Digital Inkjet Fabric Printing

Hitoshi Ujiie
Director of the Center for Excellence of Digital Ink Jet Printing for Textiles at Philadelphia University
Worldwide Textile Printing Industry

• 16.8 billion meters per year.
• The closest point to the highest (1994)
• At least 1% per year of increase
• Reasons:
  – Acceleration of fashion cycles.
  – Continuous growth of the world population.

Worldwide Print Production

Digital Printing Technology

New Workflows

1. Digital Strike - off (most common)
2. Digital Production (upcoming)
1. Digital Strike-off Workflow

- Most popular use of digital printing technology today.
- **Market testing - Engraving - Conventional production.**
- Reduce S/O (sampling) time and engraving cost.
- Quick response to the market.
- **Simulation of conventional printing looks ---- digital S/O** (color separations, penetration, hands, etc.)
- Precise color matching.
Color separation

- Bit map based raster color separation.
- Similar to conventional engraving separation.
Color matching (management)

- **Matching color chips** to inkjet S/O printers to production printers.
  - (monitor color to s/o printer to production printer)

- **Input:**
  - Conventional printing conditions (pressure, spread, mesh pores, etc.)
  - Color separation.
  - Inkjet ink information.
  - Color kitchen information.

- **Computation (simulation)**
  - Metamerism (spectra curve)
  - Choice of possible colors.

- **System**
  - Ciba Colpoca, Eido color, etc.
Printers for Digital S/O

- Plotter type printers are commonly used.
- Piezo type: (Mimaki, Roland, Mutoh, Epson etc.)
- Thermal type: (Encad, HP, Colorspan, etc.)
- Digital S/O is a part of design development processes. (designers responsibility)
2. Digital Production Workflow

- No engraving - no screen - no repeat limitation.
- Quick response to the market.
- Cost effective short to medium runs (upto 500m).
- Minimal environmental wastes.
- Personalization and Mass customization
- New design trend.
- New business model.
Seiren: Viscotex- Japan

• The early model for Personalization, Mass Customization, Agile Manufacturing and Short-Mid Run Production. (planned in 80’s)
• Inkjet production for automotive and high fashion including apparel and swim wears.
• Seiren original multiple inkjet printers and systems for production.
• Full color (flag and banner) and reduced color (200+) printing.
Mass Customization with Digital Inkjet

- E-Commerce (web)
- Digital Design
- Bodyscan
- Digital Printing
- Consumer
- Delivery
- CAD Layout Cut / Sew
For the Man With a 15.95-Inch Neck

By DAVID OLIVER

N ot since Yvanne Dodat stuck a feather in his hat 222 years ago and called it macaroni—a derogatory reference to London’s Macaroni Club, decadent young fops who had traveled in Italy and adopted its tastes—has clothes style held such sway in the wardrobes of Americans as now.

The houses of Gucci, Armani, Prada, Versace, and Calvin Klein have caused the style suit over the last two seasons, so that today’s masculinity—mythical, I know, among them—would scarcely trade their Gucci loafers for Bass Weejuns or their Armani shirts for men’s built-in-collars.

But I recently found myself in a bout of men’s style—some might call it a sickness—of the mud—Brooks Brothers, which promised to pull me in the smartest suit I could imagine.

I recalled the company’s Melrose Avenue flagship: I had bought a pair of mohair-gray herringbone breeches, shifted into them and was directed to stand semireclined in a mahogany-painted chateau. I glanced at the handles, closed my eyes and approved the “fer” business. Very bright lights flashed for about 10 seconds; I would soon be the first on my block with a computer-tailored suit.

The lights were scarlet, and they pointed me toward a large computer program that translated the data into 55 altering measurements—could you imagine 150?—from side of neck to chest—all within a hundredth of an inch.

Brooks Brothers transmits the measurements—along with a customer’s choice for fit, style and fabric—to its suit factory outside Boston or its shirt factory in North Carolina, where a master-tailor’s work is produced in two to three weeks. Custom shirts start at $85 (sizes 13 to 15 and a suit is 95), $130 or $160 more for an off-white or navy. (It can cost more, depending on fabric.) A sport coat is $300 made of a lightweight wool; in alpaca, $595.

