution is to obtain task-specific glasses which are not bifocal. Glasses can be made for sharp focus at your preferred work distance. When you get the right glasses, you should raise your visual task again.

Some people find that “multifocal” glasses (which have a continuously varying focal length, unlike bifocals which have just two lengths) have reduced their neck pain. These allow you to adjust your focus by much smaller movements of the head. But whatever your solution, try it out for a few weeks and ask for advice if your neck has not improved.
Photogenic epilepsy

Even if you are susceptible to epilepsy from flashing lights, it is very unlikely that a VDU will bring on a problem.

Between 1 in 2,000 and 1 in 8,000 people are susceptible to epilepsy from flashing lights, more women than men. By twelve years of age most people prone to this problem have had their first attack. For instance, it might be triggered by driving down a country road through an avenue of trees in the late afternoon, resulting in a pulsating light as each tree blocks the sun in turn; or by a disco strobe.

The worst frequency of a flashing light for causing an epileptic attack is 25 cycles per second (called “25 Hertz” or “25 Hz”). The brighter and bigger the flashing light, the more likely an attack.

As the frequency of flashing increases beyond 25 Hertz, the risk of seizure decreases. There is very little risk of a seizure at a VDU. A review in the American Journal of Ophthalmology in 1986 found only one case ever reported in which the problem had occurred with a VDU. At that time there were many VDU screens in use which had a 50 Hz refresh rate, but today even the worst screen uses at least a 60 Hz refresh rate.

So people who are susceptible to photogenic epilepsy should still be able to work quite happily with a modern VDU. If you have any discomfort, try increasing the refresh rate to at least 85 Hertz. That is considered to be high enough to eliminate any effect of VDU screen flicker.

Glare & reflections

The word “glare” is quite loosely used to describe unwanted light shining in your eye, making it hard to see what you are interested in.

When working with a VDU, we can usefully distinguish between

- glare which is on the screen itself;
- reflections on the screen;
- and glare which is not on the screen, which we can simply call "light in your eyes".

Glare on the screen

If light shines on the front of the screen, the contrast between the black areas and white areas of the screen is reduced (black areas look grey) which makes the screen harder to read. There are two ways that this can happen:

A. Light shines on the front of the screen from above, and scatters.

This occurs when a bright light is located directly above the VDU operator so that it casts its light on the screen at a very shallow angle, making the screen appear “milky”.

Take a manila folder or other stiff cardboard, or an umbrella, and place it above the screen so that light shining down onto the screen is blocked. If this makes the screen easier to read, you could tape a cardboard “sunvisor” on the screen, or ask for the light to be moved, or for one of its tubes (there are usually two per light fitting) to be turned off; or just try tilting the screen forward.

B. Light shines through the protective front glass and onto the black front of the screen, so that although you do not see a reflection, the screen appears washed out. This can be a problem if the work area is very brightly lit or if your screen faces a large window. Repositioning the desk and screen is usually the answer.

Reflections on the screen

The glass front of a VDU screen can act as a mirror. Can you see an image of a light, a window, or your own white shirt mirrored in the screen?
If the reflection is brighter than the image on the screen (which it usually is), your eye is attracted to the reflection. Each time your attention moves between the screen image and the image of the reflected light, your eye must refocus.

So reflections can be distracting and tiring. And just like glare, reflections lighten the dark areas of the screen, reducing contrast and readability.

Here are some solutions to reflections:

- Pull the blind to reduce glare from the sun (this requires negotiation, as people who are not effected by the glare might not appreciate the reduction in natural light).
- Tilt or turn your screen to move reflections out of your line of view.
- Try turning the whole desk so that the VDU does not “look” at lights.
- Shade or move the light(s) which cause the problem.

It can be difficult to identify which lights are causing reflections on the screen. Here is a method:

Sit at your workstation and watch the screen while a friend turns lights on and off, or moves around the room shading different lights (e.g. with an umbrella). When you know where the problem comes from, either reposition your desk or shade your screen from the light. For ceiling lights, you can:

- Hang cardboard strips to block glare from light fittings;
- Make a cardboard “sunvisor” for your screen to protect it from overhead glare sources;
- Ask for your lights to be repositioned, or ask for improved diffusers (parabolic diffusers) which restrict the angle at which light is emitted.

Don't be too critical of lighting. Sometimes lighting is unsatisfactory, but the problem is just as likely to be that old screens are hard to see. Because display technology is rapidly improving, management must balance the cost of revising the lighting against the cost of upgrading screens.

**How your screen can help**

A bright background display (such as the usual Windows display) can overcome many lighting problems which affect a dark background display. A bright background display allows the user to work comfortably under more than three times the amount of glare, and twice the intensity of reflections, as a dark background display allows.

