Sustainable Product Development

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Within the apparel industry the dialogue on sustainability has primarily been focused on the production of 'green products' and the use of textile processing methods and supply chain strategies that reduce the environmental footprint of our industry. As we begin to think of sustainability in broader terms, the product development stage provides another key point in the product lifecycle that is worthy of closer examination. What is the vision for sustainable product development and how is technology supporting this vision?

With these questions in mind, researchers in the product development area of [TC]² are directing their investigations toward emerging systems that support the notion, 'lean is green'. Reducing development iterations and creating efficient transitions to manufacturing are of primary importance in this movement toward greater sustainability. Thus, 3D product simulation, electronic communication of design and fit intent, and digital methods for printing and coloration are key components of this research initiative and the following section provides a brief highlight of related systems.

3D Product Visualization and Communication

Software tools for 3D visualization of garments have been available for a number of years. These systems support virtual dressing of avatars (digital humans or replicas) using 2 dimensional patterns digitized or created in a CAD system. Thus, these applications have been developed for use by product developers rather than for consumers and are closely tied to the pattern making system. Offerings are available from key vendors in the CAD area including Gerber Technologies in conjunction with Browzwear (V-Stitcher), Lectra (Modaris 3D Fit), Optitex (3D Runway Suite), Tukatech (e-fit Simulator), Assyst/Bullmer - a company recently acquired by Human Solutions (Vidya), and GCL Distribution (distributor of PAD System products and Haute Couture 3D).

The process for creating the 3D simulation normally involves virtually stitching 2D patterns together. In most cases the user can select from a set of generic avatars that can be customized in terms of body dimensions and shape to better reflect the target customer or 'fit model' attributes. Fabric textures can be applied to the garment along with draping properties to enhance the aesthetics of the visualization. Once the garment has been draped, users can rotate the figure to review positioning of seams and design features such as pockets. A number of solutions support the ability to visualize areas of fabric stress and ease in relation to the avatar that is being dressed. In some instances it is also possible to use drawing tools to illustrate changes to the style and add notes to the 3D rendering. With the support of 3D viewers, this rendering can be sent to remote development and manufacturing partners to support clearer communication between parties.

In related developments, [TC]² has engineered new technologies to support virtual fashion applications, one for use directly with 3D body scanning and another for use online or whenever a [TC]² NX-16 3D body scanner is not available. The first technology provides the ability to rapidly produce high fidelity 3D avatars based on 3D body scan data. The process involves morphing a generic 3D avatar to exactly match the shape of the 3D body scan. If the generic 3D avatar is "clothed" then the resulting output is a realistic representation of what that fashion article will look like on the person scanned. This enables real-time virtual fashion visualization.

[TC]² has also developed an "Avatar Engine" for use when a body scanner is not available (such as in an online environment). Using 3D statistics derived from thousands of human body scans obtained from the SizeUSA study, the Avatar Engine can generate a very realistic representation of a human with a relatively small number of measurements and shape inputs. This tool can also be used for virtual fashion purposes. Virtual fashion applications using the Avatar Engine will be launched on the [TC]² supported web site ImageTwin (www.imagetwin.com) in summer 2009. Avatars created both from the NX-16 3D body scanner and the Avatar Engine can be used to support 3D product development efforts within commercial apparel CAD applications. [TC]² is currently working with Optitex, Tukatech, Browzwear, and Lectra to further this capability.

While the majority of virtual dressing systems rely on the 2D pattern as the basis for draping, the product 'Virtual Fashion' (Reyes Infografica) offers an alternate strategy. This tool provides users with a series of standard garment 'molds' that can be edited to create new styles. Once the style has been created, fabric properties and textures can be added for aesthetic value. While it is not possible to translate the 3D representation into a 2D pattern for production, this technology does offer an opportunity to quickly generate garment concepts in 3D. As a result, it could have value for product ideation, specification, and animation.

The discussion of product visualization and communication is incomplete without mentioning the value of Shapely Shadow's FastFit360 technology. This system uses digital technology to capture a series of images that when knit together, provide the ability to view the physical sample in 3D. As with the virtual garments, these images can be shared among development and manufacturing partners to facilitate improved communication of style and fit intent. Shapely Shadow has also developed a communication tool, FastFit360.com as a secure environment for sharing FastFit images and comments.

As virtual dressing and related technologies become increasingly viable, there is an opportunity for product development teams to harness these capabilities for early identification of style and fit issues. The application of these systems may reduce sample iterations and support cycle time reduction for development. However, as with most emerging technologies, the currently technologies offer both rewards and challenges. Thus, [TC]²'s research team is in the process of gaining a more in-depth understanding of the capabilities of available systems. This activity involves developing strategies for use and identifying application issues and barriers to adoption for the apparel industry. Many of the vendors mentioned in this section have provided technology to [TC]²'s center in support of this ongoing research and demonstration activity.

Digital Printing and Coloration

Fabric coloration and printing are widely identified as hot spots for improving our environmental footprint and a desire to strengthen the links between market demand, product development, and manufacturing for coloration is not new to the industry. Over the last decade, the introduction of digital printing systems has allowed product developers to bypass the screen making process for printed sample creation. Digital sampling offers the opportunity to print and review designs on fabric early in the process and reduce over development, screen engraving costs, waste streams and energy consumption associated with sampling. However, until recently, this technology was not seen by the apparel industry as a viable resource for production and it has been possible to produce digital prints that could not be replicated via the screen method.

More recent system advances are paving the way for broader adoption and the ability to connect sampling to digital production methods. Emerging hardware systems provide significant improvements in print speeds and coloration chemistry has advanced to support printing on most fibers and fabrics. The development of pigment based colorants is of particular note, as these require only heat curing for fixation, as opposed to the steam/wash requirements of reactive and acid dye colorants that first entered the market for digital printing. Pigments have great appeal at both the product development and production stage due to ease of processing and reduced water consumption and wastewater effluent.

Researchers at [TC]² are particularly interested in emerging technologies and chemistries that will enable the development of digitally driven, waterless coloration systems that could provide benefits for both product development and manufacturing. The digital print team is monitoring developments and vendor offerings in this area and conducting applied research with the assistance of demonstration partners. Researchers are working with Yuhan-Kimberly to understand the processing requirements and color capabilities of their nano colorant pigment chemistry. On the fabric side the research team has worked with contacts at Cotton Incorporated and yarn manufacturer, Clovertex (recently merged with Tuscarora Yarns) to understand the potential of cationic cotton for digital printing and it's ability to offer improved efficiency for color fixation. [TC]² is also working with Sawgrass Technologies and Ergosoft to install textile related systems that will further support the broad digital print initiative.

What Does Sustainable Product Development Mean?

In summary, creating a more sustainable product development scenario involves identifying systems and methods that create ‘leaner’ processes and direct links within the supply chain. Technology is playing a key role in this movement and ultimately, leaner processes that incorporate 3D visualization and communication and/or digital printing strategies will allow companies to reduce waste and respond to consumer demands more effectively. In the end, this will have a positive impact on the bottom line.

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