Il colore della lana 4.0

Prato

Maggio 2017

Andrea Vannacci

introduzione

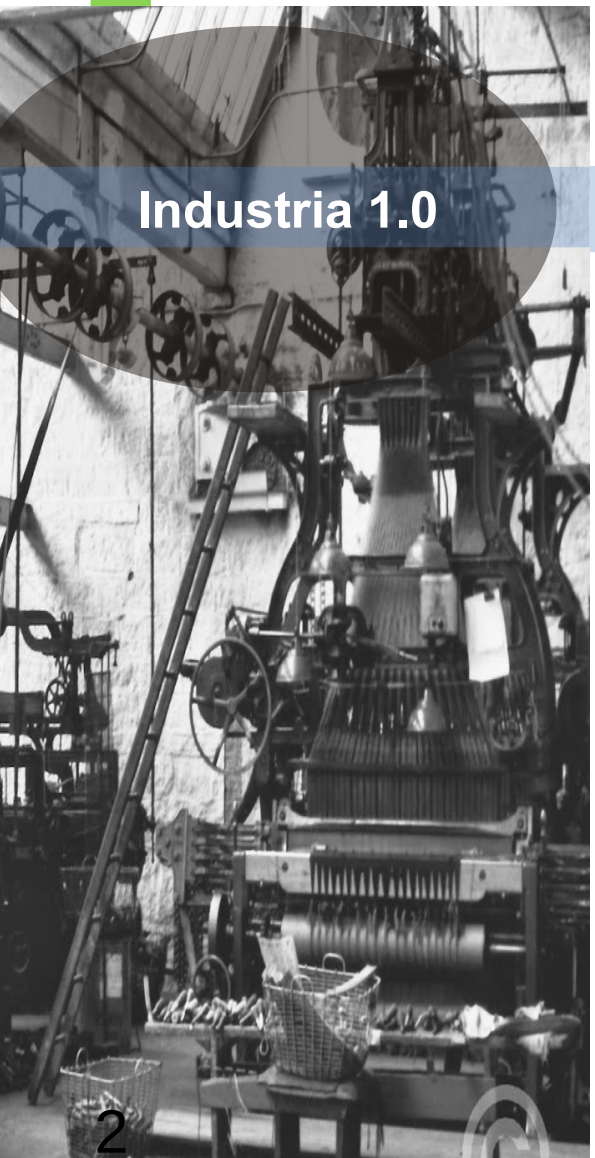
Il titolo della presentazione contiene tre importanti parole da cui nascono altrettanti argomenti di discussione: “Colore” “Lana” “4.0”

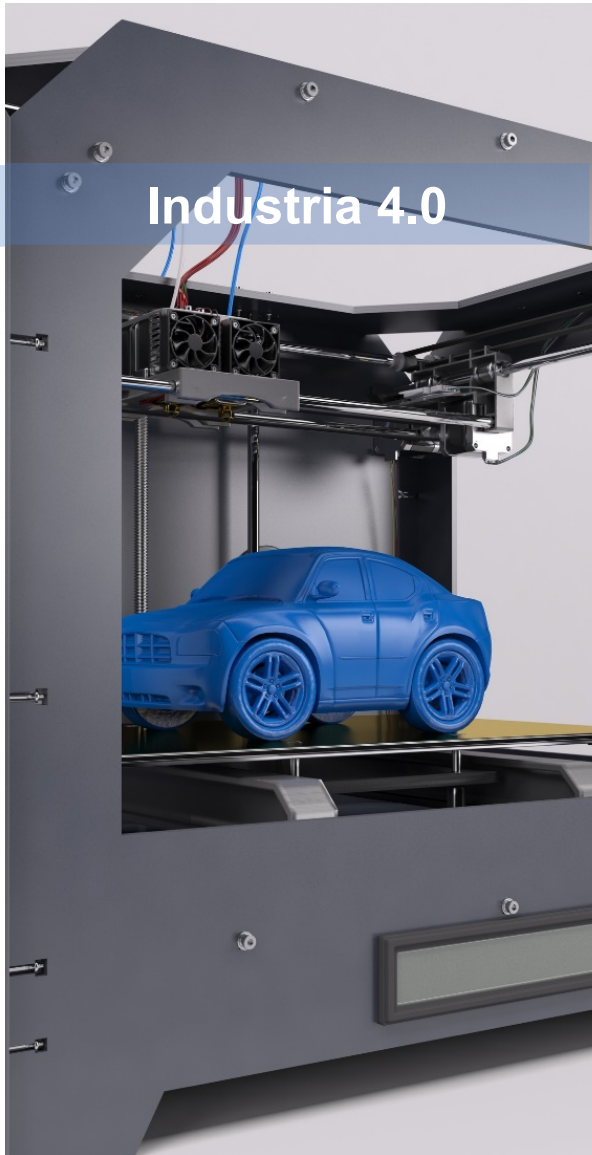
Il COLORE , l’attributo esterno che valorizza il materiale, che influenza in modo determinante la scelta e le decisioni d’acquisto di un manufatto. Il COLORE è stato ed è oggetto di continua evoluzione della tecnologia di applicazione, della natura delle sostanze coloranti, delle sue innumerevoli sfumature influenzate dalla moda e dall’evoluzione dei gusti dei consumatori.

