The variables that affect colour in digital textile printing

The development of digital printing is a major change within the textile design process as a designer is no longer restricted to a number of colours, repeat patterns, and may include photographic images and intricate detail. With digital print it is now possible to print anything between a metre, or hundreds of metres, at the click of a button. However, there is a marked difference between screen-colour and print-colour. A textile designer using Computer Aided Design (CAD) to create a design will be required to experiment with a number of variables in order to feel more confident about the outcome when using digital fabric printing. There are already various software, materials and printers involved in digital textile printing which impact on colour results. Additionally, fabric choice and secondary processes (washing and steaming) contribute to colour variation. A number of variables have been considered and are outlined.

Printer Type

Eg.Mimaki, Stork, Encad Reggiani DReAM, DuPont Artistri, Robustelli Monna Lisa, Chromojet Spectra
(Cahill, Raymond, Caccia et al, Kobayashi)

Printer Head

PiezoElectric or Thermal, No of print heads, the drop type (circle or matrix configuration) Using continuous or drop on demand printing
(Carr et al, Freire)

Matrix Application

The dither pattern (ordered - Bayer System, randomised,irregular dispersed - Stucki & Floyed Steinberg methods)
(Carr et al, Feisner et al)

Machine maintenance

Regular servicing & upkeep, cleaning, regular replacement of print heads & age of machine all affect colour
(RA Smart)

Printer faults

If a print head is misfiring, or there are blocked nozzles or dried up inks, the colour will be affected.
(Cahill)

Ink Type

4 ink types are used; Reactive, Disperse,Pigment or Acid The type depends on the fabric to be printed upon & each ink type has a different colour gamut.
(Hawkyard, Hauser et al, Rohm)

Ink running out

When one of the cartridges is running low the colour printed may be affected Additionally the age of the ink can cause colour issues
(RA Smart)

Colours in Ink bank

The set of ink colours used will determine the printer colour gamut. Primarily ink banks use lighter versions of cyan & magenta or add orange & green to enlarge the gamut
(Dawson, Feisner et al, Parraman)

Fabric Type

The texture & fabric makeup eg woven or nonwoven, & other characteristics of the cloth bleached or natural & yarn size, affect ink application & colour gamut
(Kim)

Fabric Coating

Coatings are applied to provide special qualities to the print such as improving colour take up, lightfastness, washability & ink bleed
(Hawkyard, Kim)

Colour of Substrate

The fabric may be bleached white, dyed, or remain in its natural state, acting as an additional colour in the printing process
(Davirsej et al)

Calibration

Regular calibration, using a spectrophotometer will ensures better colour communication in the print environment
(Dawson, AVACADCAM)

Illuminant

The light source that the monitor & the printed fabric is viewed under will affect the way the colour is percieved, as will the temperature
(CIE, Goethe, Ostwald, McCann et al, Goodman)

Background

The background & surroundings of both the monitor & printed fabric are viewed within will affect the way the colour is perceived
(Hanson, Albers, Noland)

Colour Gamut

The gamut of the CAD file & printer will differ & out of gamut colours will not appear as expected. Additional gamuts to consider; scanned & photographic images & the visual system
(Dawson)

Gamut Mapping

Some software manages out of gamut colours by replacing the colour to another one, scaling all the colours, restricting colour use or allowing the user to customise
(Leak, Dawson, Loser et al)

Colour palette of the textile design

The laws of simultaneous contrast, complementary colours, & other colour illusions will affect the observed colour
(Leak,Goethe,Itten, Chevreul, Rood)

The observer's vision

The uniqueness of individuals visual perception and colour processing will affect how colour is perceived. Eg colour blindness
(Barbur et al, Ishihara, Young, Rizzi)

Raster Image Processor (RIP)

The software used to communicate with printer & will affect variables such as dithering & colour mangement
(Dawson)

Colour Profile

The embedded profile that communicates to the RIP & printer the colour gamut.eg Adobe RGB 1998 (saturated & vibrant) sRGB (realistic, duller colours)

Resolution & Bit size

This applies to both file & printer. Printers tend to be 600-700 dpi, files 300 dpi files may be 8-24 bits
(Dawson)

File Format

It is recommended that files areTIFF format as this allows embedded colour profiles which can be read by the RIP
(Dawson)

Secondary Processes

To fix the inks, & remove coatings, various secondary processes such as washing, steaming & thermal baking are required which affect colour
(Kim, Wilkinson)

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