To increase screen brightness without the screen going out of focus, increase the refresh rate. At 90 Hz refresh rate you can almost work in direct sunlight.

For best glare-rejection effect the screen white should be the same colour of white as the ambient lighting. High quality screens such as NEC and Sony screens allow you to trim their colour balance, otherwise you can try adjusting the Windows screen colours (see "Reducing the blue" for details).

**Light in your eyes**

If you are trying to read a VDU screen and there is a bright window directly behind it, you will run into trouble. Move your chair and the screen, or pull the blinds, to lower the brightness of the background to a roughly similar brightness level to the VDU screen.

**Anti-glare coatings and filters**

A good antiglare coating on the screen helps to reduce both glare and reflections.

It is possible to purchase a separate antiglare filter (which may also be an antistatic filter) and fit it to the front of the screen, but this is not always a good idea. Cheap antiglare filters make the image dim, and if you turn up the brightness to compensate, the screen may go out of focus.

The best antiglare filters can cost nearly as much as a new screen, so why not upgrade to a better screen which already has a good antiglare coating and can support a higher refresh rate as well?
First try solving the lighting problem, then consider antiglare filters.

Screen flicker

A strobe in a disco flickers 5 to 10 times a second, and everyone can see the flicker. A TV set flickers 50 times a second, and most people at least realise that the TV flickers, even if they are not usually aware of it. A VDU screen also flickers, and although the flicker is less obvious than on a TV set or strobe light, we use VDU’s for so many hours a day that this flicker can be a real cause of discomfort - even if we are not consciously aware of it.

The light emitted from a TV set or VDU screen is in fact a rapidly moving line, which quickly fades away and has to be repainted over and over to give the illusion of a steady light. The rate at which the entire screen is painted is its refresh rate. (Terminology: 50 times a second is called “50 Hertz”, usually abbreviated to “50 Hz”)

Why Windows is a special problem

Until 1990, most people did not realise that computer screens flicker. Computer manufacturers knew, but they did not realise that flicker would become an occupational health issue. So with the exception of a few European computer manufacturers, nobody did much about it.

Screen refresh rates in 1990 were as follows:

- Monochrome screens and CGA colour screens - usually 50 Hz
- EGA colour screens - 60 Hz
- Macintosh small monochrome screens - 67 Hz
- VGA colour screens - 70 Hz in text mode, 60 Hz in high resolution graphics mode, 70 Hz in low resolution graphics modes.

Before Windows, nearly all computer screens displayed bright text on a dark background. More than 90 percent of the screen was dark, so the total amount of light coming from the screen was small, and the screen's flicker had little effect on the user. The main comfort issue was ease of reading the screen, and that was mainly determined by glare and reflections.

Although Windows 2.0 was used for some specialised applications such as optical character recognition, version 3.0 was the first version of Windows to be widely installed and to be used for long periods. Version 3.0 was introduced in 1990. It displays images on a bright screen background, so the total light coming from the screen is more than ten times higher than it was before. This bright background display has real benefits - it reduces the visibility of glare and reflections by as much as three times - but it greatly increases the impact of screen flicker.

The second problem is that running Windows on a 1990 personal computer reduced the refresh rate from 70 Hz (720 x 400 text mode) to 60 Hz (in what was then called “high resolution graphics” or 640x480 resolution mode). This reduction in refresh rate came about simply because it takes longer to draw 480 lines than to draw 400, so fewer screens can be drawn per second. (In fact on many 1990 screens the refresh rate running Windows was only 50 Hz!)

So Windows introduced both a lower refresh rate and higher average screen brightness – combined, the result is to produce severe visual discomfort for many users. I was one of them - which is why I became interested in screen flicker in the first place!

I find that 56 Hz refresh rate makes me feel physically ill; I can work with 60 Hz refresh rate for a few minutes before my eyes object; and at 72 Hz I can work for some hours, but I get eyestrain if I work any longer than that. At 76 Hz I do not get eyestrain unless I work for more than eight hours, but I find 80 Hz even more comfortable, and 90 Hz better again.

In 1997, most users have the option of a comfortable refresh rate, but do not know it. As a result most PC screens are still flickering at 60 Hz!
**Screen brightness**

The brighter the screen, the more intense the impact of flicker, just as loud noises are more distressing than soft ones.

If you are feeling tired, turn down the brightness of your screen. Turning off fluorescent lights can also help, as flicker from fluorescents can be just as troubling as screen flicker.