La LANA, uno dei materiali più antichi con cui l’uomo ha realizzato dei vestiti, particolarmente apprezzata per le proprietà coibentanti e in seguito a trattamenti sempre più evoluti, per la varietà di effetti superficiali che rendono la LANA così versatile e sempre di moda.

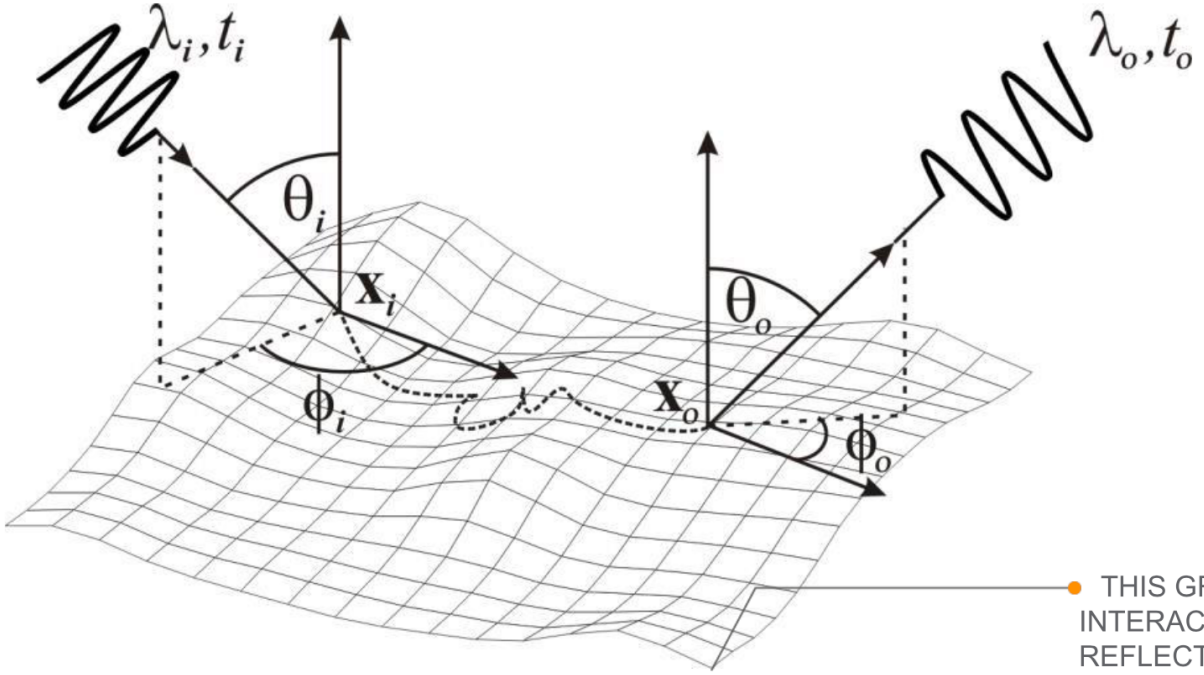
4.0 , non è semplicemente un numero ma indica la quarta rivoluzione industriale: dopo

