RISE TO THE CHALLENGE: OUTLAST AND C.RUSS



Sleeping bags are, traditionally, highly insulated products.

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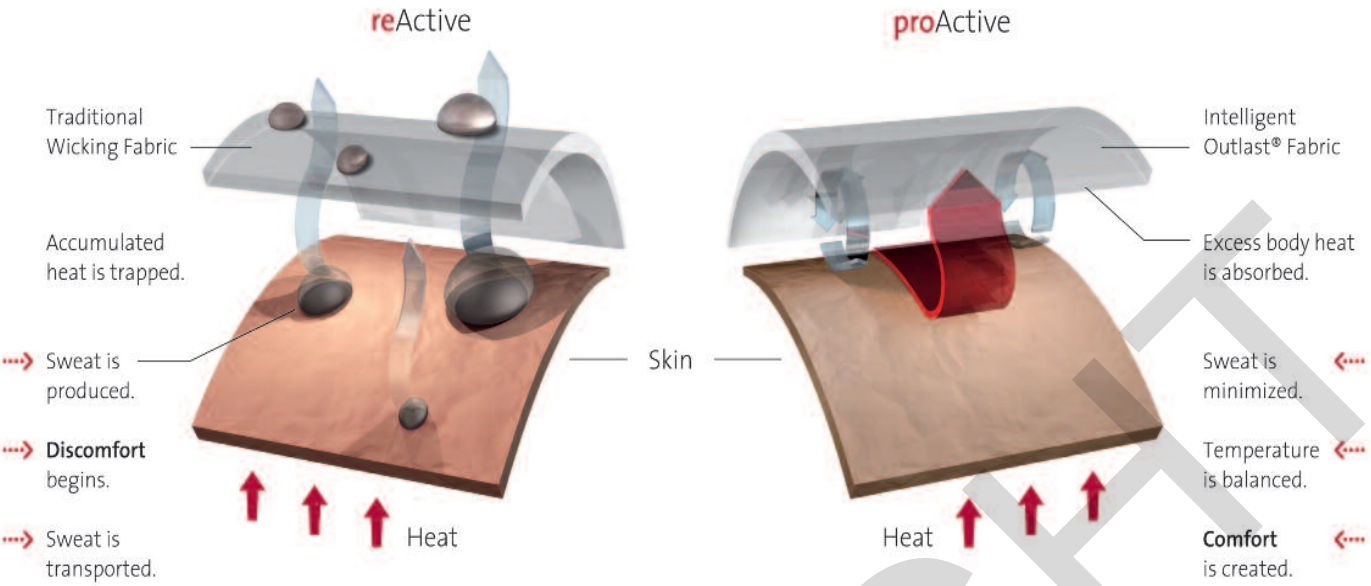
With too much emphasis on temperature control, a specialist consultant believes the outdoor industry is missing an important point in the comfort debate. Different people feel comfortable at different temperatures. Humidity, however, can make it hard for anyone to have a comfortable night's sleep.

Humidity causes discomfort

Outdoor enthusiasts often feel they sleep less well than usual in a sleeping bag. It's too easy to become too hot and less easy to adjust your position than it is at home in your own bed. Christoph Russ, a Munich-based entrepreneur specialising in climate control, is adamant that humidity rather than heat is the problem and he is currently working with phase-change material (PCM) technology provider Outlast to develop solutions for products (including sleeping-bags) that will cope well with the humidity generated by the body of a tired trekker and offer a better night's rest.

Time for bed

He's been examining the effects of humidity on sleep for more than four years, looking, for example, at the way conventional duvets can



trap humidity making sleepers uncomfortable during the night. A test he carried out in 2009 involved putting 31 sensors on the outside of a duvet, 24 on the inside and one in the bedroom to measure temperature and humidity. Mr Russ is quick to point out that absolute humidity is the key. Perhaps a surprisingly straightforward concept, absolute humidity is the amount of water vapour in the air. Humidity measurements often calculate relative humidity, which is the amount of water vapour in an environment relative to the maximum possible for the current temperature. The key point for Mr Russ is that if the air is warm, it will tend to capture more water vapour than cold air, humidity will build up, making it much more likely that a level of absolute humidity will develop at which the body will become uncomfortable. Independent of the temperature, absolute humidity is an objective and accurate way to express the connection between climate and comfort.