However! Turning down the brightness of the screen makes reflections more visible and makes the screen harder to read. And it only reduces flicker discomfort a little. Increasing the refresh rate is far more effective.

**Field of view**

The more of your field of view that the screen occupies, the greater the impact of flicker. Most recommendations for refresh rate (ie the claim that “72 Hz is flicker free”) assume that you are using a 14 inch screen at arms length. A larger screen fills more of your field of view. So your eye takes in more flickering light, and you will need a higher refresh rate for the same degree of comfort.

The first Macintosh screens had only 67 Hz refresh rate, but because the screens were so small, this did not cause visual discomfort. When Apple increased the screen size, they increased refresh rate to maintain comfort.

Increasing the refresh rate from 72 Hz to 75 Hz makes a big difference in comfort. A 17 inch screen really should not be used at less than 75 Hz refresh rate. A very bright 20 inch screen may require 100 Hz refresh rate before all users are comfortable!

**Who sees screen flicker?**

![Graph showing the percentage of people affected by screen flicker at different refresh rates.](image)

**Refresh rate - the most important factor for visual comfort**

As explained above, when 14 inch screens were the norm, there was a general belief that 70 Hz refresh rate was sufficient to avoid flicker discomfort. This was indeed true for the “average person”, but definitely not true for some 25% of people, however in earlier years they could go to other jobs which did not involve computers, or could use DOS applications.
From 1990 to 1992 I ran a campaign to convince manufacturers to increase refresh rates. The two companies which gave early support to this move were NEC and Elite Industries. NEC’s support was the key to convincing Australian computer journalists about the reality of flicker, and Elite’s support took the ideas directly to the public through funding the development of high refresh rate drivers and through providing display space for me at Australia’s personal computer shows.

Those drivers were written by Mark Evans, a gifted programmer. Mark and I held what was probably the world’s first public showing of a computer monitor refreshing at 90 Hz on the Elite Industries stand at the 1992 Personal Computer show in Sydney. At that show, many computer users came up and spoke to us of the discomfort they experienced when using Windows. Some could only use Windows for one to two hours before having to take a break to prevent a buildup of headache.

In 1998, special high refresh rate drivers are not needed, as virtually every video card manufacturer provides the user with a means of adjusting the refresh rate – as long as you can find it!

The World Health Organisation recommends at least 85 Hz refresh rate on a 14 inch screen to ensure that all users are comfortable. After many years of resisting change, the manufacturer’s standards body VESA (Video Electronics Standards Association) also settled on 85 Hz as their recommended refresh rate.

That does not mean that every screen in the office must run at 85 Hz or more. If an individual is comfortable at 72 Hz, there is no reason to change. But every office needs to be able to provide a higher refresh rate, for individual staff as one or more people in the office are likely to be especially flicker-sensitive.

As screens get bigger, there will be a trend towards even higher refresh rates, for television as well as computers. A larger screen fills more of your field of view, so the refresh rate should be increased to compensate. European TV manufacturers such as Philips and Loewe have released large wide screen television sets which refresh at 100 Hz - twice as fast as the standard TV set.

The higher the refresh rate, the longer people can work without headache or eyestrain. But we do not want you to sit so long or work so hard at your ultra-comfortable screen that you develop other problems - you still have to look after the rest of your body!

**What does a high refresh rate look like?**

One of the difficulties in explaining refresh rate is that although most people are troubled by slow refresh rates, they cannot actually see the screen flicker, and do not know why the screen is causing them discomfort.

At 90 Hz refresh rate, the image on the computer screen looks like it is painted on. It does not look like a “real” computer screen! A high refresh rate screen is often described as “more stable”, or “calmer”.

That makes it hard to sell high refresh rates, as most people when shopping for a computer are looking for something exciting - which is precisely what you don’t need after ten hours in front of the screen!

**What refresh rate does my computer have now?**

Most likely, 60 Hz! The average computer store employee does not know what refresh rate means. Unfortunately, most information technology specialists within large organisations do not understand flicker either, so there are many large organisations (banks, government departments and so on) with floor after floor of flickering VDU screens.

A few video card manufacturers have made flicker a priority, and bring a refresh rate control to the forefront of the video card’s utilities; but in most cases you have to go searching for it.

A few manufacturers set up their computers to run at a high refresh rate; but others of equal or even greater reputation surprisingly have not.

**Less blue, fewer headaches**

There is some evidence that blue light causes much of the discomfort associated with screen flicker. This
may explain why flicker is less troubling on monochrome monitors with a warm hue, as these emit relatively little blue light.

In a British experiment, high school students were given glasses which blocked blue light. They reported a large reduction in migraine headaches when using computers and working under fluorescent lights.