Industria 4.0





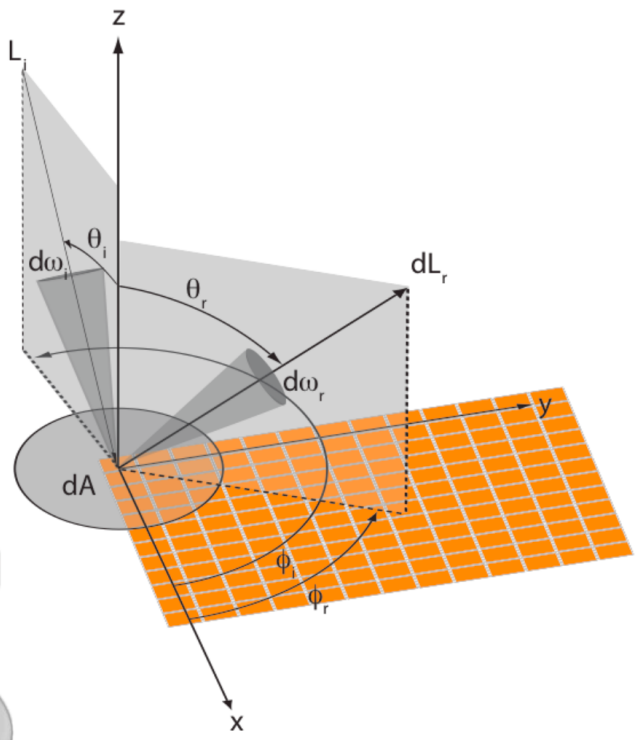
Oltre il colore... L’apparenza



- To describe the appearance of a material it is important to develop a model that explains how light interacts with an object.
- Real-life materials vary in complexity as they might be composed of different layers with individual optical properties (e.g. a clear coat applied on the surface) or there is a spacial variation of optical properties (e.g. effect pigments distributed in x and y axis).
- Computer graphics typically use simplified models, which ignore certain optical phenomena because they are either difficult to determine or they increase computational effort significantly.

THIS GRAPH SHOWS A SIMPLIFIED MODEL OF LIGHT MATTER INTERACTION WHICH EXPLAINS EFFECTS LIKE 1ST SURFACE REFLECTION (GLOSS), ABSORPTION AND SUB-SURFACE SCATTERING (SSS).

Oltre il colore... L’apparenza



- If the bidirectional reflectance distribution function (BRDF) considers in addition the planar texture coordinates (x,y) we speak of a spatially varying bidirectional reflectance distribution function (**SVBRDF**).
- The **SVBRDF** is a 6-dimensional mathematical function that defines how light is reflected at an opaque surface. In contrast to the BRDF the **SVBRDF** can also describe textured or inhomogeneous opaque materials.
- For the TAC7 every BRDF pixel represents 67 µm of material.
- Typically the SVBRDF is obtained by fitting a Sparse-BTF to a SVBRDF model.

• Title of the

La ricerca X-rite

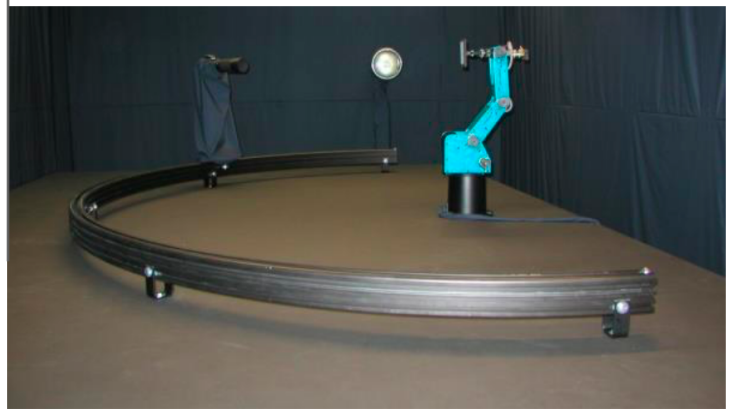
- DIGITAL MATERIAL APPEARANCE has a long research history at THE INSTITUTE OF COMPUTER SCIENCE of the UNIVERSITY OF BONN in Germany.

