Materials Perception & Materials Experience

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INSPIRING INNOVATION INNOVANTE PAR TRADITION

Innovation?

Industrial Revolution
Mass production

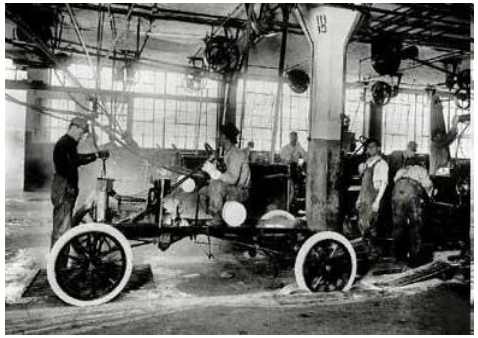
Industrial Maturation
Global manufacturing

Cheaper production
from Southeast Asia

19th century
Technological Innovations
Transportation, Energy, Chemistry…

20th

21th century
Innovations in products'
Ergonomy, Emotions, Perceptions
User experience



Centre SMS – *Département Mécanique et Physique des Interfaces*
Thématique Matériaux pour le Design et la Création Industrielle
→ *matériau comme levier de la valeur perçue des produits manufacturés*

1- Matériaux augmentés

Matériaux à apparence changeante : Elaboration, caractérisation et modélisation

- **Modélisation des effets colorés de surfaces nanostructurées d'aluminium anodisé.**
- **Elaboration de mires colorimétriques métalliques**
- **Dépôts photochromiques réinscriptibles sur supports souples**
- **Elaboration, caractérisation et modélisation des effets colorés de surfaces de titane anodisé**

Effets colorés du titane anodisé

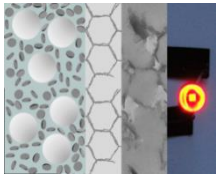
Bouilloire avec revêtement thermochrome

Matériaux actifs (smart materials)

Construction d'une base de données et développement d'un outil de sélection des matériaux dits « actifs »

Nanocomposites fonctionnels par voie latex

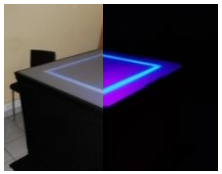
Encres conductrices nanocomposites à base de graphene par voie latex



Encre conductrice à base de latex polymère et Few-Layer Graphene

2- ingénierie de la perception

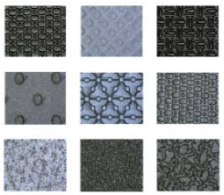
Evaluation sensorielle de matériaux et textures par procédure Napping



Métrologie sensorielle des matériaux et textures

- **Diagnostic automatisé de défauts de polissage sur des critères perceptifs**
- **Plateforme d'évaluation sensorielle – transfert des méthodes issues de l'agro-alimentaire**
- **Perceptions visuelle et tactile des matériaux texturés**

Textures de planches de bord



Influence du couple matériau-procédé sur la valeur perçue

- **Matériaux/procédés et qualité perçue des matériaux de planche de bord**
- **Acceptabilité « perceptive » des matériaux plastiques issus du recyclage**