"Climate is what we measured in the duvet test," he explains. "That, and the thermo-regulatory process of human beings. People react differently, comfort-wise, and we found that absolute humidity was the best way to establish a measure that offers the best fit with human comfort. If you look at temperature alone, half of the people taking part in the test will say it's great; the other half will say they are uncomfortable. Temperature alone doesn't tell us enough." Duvets that come out of this test best are ones with holes in them, specially constructed vents that can work like chimneys allowing the body to emit vapour before humidity builds up to an uncomfortable level. "In regular duvets these chimneys don't exist," he continues. "So humidity accumulates, creating more heat beneath the duvet."



Cool heads

He's tested the same thing in cycling helmets. The test took place in a climate chamber at 20°C and 50% relative humidity. The bike ride was simulated with an airflow fan at a speed of 20 kilometres per hour. Sensors measured the conditions inside the helmet and in the chamber. Poorly designed helmets accumulated heat in several areas and as well as humidity as the temperature rose. In turn, the retained humidity created what Mr Russ calls "heat traps". In other words, it's something of a vicious circle. The hotter it becomes, the more humidity the helmet retains, meaning it will become hotter and more humid (which is to say less comfortable) still. "All cycling helmets have holes," Mr Russ explains, "and they work with aeration, when the bike is in motion. But when the bike is at rest and there is no aeration, the cyclist wearing a poorly designed helmet cannot

(Top:) Outlast technology reduces sweat production. It absorbs excess body heat, reducing the body's need to produce sweat to cool itself down.

(Above:) To become a new Outlast product designed for use as a sleeping bag filling.

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Campers will enjoy a better night's sleep if their sleeping bags control humidity better.
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evacuate vapour effectively enough. In just 30 seconds, it can become too uncomfortable to wear, at which point the cyclist will often take the helmet off. This is a much more important point, in my opinion, than, say, the ergonomic fit of the helmet."

Body heat

Sleeping bags are usually well insulated pieces of equipment. Depending on his or her physiology, a camper or a trekker may soon feel too hot inside one. And when we feel too hot, we perspire because the body's natural way of cooling itself is to evaporate perspiration from the surface of the skin [see Ask The Expert in the July/August issue of *WSA*]. "But once you start to perspire, your body is already saying it's too hot," explains Christoph Russ. "It's insulated, so it will accumulate humidity. You will turn over because it's become uncomfortable and your body will want to cool down. Eventually, you will wake up, even if only briefly."

Only briefly, but enough to break your night's rest. Mr Russ believes PCM technology in sleeping bags can help because the PCM can receive the heat the body wants to emit. Outlast is excited about the possibilities, too, especially for one of its most recent developments, an insulation technology called PCM polyester fibre fill. The managing director of Outlast Europe, Martin Bentz, describes it as "a new development for managing heat in an optimum way". Among the first applications of the new product are sleeping bag manufacturers including it as filling, with Outlast saying specifically that it will help balance temperature and humidity during the night. Applications in apparel, for example, as fill for jackets, will also be possible further down the line, Mr Bentz says.

PCM brings humidity down

Christoph Russ has carried out tests on PCM polyester fibre fill in duvets and has calculated that it can reduce absolute humidity by 48% compared to conventional products. "This is an impressive added value," says Mr Bentz. "Outlast technology works continuously to manage heat and moisture while reducing sweat production right from the beginning, so less humidity is created. The phase change material can absorb excess body heat when it is created, which means the body will not have to produce sweat to cool you down. This is also more hygienic."

For his part, Christoph Russ makes the observation that the outdoor industry is "extremely marketing-driven" when it comes to functionality such as the breathability of fabric or water-repellency, but that it is inclined to "ignore the differences between individuals" when talking about comfort. He feels that measuring humidity is "not yet accepted" by the industry as a good indicator of levels of comfort. Previous tests have concentrated on measuring the climate at specific spots on the body, such as the kidney area or somewhere on the spine, while ten centimetres away the levels could be totally different, he says. "But humidity is the best measure," he insists. "Better than temperature. And it will be seen as such, more and more."

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