- In 2009 the SENSIBLE GRAPHICS GMBH was founded by the university as a spin-off to industrialise the appearance measurement technology.

universitätbonn

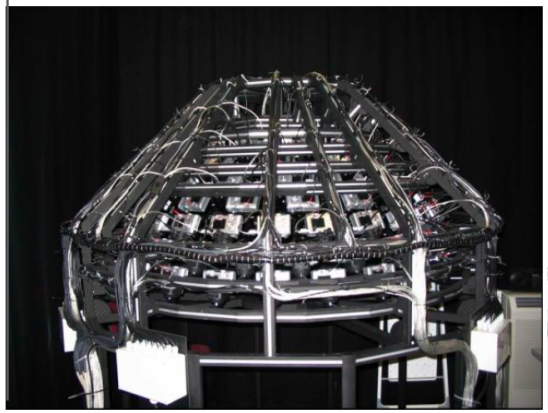
2003

- Initial laboratory setup with a robotic arm and a single camera and a single light source.



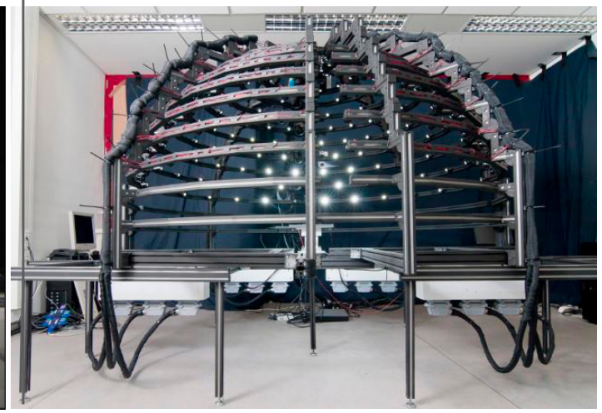
2009

- The consumer camera DOME (2009) was equipped with 151 Canon PowerShot G9 digital consumer cameras.



2011

- DOME 2.0 with 11 industry grade cameras and almost 200 LEDs.

