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TEXTILE CHALLENGE: CATERING TO THE HUMAN BODY IN FLIGHT

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INTRODUCTION
Unknown to many of the 3 billion air travellers per year, the human body is subjected to physical stress during commercial flights. As the cabin is artificially pressurized with a moisture level that is less than in the Sahara desert, the in-flight climate causes travellers to feel dry skin, eyes and nose; have an accelerated heart rate and feel body gases expand in their ears and stomachs. Passengers with lung problems (or smokers) might suffer from slight hypoxia and get head aches. Furthermore, on certain routes passengers are affected by cosmic radiation.
However, this not only affects the passengers but also the many crew-member. They have further physical challenges to deal with such as climate changes when they leave a hot country like Singapore and stand at an open door after landing in Moscow.
The question for the future of air travel is how textile innovations can cater to the human needs of the body, in cooperation with knowledge from aviation medicine. How can air travel be improved? The idea to research this question comes from the author's own experience as a flight attendant on long-haul flights with an academic background in textiles and fashion.

IN DETAIL
Both cabin crew members (CCM) and passengers (PAX) are subjected to physical discomfort during long-haul flights.

1) LEGS and CIRCULATION: A CCM walks an average of 22000 steps or 18km per long-haul flight (author's own experiment), burning 1000 kilo-calories. Meanwhile PAX are confined to their seats for many hours. Both situations are bad for the legs and blood circulation and would benefit from compression tights.

2) DEHYDRATION : The external air of about -60° C is sucked in, compressed and cooled down, mixed with cabin air and delivered at an increased temperature. However, for pilots the air is not recirculated but kept fresh to ensure their absolute alertness (Egli, L., Jardine, A., Krogerus, M., Maggi, B., Sachse, G. Schneider, R.U., Weber, D. August 2009).
In the cabin where CCM and PAX spend hours, at 12% the cabin air is dryer than the air in the Sahara and causes dry eyes, nose and skin and can even cause dehydration. The ideal textile to be used here could be a moisture-delivering fabric which can be used both as the uniform for CCM and as travel clothes for PAX. Such types of fabrics are already used for hosiery and underwear delivering aloe vera or vitamin E through the technique of microencapsulation (Ghosh, 2006) and Nike has been offering a moisture-regulating sports range since 2007 for tennis athletes.

3) LUNGS, HEART and HEALTH MONITORING: Passengers and crew are subject to a pressurized cabin which equals the altitude of aprox. 2400 meters (this can be lower with newer aircrafts such as the A380 or Dreamliner) and is about 20% less than on the ground. This causes problems for all people inside the aircraft and can be especially dangerous for vulnerable individuals such as PAX with illnesses or babies. The change in pressure increases the frequency of the heart-beat, makes breathing more difficult (even causing hypoxia), and causes gases to expand which in turn hurt the ears and insides of the bowel.

It would thus be advisable to wear smart textiles or medical wearables which offer monitoring of bodily functions so that PAX with predispositions can act immediately, such as respiratory monitors which have been integrated into textiles and are designed for everyday life (Merritt, C.R., Nagle, H.T., Grant, E. 2009). There are a few interesting products by sports brand Adidas which are marketed under the name "mi Coach" such as the Bluetooth Smart Heart Rate Monitor with Textile Strap (Adidas, 2016) or the "NuMetrex heart sensing sports bra and cardio shirt [which] integrate special sensing fibers directly into the garment. This eliminates the need for a separate heart monitoring chest strap." (Tetronics, 2016): However, these products are currently targeted at athletes who are on the ground and not intended for in-flight use.
The change in cabin pressure even affects the taste buds which is why many airlines such as Lufthansa develop special meals which cater to the change in taste. Lufthansa has even developed special pressure chambers to test their meals (Seipke, S. 2015).

4) CLIMATTE ADAPTATION: Furthermore, both PAX and CCM may experience climate change upon arrival at their destination without enough time for acclimatization. In the case of CCM, this climate change happens many times during an active flight month, sometimes as frequently as several times per day. Again, neither the CCM's uniforms, not the PAX' clothes help to protect the body form extreme climate changes.

Image 1: Author's own archive from JAL.