Thousands of points of light decide how you’ll look your best.

Brooks Brothers has inaugurated mass-customization’s most comprehensive and perhaps ambitious service to date: plans to install the digital tailoring in its stores in other major cities. After a customer orders the service, he or she is asked to order the suit. Brooks hopes the service will eventually replace a good percentage of its suit sales, and reduce the financially struggling company of carrying a large inventory. After a major makeover this season, the service has been improved and is expected to be a complete hit.

More than 600 customers who use the service have been asked to wear it. The new service is designed to be a complete hit.

Famously, Brooks Brothers is a maker of custom suits. It is now taking on the world. The company’s president, Joseph Gromek, said, “We are not a clothing business, but a technology company.”

Mass customization is programmed into Brooks Brothers.

Brooks Brothers’ tailoring service, introduced Nov. 4, ordered a back suit in an Italian worsted wool for $1,380, a 15.95 percent discount offered during the first two weeks of the service. As he left for the new suit, he is assisted.

Every tailor who ever measured me said I had a 15.95-inch neck,” he said. “I don’t know how many inches I’m 40 already, but I’m already 40.”

“I never thought that the computer-tailored suit would be as good as it is,” said Joseph Gromek, a business consultant and co-founder of “Markets of One Creating Customer Unique Value Through Mass Customization” (Harvard University Business Publishing, 2009), and the computer-tailoring suit had a better chance of success than the fabric for custom-made suits and shoes.

Customers can make custom-made suits and shoes are used in taking them home. But customers are used to waiting for alterations.

The time I had dressed, the computer had its body mapped with an accuracy of 150 feet. It was too late to see my silhouette broken if I the fabric was fantastic: the suit was too big. In the end, the fabric is chosen and the suit is made to fit the body. It was an amazing experience, but I was glad to see the suit now.

The suit was on. The fabric was fantastic: the fit was very good, and it was a fantastic fit around the neck (which is 11 inches around, according to the size, and that’s the only measurement I’m revealing). But because of a computer glitch, two suits were made one in the fabric, one in the fabric. I had chosen, and one in the fabric of the suit. It was a mistake that even the computer in the digital age. It was a mistake that even the computer in the digital age is not for humankind to slip its own name in.

The good news: at Nick Polito, the store’s digital tailoring advisor, pointed out, the computer would note my postproduction preferences, so next time ordering would be the eaves.

Famously, Brooks Brothers’ tailoring service, introduced Nov. 4, ordered a back suit in an Italian worsted wool for $1,380, a 15.95 percent discount offered during the first two weeks of the service. As he left for the new suit, he is assisted.

Every tailor who ever measured me said I had a 15.95-inch neck,” he said. “I don’t know how many inches I’m 40 already, but I’m already 40.”

“I never thought that the computer-tailored suit would be as good as it is,” said Joseph Gromek, a business consultant and co-founder of “Markets of One Creating Customer Unique Value Through Mass Customization” (Harvard University Business Publishing, 2009), and the computer-tailoring suit had a better chance of success than the fabric for custom-made suits and shoes.

Customers can make custom-made suits and shoes are used in taking them home. But customers are used to waiting for alterations.

The time I had dressed, the computer had its body mapped with an accuracy of 150 feet. It was too late to see my silhouette broken if I the fabric was fantastic: the suit was too big. In the end, the fabric is chosen and the suit is made to fit the body. It was an amazing experience, but I was glad to see the suit now.

The suit was on. The fabric was fantastic: the fit was very good, and it was a fantastic fit around the neck (which is 11 inches around, according to the size, and that’s the only measurement I’m revealing). But because of a computer glitch, two suits were made one in the fabric, one in the fabric. I had chosen, and one in the fabric of the suit. It was a mistake that even the computer in the digital age. It was a mistake that even the computer in the digital age is not for humankind to slip its own name in.