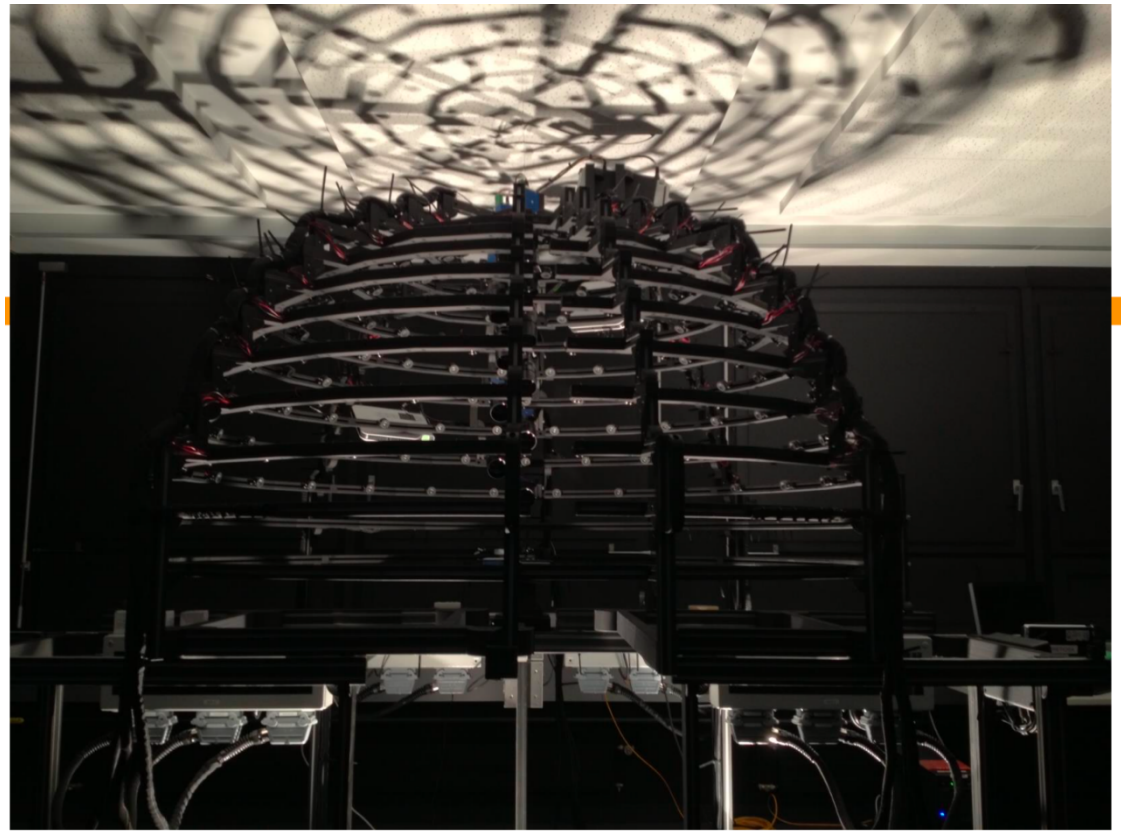


X-RITE, INCORPORATED

x·rite PANTONE®

• Title of the

La ricerca X-rite



- 2012 X-RITE acquired SENSIBLE GRAPHICS and turned it into a development center for the TAC technology.
- With the sponsorship of X-Rite the university established a GRADUATE SCHOOL OF MATERIAL APPEARANCE which offers 8 PhD scholarships and installed a new professorship focusing on Digital Material Appearance.

2012

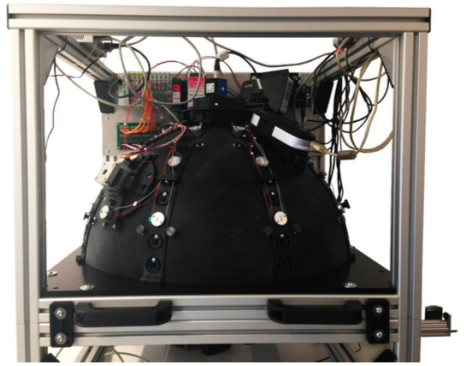
- With the acquisition of Sensible Graphics X-Rite also got access to the DOME technology developed at the University of Bonn.
- Based on the DOME 2.0 at the university a sister device was build at X-Rite's R&D Center in Zurich, Switzerland.
- Whereas the university continued research on 3D objects the DOME 2.5 at X-Rite got optimised to measure flat material samples faster and with higher accuracy.
- Today the device is still used occasionally within X-Rites scanning service offerings.

La ricerca X-rite

- After the launch of the DOME-based TAC Scanning Service many customers asked us to build a TAC scanner which they can purchase.
- Based on the DOME technology X-Rite developed a concept for a significantly

2014

- In December 2014 the first prototypes of the new TAC7 scanner were installed at pilot customers in the automotive industry.



