DIGITAL TEXTILE MICROFACTORY

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ABSTRACT
The MICROFACTORY, coordinated by DITF, is a completely networked and integrated production chain from design through to finishing and confection. This seamless digital and integrated process is a particularly important milestone for the fashion industry on the way towards Industry 4.0. It saves time, reduces material consumption and increases the quality of design, especially with complex fabric designs. The DITF forms the largest textile research centre in Europe with more than 300 scientific and technical staff. As the world's only textile research facility and covering an area of more than 25,000 m², the DITF works right across the textile production and value chains. Since 1921, they have been across all the major fields within textiles and among the leading research institutions worldwide.

INTRODUCTION
In the apparel industry, only the next collection counts and must be implemented as quickly and cost-effective as possible. The paradigms of Industry 4.0, which are horizontal integration through value networks, end-to-end engineering across the entire value chain and vertical integration as well as networked manufacturing systems, lead to more efficient, flexible and responsive processes. Here the "Simulate, Print and Cut" solution realized in the MICROFACTORY, as a seamless digital and integrated process, is a particularly important milestone for the fashion industry on the way to Industry 4.0.

MOTIVATION
Textile and fashion industries are characterized by fast changes and individualization. This trend results in decreasing lot-sizes, products that meet the individual requirements of single users in terms of morphology, fit, size, colour, style and design. Local production is ecologically and due to difficult political times also economically superior. Solutions to reduce time-to-market, lot sizes and to enable local or regional production are on high demand. They offer the opportunity of new business models and business ideas. This new paradigm is powered and made possible by a number of new technologies, such as virtual garment development with 3D-CAD systems, digital textile printing and automated single-ply cutting. These technologies open up new perspectives for rapid prototyping and small-series production.
Current process chains are mainly set up for mass production and characterized by huge communication efforts. The lack of streamlined process chains and integrated concepts results in a lot of errors and a lack of automation. Current approaches as rather disjoint design, pattern development and production do not meet demands for highly flexible and integrated process chains.

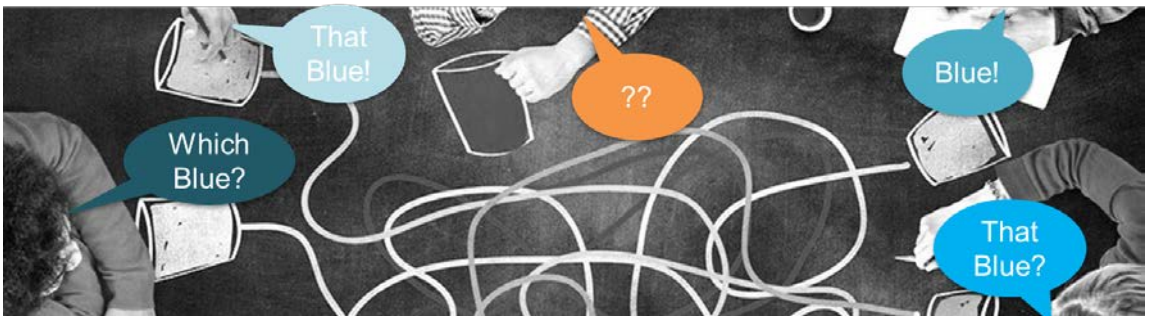

Figure 1: Communication effort

The MICROFACTORY as an integrated digital process chain is streamlining the garment development and production process. Standardized and automated interfaces between design, development and production offer a number of advantages, such as

- increased resilience of the process chain
- reduced communication efforts
- standardized communication paths
- less error prone processes
- increased modularity of supply chain
- dynamic feedback loops.

THE MICROFACTORY STEP BY STEP

1. THINKING 3D

Starting point is the development of a creative design in CAD. Using a 3D simulation, the design is processed for cutting out and sewing. For this purpose, identifying QR codes as well as position markers are integrated into the production order for later localization.

Simulate apparel Place designs, logos, etc.

Figure 2: Interactive 3D Garment development

3D is currently the major trend for garment development. Interactive garment development by bringing pattern, material and design together opens dynamic feedback loops between pattern making, textile design, and material selection. New ways of collaboration emerge. This reduces development time and time-to-market and increase sustainability – “digital waste” does not harm the environment.