The good news: at Nick Polito, the store’s digital tailoring advisor, pointed out, the computer would note my postproduction preferences, so next time ordering would be the eaves.
PHOTO SHOP

You’re so vain, you probably think this thong is about you. Thanks to digital print technology, three weeks after leaving a picture at Brazilian label Rosa Chá’s in-store shop at Bergdorf Goodman, you’ll be flaunting a bikini adorned with your own image. Modest types can opt to use a photo of a boyfriend, a favorite pet, or a sunset.
Production Inkjet Printers

- Mimaki: TX-2 (TX-3)-1600
- Dupont: 2020
- Robustelli: Monna Lisa
- Reggiani /Ciba /Aprion: Dream
Mimaki: TX2 (TX3)-1600

- 3 - 28 square meter / hour
- 360, (540), 720 dpi
- 8 process colors (16 heads)
- Acid, Reactive, Disperse, Pigment.
- Epson type heads
- Head height up to 7mm

----------

- Auto nozzle check function
- Belt type media handling
- Head height up to 3-10mm (selectable)
Dupont Inkjet: 2020

- 15 - 52 square meter / hour
- 360, 540, 720 dpi
- 8 process colors (16 heads)
- Acid, Reactive, Disperse, Pigment.
- Seiko piezo head
- Print head clearance 1cm
Robustelli: Monna Lisa

• 26 - 75 square meter / hour
• 360 - 720 dpi
• 8 process color (24 heads)
• Acid and Reactive
• Original Epson piezo head
• Print height up to 16 cm
Reggiani / Ciba / Aprion: Dream

- 150 square meter / hour in high quality mode
- 600 dpi
- 6 process color (7 print heads for each process color)
- Acid and Reactive (Disperse and Pigment)
- Aprion piezo heads
- Printing height up to 16 cm
Silk Printing - Como Regions

- It is known for high end apparel prints including silk scarves and ties.
- Integrations of conventional and digital productions. (design looks and cost)
- Multiple Mimaki TX-2 printers and the latest Dupont 2020 and Robustilli Monna Lisa printer for productions.
- 6000 meters of productions with TX-2.
- “Speed is not the issue, the quality is.”
Eastern Silk Mills, Elizabeth NJ

• Silk Printing for US fashion
• Started with Table Printing
  Carriage Printers
  Turn Table Printers
• Inkjet for Economical Needs
  Conventional
  40 mins (1 color) - 1 piece
  1 day (10 colors) - 1 piece
  * Skill and Experience
  Digital (Dupont Printers)
  2 hours (180 + 180 dpi) - 1 piece
  *Color Gamut and Matching
Creation Baumann: Switzerland

- Jobber and vertical manufacture for high-end furnishing fabrics.
- A mission is to provide new fabrics.
- Inkjet fabric for high-end drapery on cotton and microfilament polyester (Trevira).
- Several inkjet printers. (Mimaki TX1, TX2 and Colorwing)
Olonia Stampria - Bargamo
cotton print

- Printing for Home furnishing and Bedding. (30Mi sqm/year)
- Commission and Original prints.
- 3 rotary
  1 flatbed with pigment
  Reggiani Dream Inkjet printer
- Inkjet printed fabrics as companion products to conventionally printed fabrics.
- Digital color matching of conventional pigment prints and reactive inkjet prints.
In the current textile printing market, many textile printers are forced to be more competitive due to the worldwide competitions. Competitive survival depends on finding a **niche** in order to differentiate themselves from their peers.
Integration of Design and Technology

- Image enhancement of conventional design
  - Spot colors --- Color Separation (Grayscale vs Raster)
- New styles of design / types of product
  - Design flexibility
  - No Limitation of use of color.
Most designs are still done by hands-on. Requires color separation to retain good image quality.
Color Separation

- Adjust to Grayscale separation from Raster separation. (more true to the image)
New Design Style
(flexibility)

• Photographic
• Extreme tonal / Extremely fine
• Unlimited use of color
• Simulation
• Graphic
• Digital effect
• Contained piece
Photographic
Extreme Tonal / Extremely Fine
Unlimited Use of Color
Setola to Run Oxford’s Core Men’s Groups

By BRENDA LLOYD

ATLANTA — Just five months after it acquired Tommy Bahama, Oxford Industries got a second thumbs-up from the industry last week when it snagged Michael J. Setola as president.