2016

• Title of the

CATTURARE | con TAC7 SCANNER

4 industry-grade cameras

32 white LED point-light sources

8 spectral light sources

Variable linear light scanner

Backlight module

Structured light projector

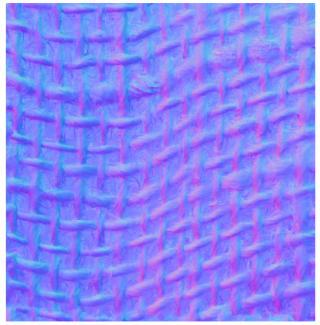
Rotation stage to capture anisotropy

product design award

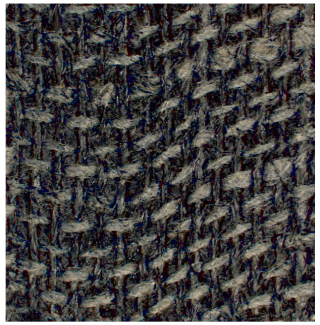
x·rite PANTONE®

TAC7 | esempio

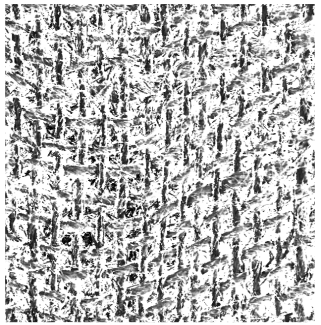
Diffuse albedo map



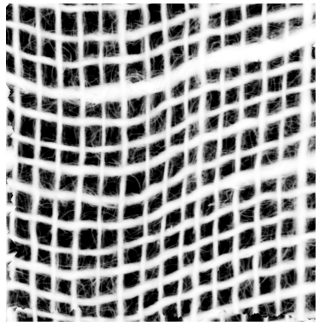
Normal map



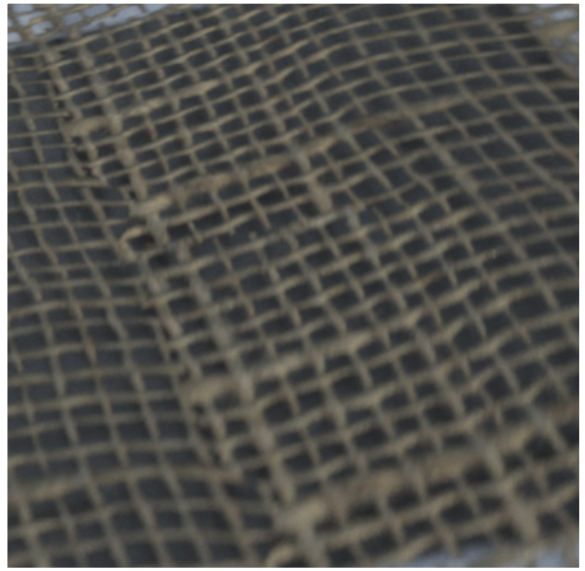
Specular color map



Roughness map



alpha map



Linen Fabric

I formati digitali per comunicare

The data format to communicate color digitally is the

Color eXchange Format (CxF)

CxF was originally developed by X-Rite in the early 2000s as a universal language for transporting **complete color information** from concept to final production across devices, applications and geographies. It was handed over to the International Standards Organisation and has now been published as an ISO standard: **ISO17972 Graphic technology – Colour data exchange format (CxF/X)**

CxF is based on **XML** and can include spectral color values, named colors such as PANTONE®, color spaces and appearance effects (specific lighting conditions, type of substrate, type of ink, density, opacity, transparency of the color, gloss, texture, position and shape of color patches), as well as commercial aspects, mathematical, optical conditions, etc.

- COLOR
  - TEXTURE (SPATIAL VARIATION IN COLOR)
  - GLOSS
  - VARIATION OF HEIGHTS
  - TRANSLUCENCY OR TRANSPARENCY

The data format to communicate appearance digitally is the

Appearance eXchange Format (AxF)

AxF is a newly developed data container to transport **complete appearance information** of materials across devices, applications and geographies.

In contrast to CxF the information is stored as **binary data** to master the significantly bigger data volume which is needed to describe the total appearance of a material.

AxF is developed as an **complement to the CxF** format and it is able to store CxF based color information inside to save the color information of an material.

It is our intend that the format gets the same wide adoption across different application and devices like the CxF format today.

