ASK THE EXPERT: COMPARATIVE FIBRE STRUCTURES

Structural advantages

In this article in our series asking fibre and fabric experts questions on key textile subjects, Dr Julie Soden, a specialist in constructed textiles and 3D woven composites at the School of Art and Design at the University of Ulster, Belfast, gives her answers to questions on fibre structures.

The structure of fabrics—from the difference between 2D and 3D lay-ups (the build-up of successive layers of materials) to composite materials, and crimp and non-crimp wovens—can make an important difference to apparel design and manufacture.

Question: When clothing companies are considering a 2D or 3D lay-up, what are the most important factors that they need to bear in mind?

Answer: 3D composite textiles were evolved to avoid cut and sew operations and the repetitive and labour-intensive lay-up process in aerospace engineering that left weakness between the plies. Tailoring and selection of materials into specific areas is important in engineering composites, but even more so in technical sports apparel. Scale of operation often dictates what is possible in production. Working in design, I often see young designers taking inspiration from an engineering composite system, where interesting combinations of fabrics are put together in layers. For instance, in more experimental collections, designers may use a technical spacer knit fabric, more akin to healthcare, and marry it with a super-light non-woven fabric from the automotive industry and a wicking polyester woven sports fabric for new 'hybrid' ideas. In terms of composite materials, the principal stress direction is usually the warp (x-axis) orientation. Therefore the strongest and

Textile structures can help the industry turn clothing into "a wearable regulatory system".

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highest-specification fibres and yarns are usually positioned in that direction to perform to their optimum. The bias and natural drapability of fabrics should be respected and the designer must take that into account.

Q: It's a global market, but each territory has its particular climate needs. In your opinion, what could textile and apparel manufacturers do to reflect more accurately in their textile structures the differences in wearers' needs for activity in a dry climate compared to a climate with high humidity? We often hear criticism of brands because they sell one product with the same textile structure for use in climates as contrasting as those of the Rockies and the Highlands of Scotland.

A: I think the advances have to come from the performance and behaviour of the fibres, bespoke fibre developments and special blends that are not adversely affected by coating or finishing processes. I think dealing with humidity and the ability to keep dry and cool is more difficult than warming and insulating. Continuing to look at biomimetic effects and nature will provide continued evolution so the clothing becomes a wearable regulatory system. Phased-release yarns with carrying and molecular transportation potential are interesting. The speed of changeable weather conditions that we experience in Europe and the response of the textile to these changes is important.

Q: Based on your knowledge of weaves and structures, which in your opinion work well for the different pieces of clothing and equipment that mainstream outdoor enthusiasts use?

A: The majority of weaves are very plain, rip-stop checks or simple twills. This is dictated by the industrial machines that produce them, which have a single-volume capacity function to produce large volumes of the same fabric; they have been developed for maximum profit and speed. All go through industrial finishing and their surface characteristics must host coatings or prints, so patterns need to conform to machinery readily. Multi-way stretch woven fabrics for trousers and fitted jackets are essential. Designing for the fully stretched or crouched position is preferable as length and conformability are important, even in a regular outdoor jacket. Jacket lengths are so short in many brands. Socks are so important: lightweight Jacquard knits are very technical structures to produce with heels, toes and different structures used to hug the profile of your foot and ankle - fabulous.



Dr Julie Soden from the University of Ulster, Belfast.

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Q: With regard to ongoing innovation in fibre and textile structures, which are the developments for the not-too-distant future that most excite you?

A: Variation to create more unique and decorative patterns could be achieved using float weaves, which would create exciting surface texture without the need for digital print. I'd like to see fabrics with differential shrinkage and thermal properties, where two fibres (one being performance wool) are used within one fabric to create interesting 3D textured surfaces with integrated performance. These would have increased production costs so would be considered for the upper market initially. Jacquard knitted structures are exciting and offer many possibilities for outerwear.

Q: What steps would you like to see the manufacturers of fibres, yarns and fabrics take to raise awareness among designers of the different qualities that the structures of various composite fabrics could bring to their work?

A: Composite and technical textile fabrics are mainly designed around key properties such as reinforcement, containment, protection, absorption, sensory and aerodynamic functions. These words are very powerful and I introduce these definitions and classifications of materials to young student designers so they feel confident to explore these areas further. Many are really surprised and motivated by the technical textiles field from a design and manufacturing perspective and it's important that the industry supports these young, eager graduates through work experience, internships or collaborative projects.

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