The appointment will allow J. Hicks Lanier, who’s been president, chairman and CEO of Oxford Industries since 1981, to share some of the responsibilities at the Atlanta-based apparel manufacturer.

In June the completion and workload at Oxford changed dramatically when

See SETOLA, page 6

Flying Colors
Simulation
Sweet disorder in a dress

Kindles in clothes a wantoness.

A lawn about the shoulders thrown

Into a fine distraction.

Aering lace, which here and there

Entrails the crimson stomacher.

A cuff neglectful, and the sky

Flax and to new confusedly.

Morning wave, observin

In the tempestate whose to

Dearest he is in whom act

A more bewitchre than when act

Too precious every part.
Graphic
EVERYBODY
Digital Effect
Contained Piece
Full Digital Production Workflow

• Flexibility (Styles and Mechanics)
  – Inkjet is still a direct printing stage
  – Possibility for specialty printing styles.

• Surface Patterning (substrates and colorants)
  – Universal sets of ink

• Entrepreneurs (independent agents)
  – Many short-midium run producers
One of the ways that U.S. textile printing industry can compete with world-wide market is not to focus solely on quantity of production, but to focus on high value added quality products.
The Center for Excellence of Digital Ink Jet Printing for Textiles at Philadelphia University
Background

• Founded in 2000 as one of the first digital textile printing research facility in the US.

• Membership: to team up with technology manufacturers and developers.

Ciba Specialty Chemicals, DigiFab Systems, Dupont Ink Jet, ErgoSoft, Jacquard Ink Jet Systems, McDermid ColorSpan, Mimaki Engineering, Mutoh Industry, Rohm and Haas, Wasatch Inc, etc,
Mission

• To provide information in neutral position.
  
  The technology was/is still early development stage and too many commercial advertisement as information sources.

• To conduct design/engineering research.
  
  Research projects (design and technology)
  Proof-of-concept projects
  Testing
  Production printing

• To conduct educational events.
# Current Equipment and Software

## Printers

<table>
<thead>
<tr>
<th>Thermal Head</th>
<th>DisplayMaker FabriJet (McDermid ColorSpan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TX-1500 (Encad)</td>
</tr>
<tr>
<td></td>
<td>DesignJet 500 (HP)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Piezo Head</th>
<th>TX-1, TX-2, GP-604 for Flat bed garment (Mimaki)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Falcon, Falcon Plus (Mutoh)</td>
</tr>
<tr>
<td></td>
<td>Hifi Jet (Roland)</td>
</tr>
<tr>
<td></td>
<td>Epson 3000</td>
</tr>
</tbody>
</table>

## Scanner

- Contex 42" large format scanner

## Software

- ErgoSoft, Wasatch, PraxySoft, etc.

## Colorants

- Ciba, Dupont, Rohm and Haas, etc.
Research

- **Design research**
  New design styles (Curriculum)
  New product application and production workflows
- **Engineering research (NTC, NEA, LEHP etc.)**
  “Integration of fabric formation and coloration processes”
  “Universal Set of Dyes for Digital Inkjet Textile Printing”
  “Nonoparticulate Textile Colorants for inkjet textile printing”
  “Conductive inks for functional textiles”
  “Inkjet printing textile archives - Barnes Museum”, etc.
- **Proof-of-concept projects**
  Inkjet printing Army Camouflage printing
  Inkjet printing narrow ribbon fabric
  Printed nonwoven product development
  Chemical Impregnations, etc,
- **Testing (Print performance, Line acuity, optical density, fastness, etc.)**
  Various inks and substrates
- **Production (samples to short runs)**
  Scarves, ties, umbrellas, bags, T- shirts, yardages.
Educational Events

• **Conferences and workshops**
  Designer meets Technology (2004)
  Digital Textile Design Workshop (June 13-17, 2005)

• **Presentations**
  Digital printing conferences:
    AATCC, DPI, NIP (IS&T), SDA, TC2, etc.
  Chambers of Commerce and Museums.
http://www.philaU.edu/textiledesign

UjiieH@philaU.edu