• Title of the

The total appearance capture ecosystem

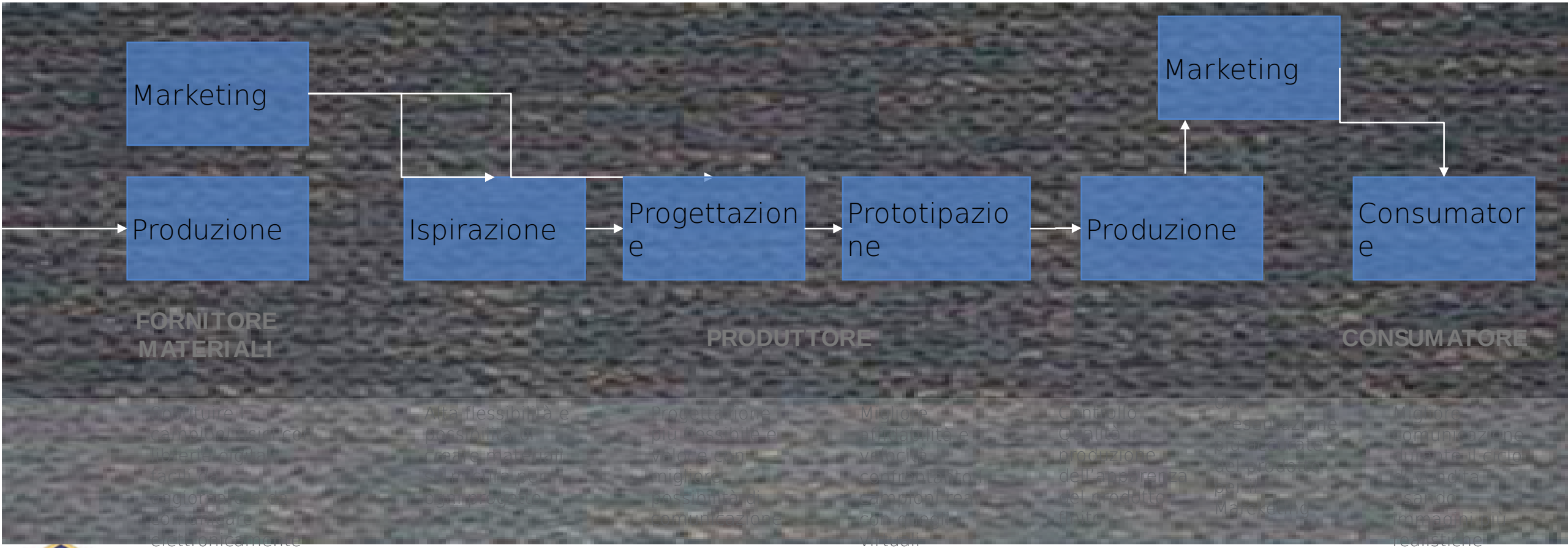
CATTURARE | **COMUNICARE** | **COMPARARE**

