Factors that can affect your personal comfort.

Have you ever noticed that some rooms are comfortable to sit in while some others are distinctly uncomfortable after just a few minutes, even though the air temperature is the same?

Have you ever experienced the office thermostat being changed up and down by some folks who like it warm and the others who like it colder?

What are the factors that contribute to a comfortable environment and why is it so difficult to find the 'Goldilocks Zone' of just right?

Air temperature alone is not a good predictor of how comfortable you will feel in an air-conditioned space.

Your body is finely tuned to detect how much heat is entering or leaving your body. Lose too much heat and you feel cold. Gain too much heat and you will start to feel hot & uncomfortable. Striking the right balance between heat loss and gain is the key to finding a comfortable environment.

Heat is transferred between the body and the environment via 3 pathways – convection, radiation and conduction. Convection is typically from the body to the surrounding air, radiation can be from sunlight or being close to a warm object and conduction is from a solid to your body surface (think of lying on the cool bathroom tiles on a hot day)

Factors that affect human comfort

1. Air temperature
2. Radiant temperature
3. Air speed
4. Humidity
5. Personal factors – metabolic rate & clothing levels

The first 4 factors are functions of the environment and air conditioning systems. The last one is a function of your activity levels and what you are wearing.

Air temperature is what you can measure with a thermometer or your air conditioning systems thermostat.

Radiant temperature is a measure of how much heat radiation is falling on your skin and clothing. Think of how nice it feels on a cold day standing in the sunshine.

Air speed affects the convective heat transfer from your skin to the surrounding air. You would be most familiar with the way air speed interacts with air temperature to give 'wind chill'.

Humidity is a measure of how much water is dissolved in the air. This is important for personal comfort because the body can lose heat by sweating. If the air is already full of water (high humidity) then sweating is less effective.

The two personal factors of metabolic rate and clothing are very important and probably have the largest effect on your comfort levels

Your metabolic rate (think of having an internal furnace that is burning food and turning it into heat) is a function of activity. Its typically low when you are sleeping and resting but quickly rises when you become active.

Clothing levels directly change the amount of insulation between your body and the environment. More clothing equals lower heat loss, great if you are outside on a cold day but if you are overdressed on a hot day indoors then this may cause you to turn down the AC thermostat unnecessarily. If you are sitting down in a chair, then that chair also counts as your clothing.

So how do these 5 factors interact? The University of California has put together the 'Centre for the Built Environment Thermal comfort tool' that will give you an insight into finding a comfortable combination of these factors.

For the technically minded, you can find this tool on line at http://comfort.cbe.berkeley.edu/

Figure 1 is an example of an environment that 95% of people would regard as comfortable. The red circle is square in the middle of the blue 'Goldilocks Zone' – just right