1- Enhance perceived quality of man-made materials ad surfaces

2- Enhance human-product interactions through functional surfaces

PERCEIVED VALUE

User experience

customer expectations

cultural expectations

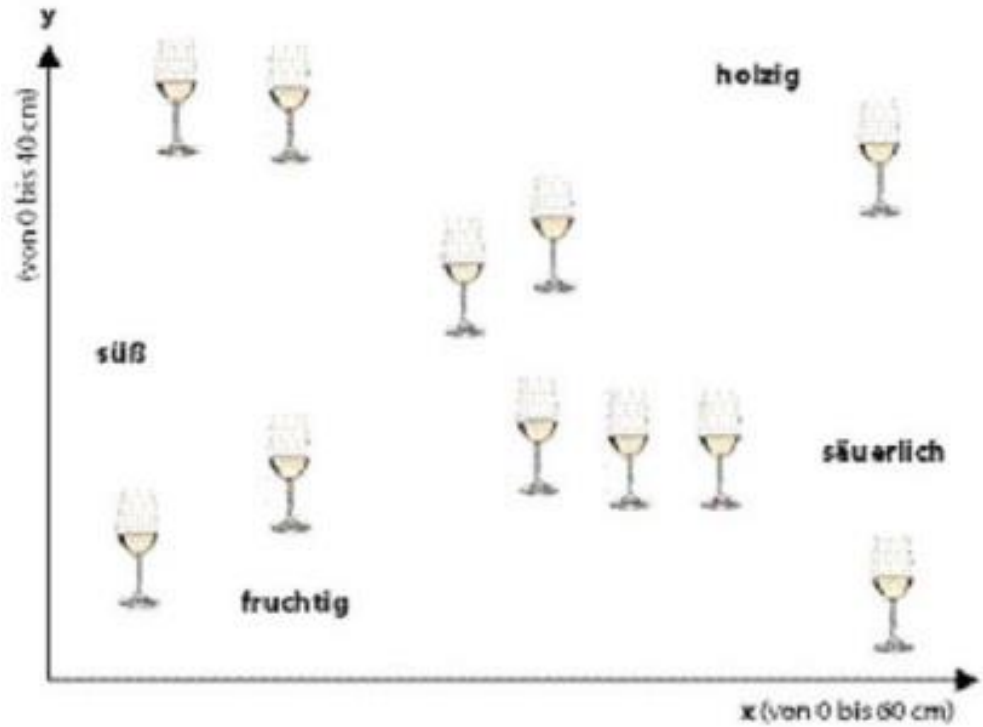
Brand identity

Aesthetics

Materials choice

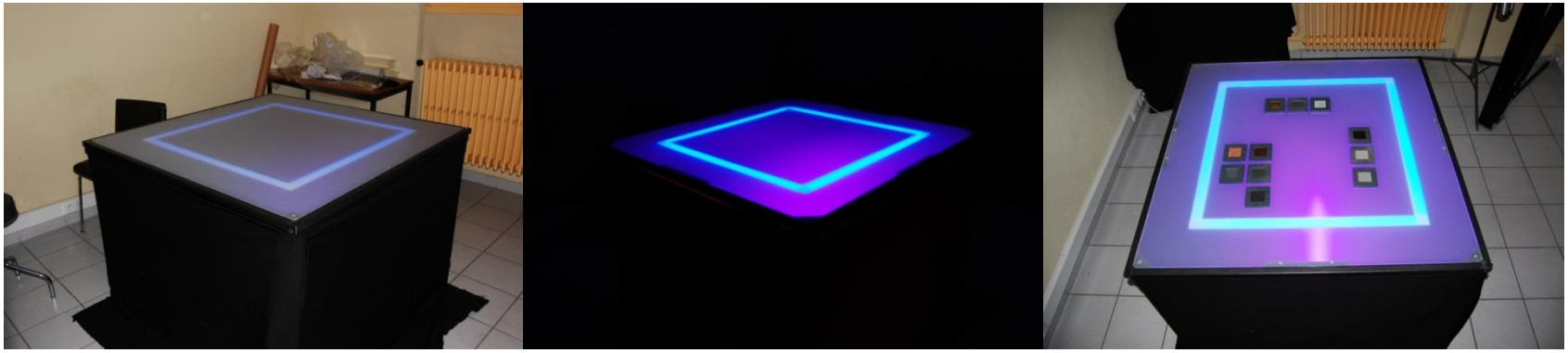
Sensory evaluation
Projective mapping (napping ®)