CREATE

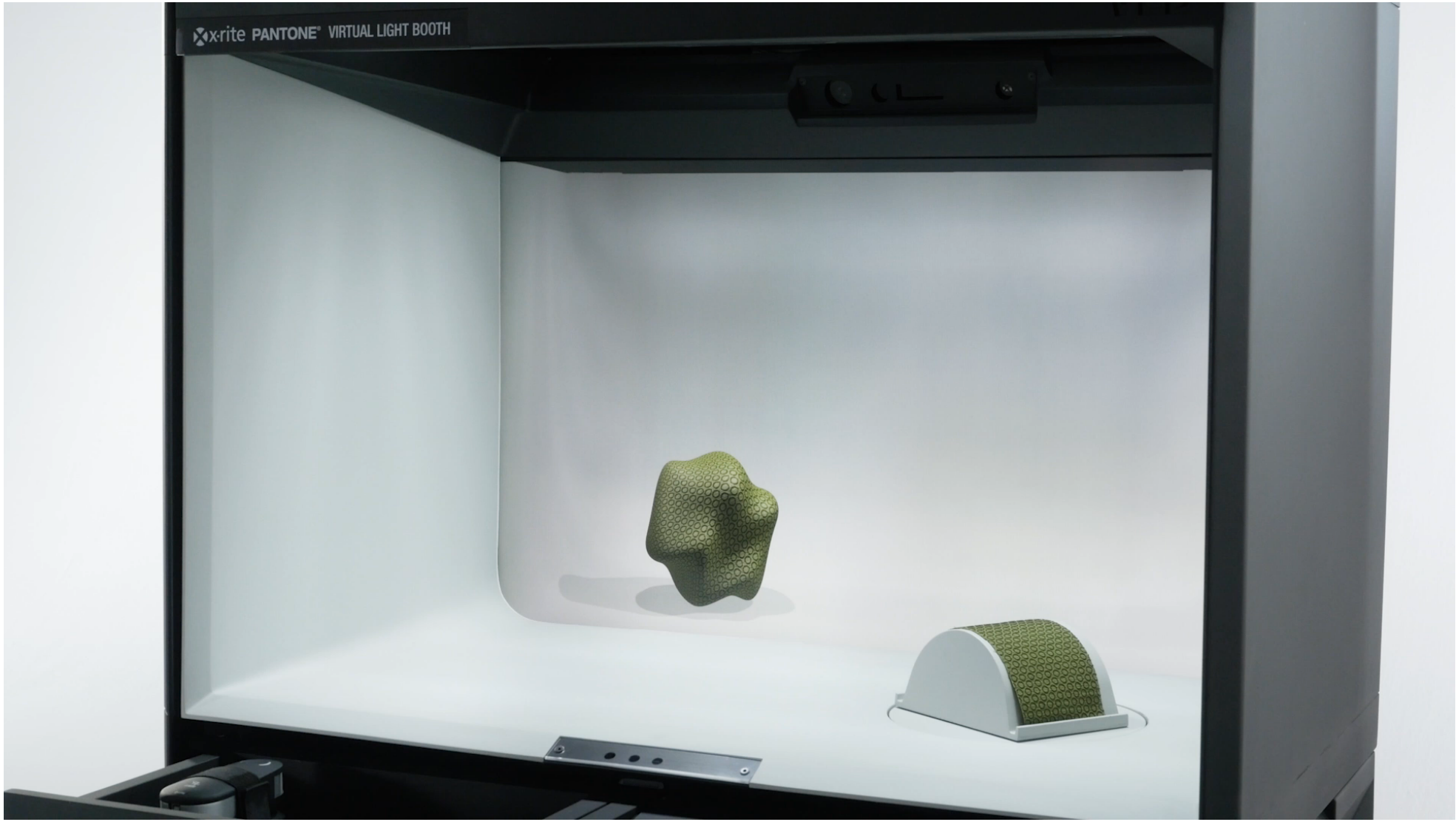
AUTODESK®
VRED™ PROFESSIONAL

x-rite
PANTONE®

Come cambia il flusso produttivo



Comparare con i modelli virtuali



Evoluzione dell’apparenza

ADESSO
STAZIONE

CATTURARE

Creare e utilizzare lo standard (AxF)

- Catturare
- Comunicare
- Visualizzare

PROSSIMO
RETE

WORKFLOW

Connettere tutto il workflow produttivo con altre stazioni

X-Rite

- Editare, Confrontare, Differenziare
- Calibrare Inter-Instrument Agreement (IIA) Ripeatibilità
- Netprofiler APP dE Appearance

FUTURO
CLOUD

VIRTUALIZZARE

Aggregare dati prelevati da librerie campioni organizzate per materiali ed effetti standardizzati nel Cloud

- Search, Navigate, Naming, Referencing
- PANTONE® Material Nomenclature, Ontology, Classify, Categorize
- PANTONE® Material Nomenclature Library Global Appearance Platform (GAP)

Increasing Business Relevance

conclusioni

La digitalizzazione del processo produttivo porta notevoli vantaggi per le Aziende innovative che adotteranno queste tecnologie:

Riduzione dal 10% al 40% dei costi di manutenzione

Riduzione dal 20% al 50% del Time to Market

Riduzione del 10%-20% dei costi per il controllo qualità

Riduzione del 20%-50% dei costi di magazzino e inventario

Incremento dell’85% della capacità di previsione dei flussi produttivi

Incremento del 45%-55% della produttività delle professionalità tecniche

Grazie per l’attenzione