It is also possible that some of the “sick building syndrome” problem is actually due to screen flicker and fluorescent light flicker. There is much less problem where natural light rather than artificial light is dominant.

To reduce the amount of blue that your VDU screen produces, change the colour of “white” on the Windows screen. If you are running Windows in 256 colour mode or higher, you have a reasonable choice of screen colours; experiment with an off-white instead of the sometimes harsh “Windows white”.

Alternatively if your monitor has a colour control, turn down the blue level.

Whichever approach you take, the colours will look strange at first, but your eye quickly adapts - the same as your car headlights look a little yellow at first but after an hour driving in the country they look white.

Even if you do not want to make the white warmer, you can still reduce the impact of flicker by adjusting the colour of borders. When displaying a word processing document the area of the “page” on which the text is typed (ie inside the page margins) is best viewed with a white background, but the area of the margins and the background behind the page does not have to be white. Set those areas to a darker colour, perhaps just a grey, to reduce the total area of the screen which is brightly illuminated.

Fluorescent light flicker

Fluorescent light flicker can cause headaches and eyestrain in the same way as VDU screen flicker. Standard fluorescent lamps switch on and off 100 times a second. Although in theory this is too fast to be seen or to effect you, it is likely that the tubes conduct more in one direction than in another, and that as a result fluorescent lights produce some 50 Hertz flicker. For people who are sensitive to fluorescent light flicker, some solutions are:

- Move to a window desk so you can work mainly under natural light. Turn off most of the fluorescent lights above you, or turn off every second tube (by rotating it 90 degrees in its socket).
- Use an incandescent desk lamp.
- More expensive but the total solution - replace the ballasts in the fluorescent lamps with high frequency ballasts which switch on and off 30,000 times a second or more. Philips and Helvar produce these ballasts. They also allow a fine and smooth control of overall lighting levels, so have them installed with a suitable dimmer.
- Use tri-phosphor tubes which have more of the warmer, longer wavelengths than standard tubes (and therefore less of the blue).

The longer you work each day, and the more stressful your job, the more important it is to have good lighting.

Light tables

People who work with photographic slides often use “light tables”, which are Perspex tabletops with fluorescent lights underneath. These can be even worse than VDU screens or overhead fluorescent lights for producing flicker headaches. The remedy is the same as for fluorescent light flicker - install high frequency ballasts.
Anti-radiation filters

Most “anti-radiation” filters make claims such as

"blocks 99% of E-field radiation!"

“E-field” means electric field. Electric fields do not radiate, they just sit there. Combing your hair on a dry day produces a high E-field; walking across a nylon carpet does too. A torch battery produces an E-field, so does every electrical appliance in your house, so do clouds.

I am not aware of anybody who has suggested that electric fields from VDU’s are harmful. “Anti-radiation” filter makers are claiming to solve a problem which does not exist.

The controversy about VDU’s has been about magnetic fields, not electric fields. Screen filters cannot block magnetic fields.

(There is a device which wraps around the rear of the VDU, and does reduce the VDU’s magnetic field, but it is hard to see a good reason to recommend it, however it does no harm.)

It is not clear that there is any risk from exposure to low levels of magnetic fields. Although some people claim that there might be a small risk from exposure to magnetic fields from power lines, there is no clear evidence even for that claim, except in relation to young children - and even then it is not clear whether the magnetic field causes the problem or whether it is something else associated with power lines.

It is probably not a good idea to live under a high voltage power line if you have young children, and it is probably not a good idea to let them sit next to a television or VDU screen. However once you are grown, there is at present no good reason to believe that a VDU, television set or power line is harmful.

What if the scientists are wrong? Most of the studies done to date have failed to find a problem. I think that means that if a problem does exist, it is very small.

Depending on your age, the main risks in your life are smoking, drinking, driving, bad diet, entertaining aggressive and hostile thoughts, and lack of exercise. Concentrate your efforts on those!

Stress

The simplest definition of stress is, being ready to act for too long without a rest. This readiness to act (called “activation”) involves our muscles and our brains.

There is an ideal level of activation for each of us, at which we perform best. Too little activation means we don't put enough into the job. To give a physical example, if we only feel like lifting five kilograms and the box weighs ten, it won't budge - not because we are not strong enough, but because we are not applying enough effort.

Too much activation results in our brains going into “overload”. As an analogy, if you turn the brightness on your VDU up too high the image goes out of focus. The screen is brighter than before, but less readable. In the same way, too much activation reduces performance. We end up running around “like a chook with its head cut off” - lots of action with little result. A common symptom is that instead of doing the job we sit cursing as we make one mistake after another through rushing.