→ Performed in Food and Fragrance industries



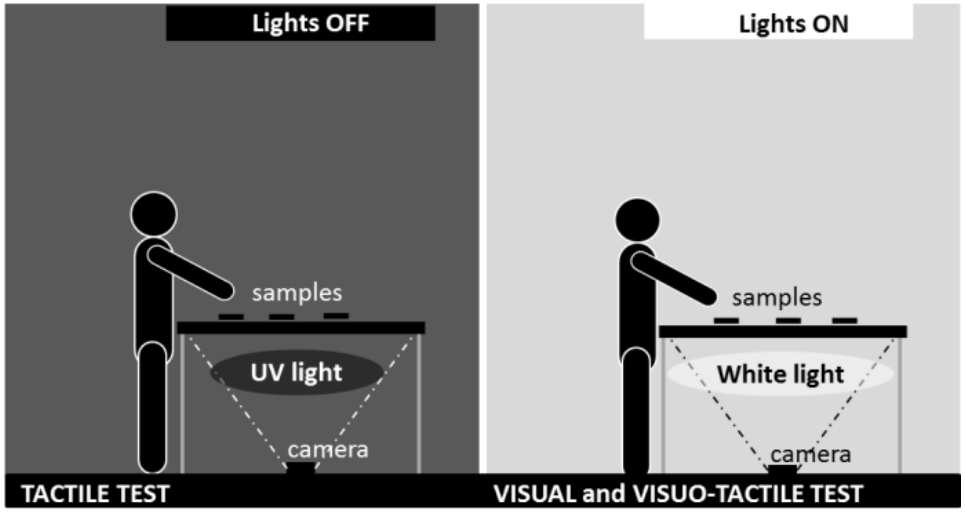
Campden predicts growing food industry interest in ‘sensory mapping’, By Ben Bouckley, 08-Dec-2010
www.sensorydimensions.com

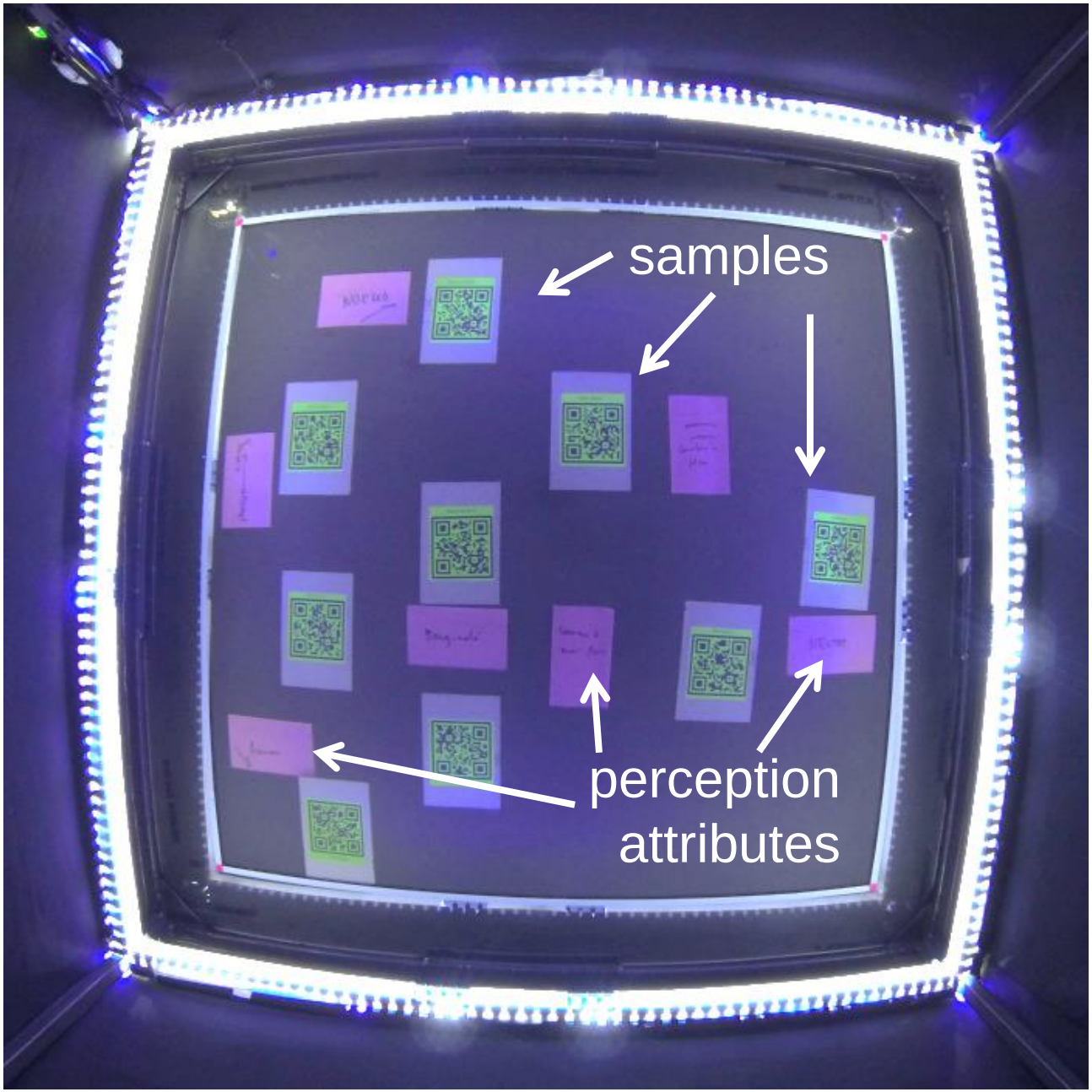
SensoTech - A set up for automated projective mapping For Materials and Products