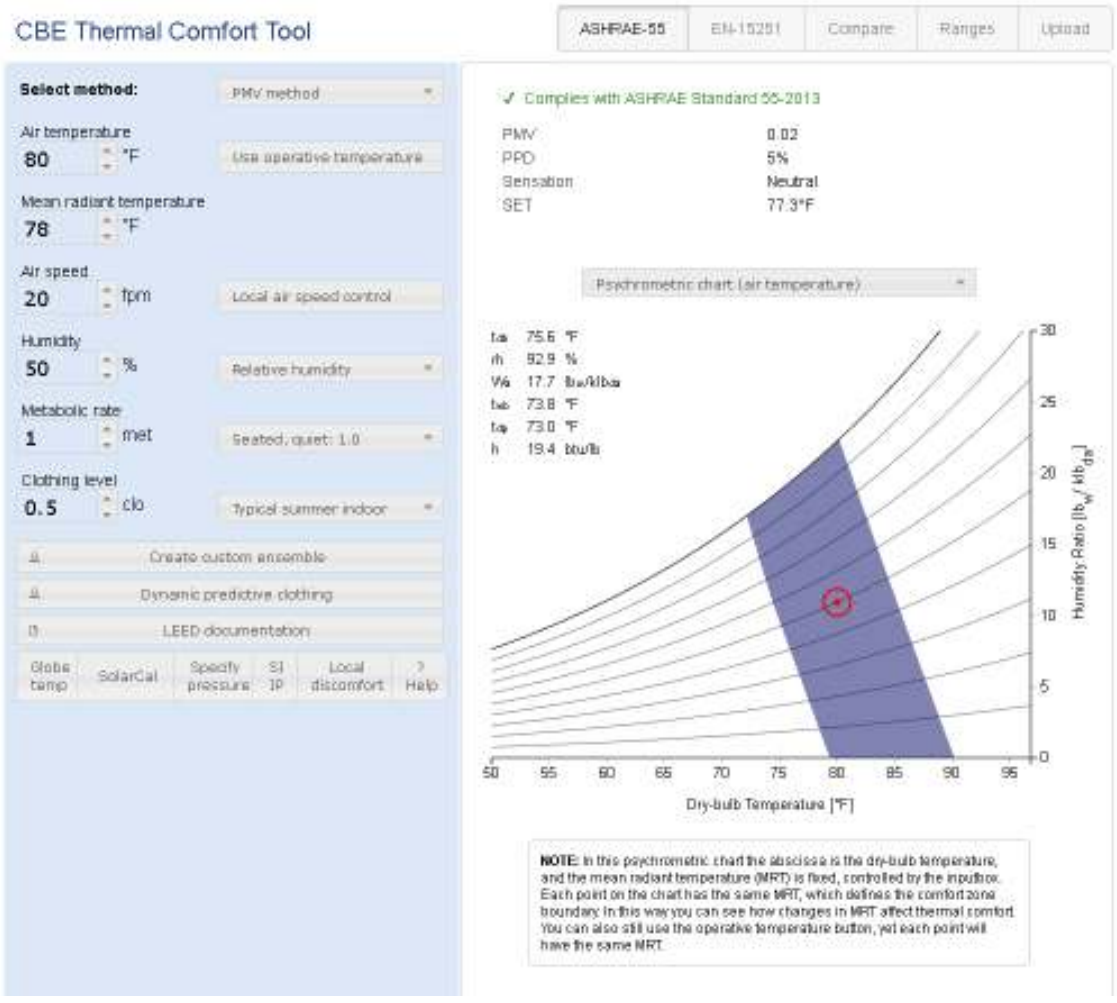

Figure 1 - Just right

If you change any or all of the factors above, then you can move the red circle out of the blue zone into uncomfortable.

Figure 2 is an example where the radiant temperature is up a bit (some direct sunlight on your body), the air flow has decreased and humidity has increased. Note that you are still seated quietly in the same clothing as the first example and the air temperature has not changed from 80°F. This is a condition that 1 in 5 people will find uncomfortably warm