Even if you work at an ideal level of activation, you still need to take breaks. You can also become over-tired from working too late into the night, or from working all weekend. Our bodies need an alternation between activation and relaxation. In traditional terms, “Hard work never killed anyone - a lack of rest did!”

You could be activated in the wrong direction. If you are bored or consumed by negative thinking, your attention will not be focussed on job accomplishment but you will still get tired.

So there are three broad strategies for reducing stress.

First, if the problem is excess activation, you need to relax a little. Don't take the job so seriously!
The second strategy is to get yourself a life outside of work. “All work and no play makes Jack a dull boy, and Jill a dull girl.”

The third strategy is to make peace with the boss and with yourself so you can get on with the job.

For a detailed explanation of stress at work, see “The Pocket Stress Reliever”.

**Setting refresh rates**

Each video card has a slightly different method for setting refresh rate. If you read the documentation which comes with the card you will be able to work out how it is done.

**Setting refresh rate under Windows 3.1**

If you cannot find an icon for a refresh rate utility, it is worth looking around your hard disc to see if there is a directory called “VGA” or “VGAUTIL” or “TRIDENT” or “S3”. The refresh rate control program might be already there.

If you cannot find the utility, look at your installation discs and manuals; finally look up the Internet. For instance if your card is a Trident 8900D, use Alta Vista to search for ”8900D driver”.

If you do not know what type of video card you have, watch the top of your screen when you start the computer. Video cards often present a message there announcing what they are. Otherwise, run the Microsoft utility MSD (usually found in your DOS directory) which will identify the type of video card, or at least the chipset. A Windows diagnostic program such as Norton Utilities will provide much more detailed information.

Most video cards manufactured in 1995 and later provide a refresh rate control which can be run from within Windows; for instance the “Hawkeye” utility from Number 9, and the “In Control Tools” utility from Diamond. It is always worth looking on the Internet to see if improved utilities have been released for your card.

Older cards often have a utility on their installation disc which provides refresh rate control, but this will need to be run from DOS before Windows is started. The name of the utility varies, but it could be one of the following:

- vesa.com
- dmode.com
- setmode.com
- vmode.com

With some of the above, you will need to use extensions, for instance “vmode 72” means “set video mode to obtain 72 Hz refresh rate”.

Older cards are less likely to be capable of refresh rate adjustments than more recent cards. A good new video card costs under $100, so it is not worth spending too much time trying to get an old one to work. Try to find the discs which came with the video card, have a look on the Internet, and if you are still having no luck buy a new card.

Caution - high performance cards are cheap only for PCI bus motherboards. For around $60 (Australian price, 1998) you can get a very good fast PCI bus video card. A good fast ISA bus video card will cost you a lot more than that, as they are no longer being made, and you will be paying 1994 prices. So if you have an older style motherboard, you might find it better to replace the entire computer rather than to buy a new ISA bus video card. It’s worth asking about that option.

**Setting refresh rate under Windows 95**

Although the Windows 95 CD contains drivers for most video cards, it does not always correctly set up their refresh rate. In particular, cards which use older S3 video chips often start up with very low refresh rates (for instance, 800 by 600 might default to 56 Hz refresh rate even if your monitor can support 90 Hz...
refresh rate at that resolution).

The answer is to download the latest video driver from the Internet site of the video card manufacturer. These will install into Windows 95 and will generally integrate with the Microsoft display control program.

To change your display driver and properties, right click on a blank area of the Windows 95 desktop. In the original (1995) Windows 95 the video driver might install a “Refresh rate” tab in the Display Properties box, but in later releases the refresh rate control might be found as a button labelled “Advanced properties” in the “Settings” tab. Unfortunately, the 1997 release of Windows 95 does not work correctly with the 1997 release of the S3 refresh rate control! So make sure you get the latest version of the drivers.

Although Windows 95 Help contains no entry titled “refresh rate” and no entry titled “flicker”, if you search the installation CD you may find some useful information.

**Windows 98 and later**

Windows 98 has better support for refresh rate control than Windows 95, but you have to dig into Windows to find it. Refresh rate is set under the “Adapter” tab of the “Advanced settings” in “Display properties”!

**Conclusion**

Don’t be put off by computer-speak when trying to solve an eyestrain problem. If you feel that there is something the matter with your screen, there probably is!

For instance, one user who complained that their screen wobbled was found to be working next to a large power cable. The magnetic field from the cable did actually cause the screen image to wobble. Others find a similar problem when two screens are placed too close together.

So persist in your efforts to get a reasonable visual environment. Although eyestrain does not cause eye damage, it is uncomfortable, and it is worth putting in some effort to get it right.