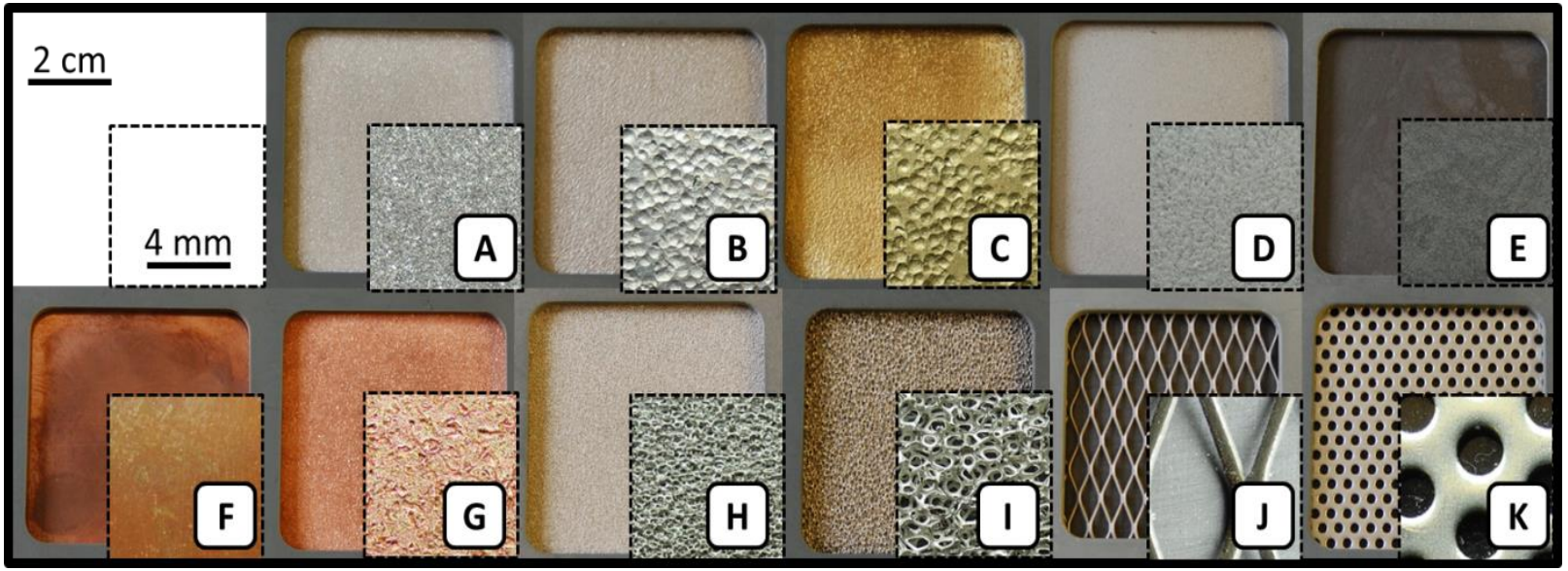
→ simple and quick technique to obtain product inter-distances