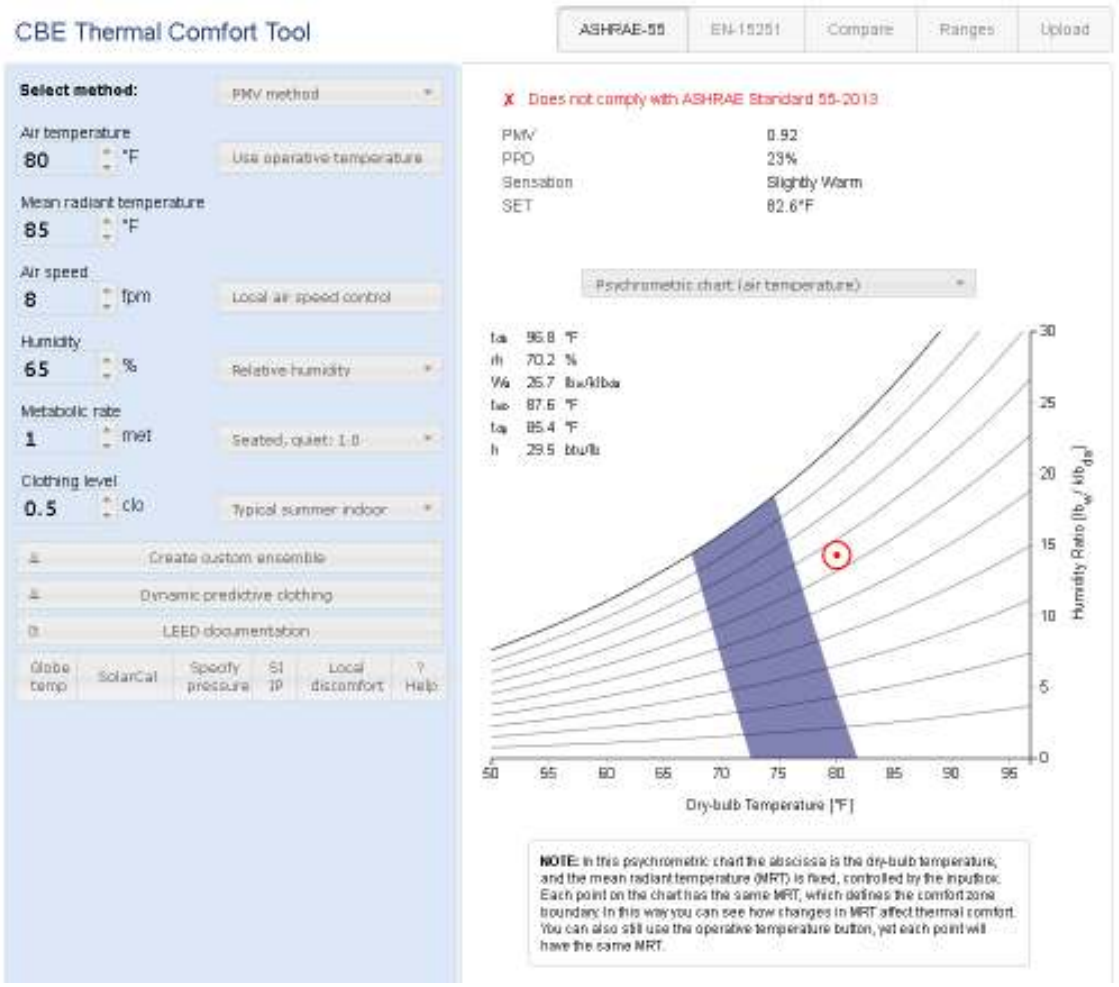

Figure 2 – Uncomfortably warm

Why do I go to sleep comfortable but wake up cold even though the air temperature hasn't changed?

As you move into sleep your metabolic rate decreases and you are generating less heat. Starting from our original example of comfortable conditions and decreasing the metabolic rate to sleep levels we see that 70% of people would find these conditions too cool with that level of clothing.

