

The difference lies in the trousers

Rebecca Taylor and Rebecca Bunn raising the sails in the Baltic.

Photos: WSA

In most outdoor activities we pay great attention to what we wear in order to be comfortable. That is, except for trousers. Trousers have a certain distinction. They are an old invention and were found in use 10,000 years ago made of fur and hide. Indeed when the Persians fought the Romans wearing trousers we are told that the Romans felt sorry for them. Industrialisation was the time when we really began to get serious about trousers and there was no more essential moment in their development than the introduction of the 501 classic from Levi in 1873.

According to W.L.Gore trousers are more important than you might think, so much so that it ran a symposium on the subject of functional trousers in the workplace to explain the point and demonstrate what its products can do about it.

What's the answer? 37

The key to everything lies in the number 37. This, in degrees centigrade, is the human body core temperature and the body gives us surprisingly little room for manoeuvre. Uli Spindler has been with Gore for eight years and is their expert in comfort. He explains that variation from core temperature soon leads to discomfort, or more seriously to death. Core temperatures of 30°C up to about 42°C mark the limit. Mankind developed in warm climates so no clothing of significance was needed to keep body temperatures up. As soon as ancient man began to move to areas like northern Europe or Canada clothing became essential. "We may think of clothing as fashion," says Spindler, "but essentially it is all about temperature control." In warm climates sweating or reducing activity works well to keep body temperature under control. Heat



Uli Spindler, comfort guru from W.L.Gore

removed as sweat evaporating from the body is particularly effective; one litre of sweat per hour removes 670 watts of heat. For those working in warmer conditions, having breathable clothing is important to avoid interfering with the body's ability to dispose of sweat.

Heat loss arises primarily from temperature change, but is accelerated by additional factors such as rain, wind and snow. On the heating side, factors over and above temperature are muscle activity and basic metabolism. Muscles fatigue over time and cannot continue to help raise body temperature forever. When temperatures cool, body heat is retained by the constriction of blood vessels near the body's surface and then by shivering, which uses muscle contractions to increase metabolism. Shivering can result in a maximum fivefold increase in metabolism. Below about 4°C one cannot sufficiently increase the metabolic rate to replace the heat lost to the environment, without the addition of clothing of some sort. Chattering teeth is the body's mechanism to tell us that we need to change activity.

Air is the great insulator

Clothing acts as a protection layer between the skin and the cold external ambience. Textiles usually contain 95% air and it is this which provides the insulation. If the air is not well contained it will not be so insulating. Wind will cut through air permeable clothing and reduces the effectiveness of the still air layer, while rain acts like sweat and removes heat away via evaporation. Wet clothes insulate three times less well than dry ones. Functional clothing, which protect against weather and a variety of hazards (these can include fluids, fire and blood) needs to offer the appropriate level of insulation, windproofness and waterproofness, all married with appropriate breathability. Other types of protection depend on actual type of use.

The breathability is most important as any high activity will create a sweat build-up inside, then when the activity is stopped it will get very cold.

Management of body temperature in the upper body is much easier via layering which in its simplistic form can involve removing a jacket or jumper when coming indoors out of the cold. Yet the torso area, where layering is easy, only covers 45% of the body surface area. To be comfortable you have to be sure that this part of the body is also in good shape. Spindler says, "If your legs are cold then your feet will certainly be cold, and before long your torso will also be cold." A cold body implies a weaker immune system and cold muscles are weaker and more susceptible to injury.



For well over one and a half years the Rhineland-Palatinate state forest workers have been wearing new duty trousers equipped with the windproof and breathable Windstopper liner which forms a vital part of their integrated clothing system.

Layering below the waist is not so easy, and, apart from the New Zealanders who regularly "tramp" wearing long johns under shorts, changing trousers in public is not appropriate or culturally acceptable in most modern societies. Trousers are normally worn all day and are directly against the skin, so the comfort demand for trousers is much higher than that for a jacket.

Comfort is the absence of discomfort

The challenge for companies such as Gore is to introduce membranes into the trousers in a way that will make them neither unwieldy or uncomfortable, nor too thick and hot for warm temperatures. Under questioning Spindler defines comfort as the "absence of discomfort" and extends this in trousers to cover not only the physiological issues related to body heat, skin temperature and sweat coverage but also the sensorial, ergonomic and psychological.

These complex terms underlay the complexity of trousers themselves, with the sensorial covering areas such as skin sensation and irritation, ergonomic all to do with fit and functionality, an area in which trousers are more demanding than jackets and jumpers, and the psychological aspect to do with expectation, mood and noise. Noise is an important property for golfers while women rate mood and look highly.

Sensorial comfort and wet-cling

Based on these sorts of categories Gore has used the Hohenstein laboratory to test for skin sensorial comfort when three-layer Windstopper laminates are incorporated and found they perform well against conventional trousers. This test looks at areas like wet-cling, hairiness, stiffness and contact points. This was then confirmed in actual wear which also allowed the measurement of micro-climate and skin temperature. The outcome was that trousers with Windstopper laminates clearly kept the body warmer in cold climates, yet did not create discomfort indoors.

Endorsements for this are provided by the German producer Schöffel. The product manager Herbert Lindenmaier describes how in 1961 it changed from dealer to manufacturer and now like the versatility available with a trouser using Gore-Tex laminates. One of its favoured products utilises a removable Windstopper-Flanel liner. With this the company has lightweight summer-like outdoor trousers suited to hot summer days, with excellent breathability and perfect wearing comfort, and in autumn the introduction of the Windstopper lining creates a warm trouser, which is windproof, with good breathability and some protection against moisture.

Organisations such as the Rhineland-Palatinate State Forestry service moved to polyester and Windstopper trousers as part of its new uniforms to give protection allied with flexibility for bending. It is curious to consider that a mix of material and waist band height made bending difficult in its previous equipment and that the introduction of Windstopper while not protecting against thorns does protect against nettle stings.

Conference attendees were given the opportunity to test Gore-Tex Windstopper trousers while sailing in the Baltic Sea off Travemünde. This was a good location, so famous for its cold winds that to sit on the beach sunbathers are given a characteristic solid backed chair to protect them from it. Out on the water attendees noted that the wind was significant and more than one was well aware that while the Windstopper laminate in the trouser certainly did the job, "not to bring the extra fleece for the upper body was a mistake in the Baltic".