Tactile
Visual + Tactile | conditions
Visual




samples
perception
attributes

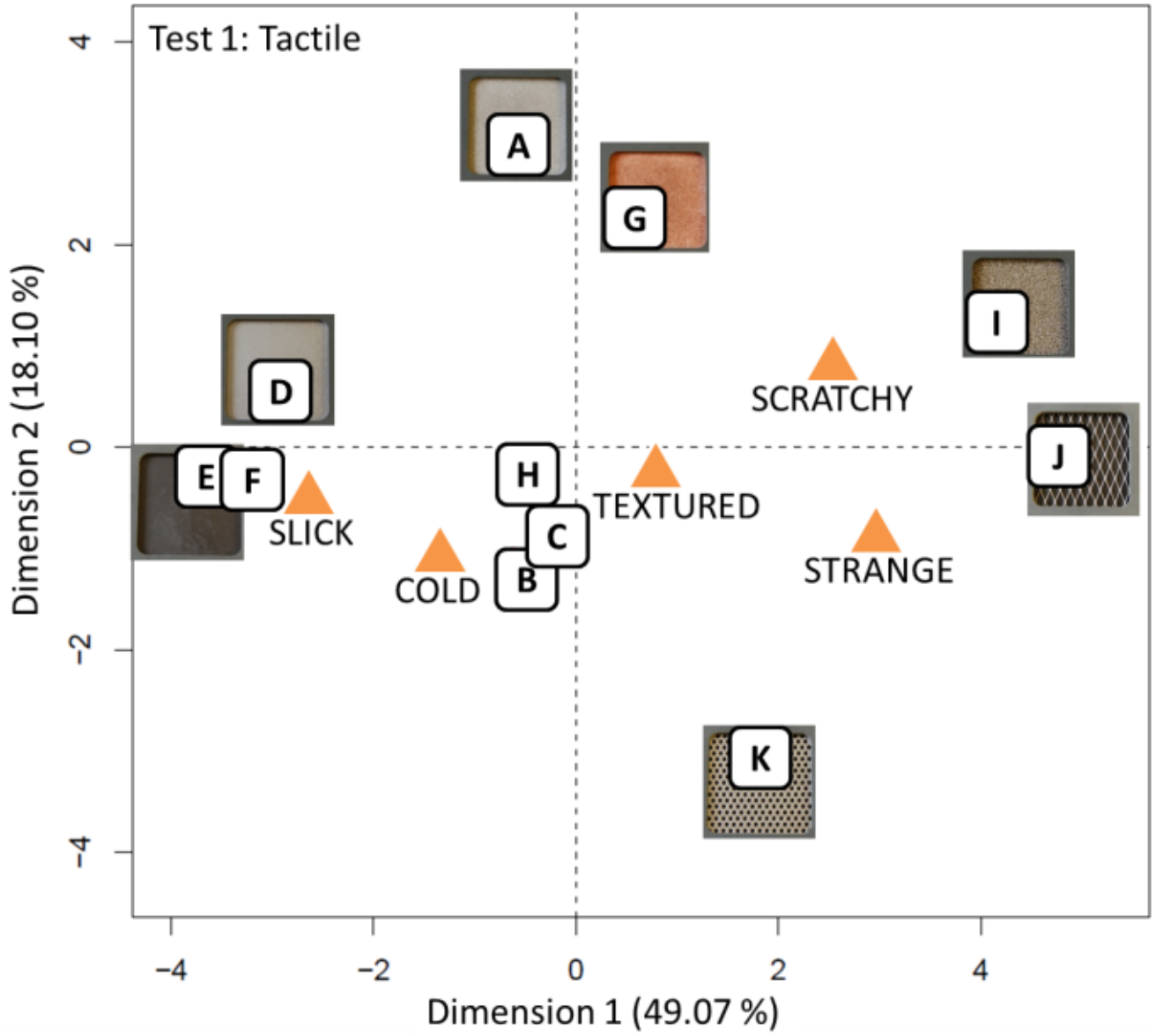
→ Individual maps of 10 assessors
→ Multiple Factor Analysis