2. STANDARDIZED COMMUNICATION

The result of the 3D-Design process is stored in print and cut ready pdf-files. These files are the basis for a networked production. The multi-layer concept for pdf offers a solution to individually hide or show layers for drill holes, notches, contours and textures within a marker. These layers are helpful for the RIP (preparation for printing and cutting) and for the actual cutting of the printed marker. Within RIP software the print data are rescaled due to the expected shrinkage of the fabric. Register marks are added around the contour of the pattern for cutting.

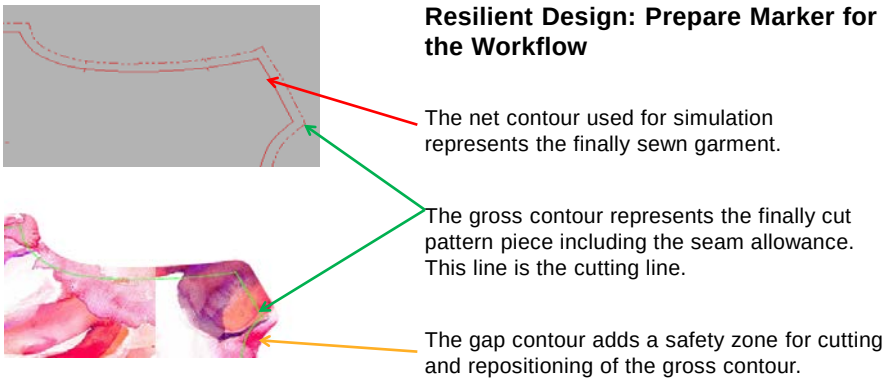

Figure 3: Resilient design.

This resilient design takes into account all following process steps already at the design stage. The according pdf-file contains all necessary information and controls thus the production process.

3. DIGITAL TEXTILE PRINTING

Special software enables the design colour data to be processed for digital printing. Best colour accuracy can be guaranteed due to the use of multispectral technology. This allows to define the colour space that is technically feasible in advance and to include it to the design software. In a next step the individual designs are printed onto transfer paper via sublimation printing machines or directly on the fabric. Some experience and knowledge is necessary to choose the right combination of fabric preparation, suitable inks and the corresponding process parameters. The DITF are doing a lot of research in the area of inkjet preparation, new inks and best process settings.

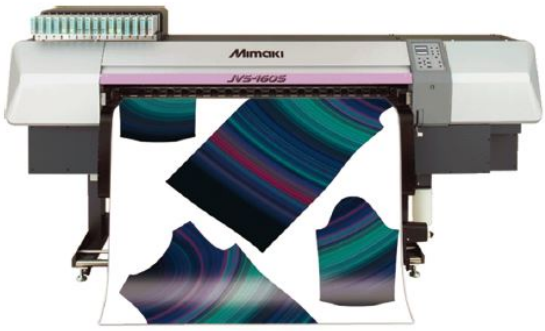

Figure 4: Digital textile printing

4. CUTTING AND CONFECTION

Also the cutting process is supported by the pdf-file. Due to the identifying tags, the job is detected in a camera-assisted manner. Using the markings supplied, the system identifies the exact location and cuts the material to size fully automatically in accordance with the selected job parameters.

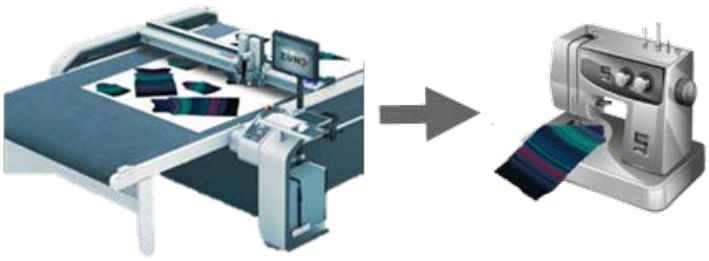

Figure 5: Automated single-ply cutting and confection

In the last step the individual elements are assembled into a finished product with welding and tapping machines.

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