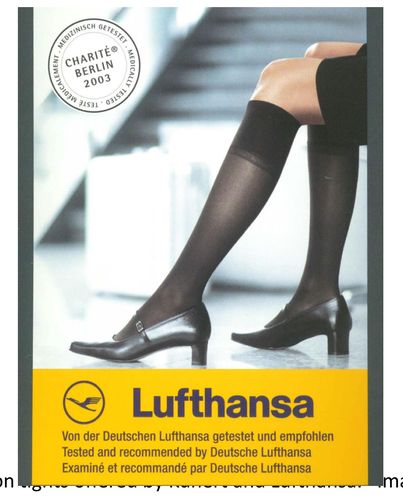

Image 2: Compression

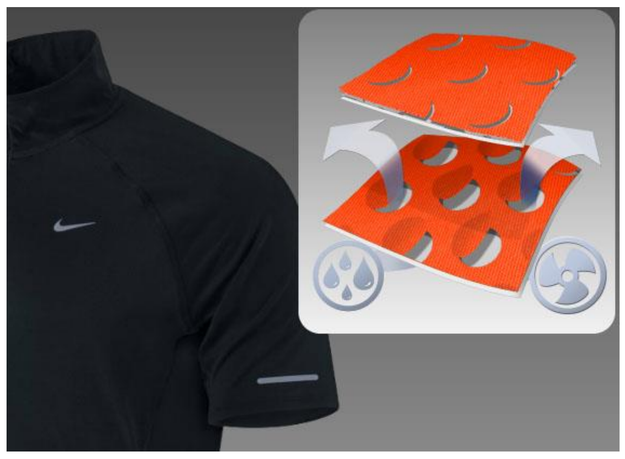

Image 3: Nike's moisture-regulating "Sphere React Cool Shirt"

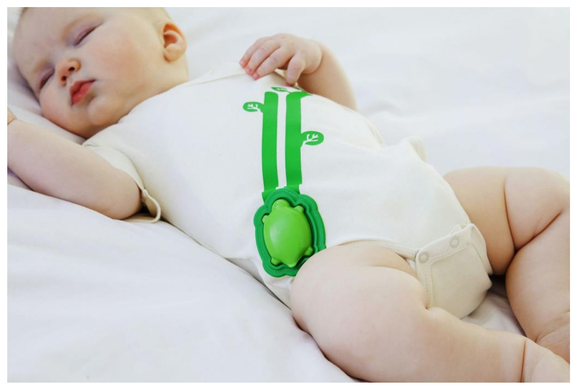

Image 4: http://knowwearabletech.com/facts-on-wearable-monitor/

5) STATUS QUO of SMART TEXTILES IN AVIATION: There is no current use of "smart" or "nano" textiles in aviation, although they would greatly contribute to the comfort in flight.
There are hardly any companies which offer travel clothing with smart or medical properties for more than 3bn PAX per year. Apart from compression tights from suc brands like Kunert there are no special clothes available at the moment. There are trivial items such as inflatable neck pillows, earplugs or slippers which are being sold for comfort or travel-ranges from premium and luxury fashion brands catering to a fashion-conscious jet-setter who is worried about an impeccable appearance (Cristobal, 2010). It is therefore vital that airlines and fashion brands pay attention to the growing number of annual CCM and PAX who use commercial aviation and create innovative clothing.
Airlines which are responsible for creating comfortable and functional uniforms for sometimes tens of thousands of crew still use old-fashioned materials such as cotton, wool and polyester and rely on employing celebrity-status designers to boost the image of the crew's appearance. These include Vivienne Westwood for Virgin Atlantic or Christian Lacroix for Air France which have made stylish clothes with no special "smart" properties.

CONCLUSION
In conclusion it can be said that the human body is in need of better protection during flight and would benefit from clothes with smart, medical or nano properties which help to do just that. The actual challenge does not seem to be in developing the smart textiles but in applying them for the commercial aviation segment. With IATA estimating 6bn air-travellers by 2030, it would now be the right time for clothing brands and smart textile manufacturers to team up and start creating complete ranges which can be sold to airlines and air travellers. The author is happy to consult companies on this matter.

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