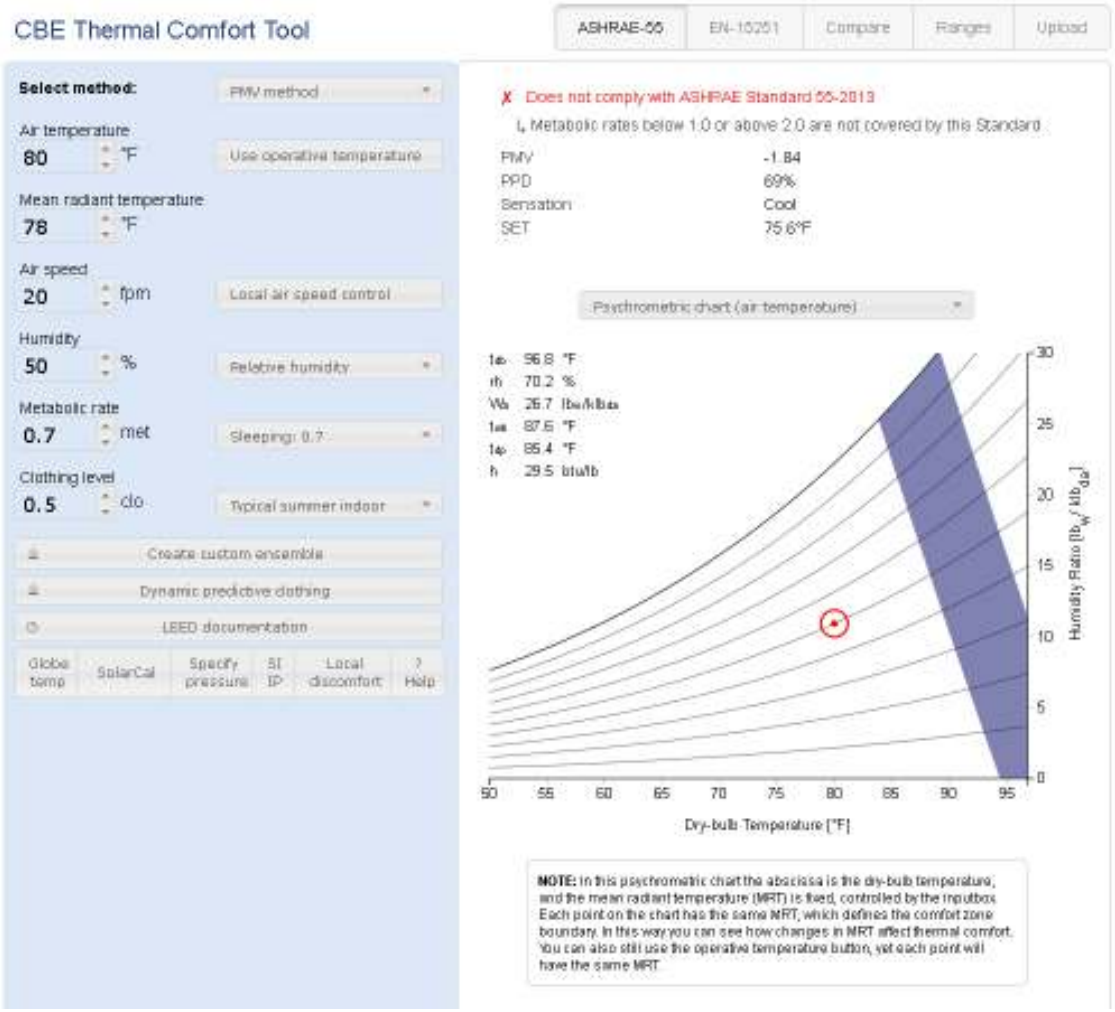

Figure 3 - Too cool during sleep

Another interesting point from the Berkeley comfort tool is that even with every condition exactly right 95% of people will be satisfied but 5% will still be dissatisfied. Personal comfort is a very personal thing!

Two other factors that can influence your comfort levels are to do with air quality - CO_2 (carbon dioxide) and VOC's (volatile organic compounds) concentrations. CO_2 is produced as you metabolise food, so there is no getting away from it. However, ensuring that there is a supply of fresh air will dilute the CO_2 and prevent that 'stale room' feel. High CO_2 levels will lead to fatigue and poor concentration. VOC 's come from most of our modern plastic based furnishings & paints. Probably best known is the 'new car smell'. Different people can have vastly different reactions to VOC levels in the air. Again, the only remedy is ensuring a good supply of fresh air enters your living area.

Summary:

1. Adjust your clothing levels to suit your environment. It's the most effective factor that you have direct control over. Getting this right will save on air conditioning & heating costs.
2. In hot conditions it pays to eliminate direct sunlight entering the room. This contributes to the radiant temperature that you experience.
3. Ensure that you have an appropriate amount of fresh air entering the room. It will improve your levels of comfort and reduce fatigue.
4. Air temperature, Air speed and humidity are functions of your AC system. Ensure that your system has the right cooling capacity, will deliver the right amount of air flow and can dry the air in humid conditions.
5. Comfort levels during the sleeping hours can be improved by use of an air conditioning system's SLEEP function. This will allow the air temperature to increase slightly and help to prevent waking up cold as your metabolic rate decreases through the night.