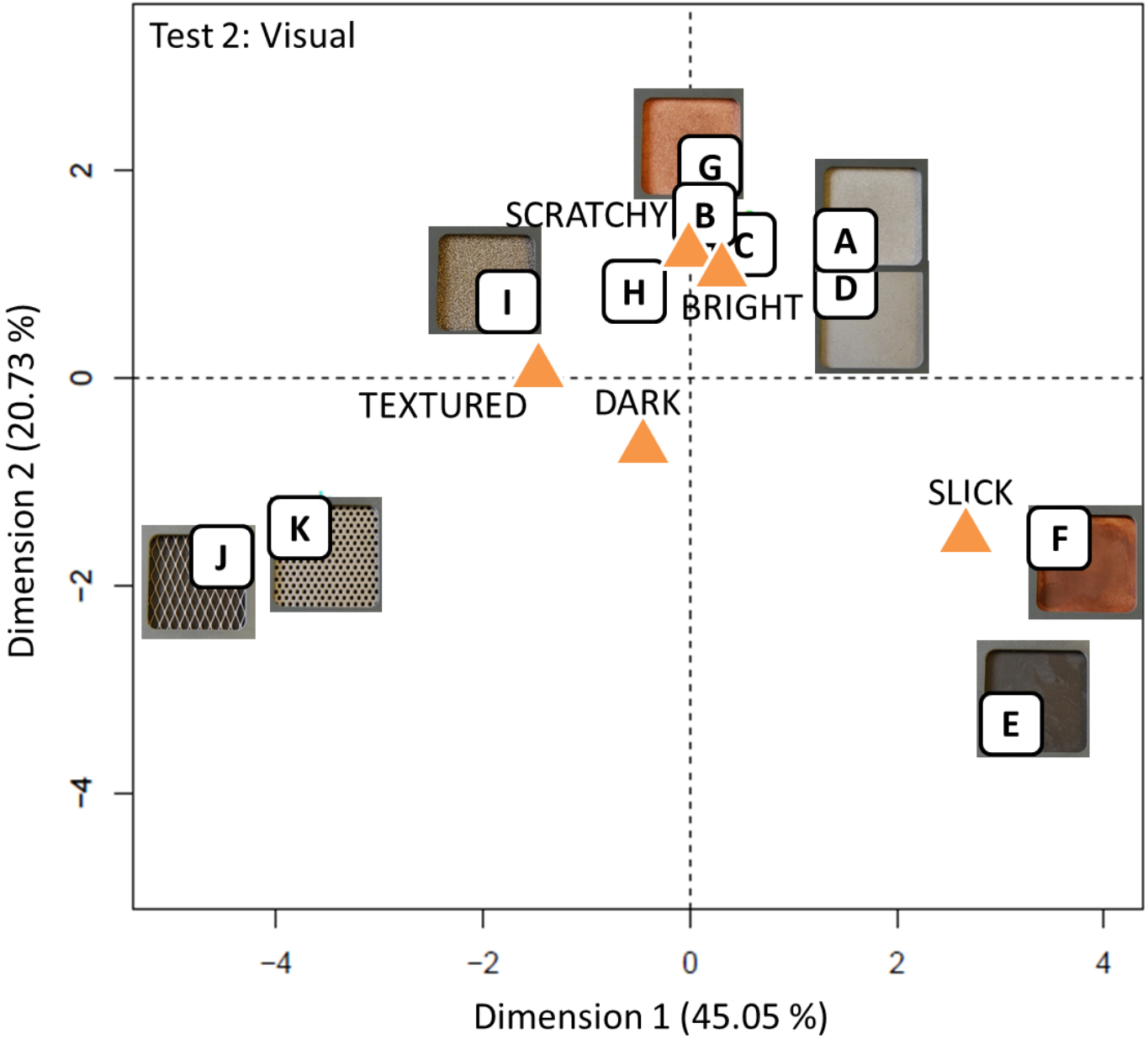
Sample	x_2LR	y_2LR
A	1558.59	1700.11
B	2316.35	2112.12
C	1766.51	1145.04
D	2153.04	1582.86
E	2500	1796.56
F	1347.25	1299.01
G	1989.51	1188.1
H	1201	891
I	2687	1998

+

TEST 2: VISUAL		Sample reference											
Keyword	Words associated	A	B	C	D	E	F	G	H	I	J	K	Total
TEXTURED	textured, fine, like foam, like coton, coarse, grating, alveolate, agglomerate, mottled	2	2	2	2	0	0	3	6	5	6	6	34
SCRATCHY	rough, abrasive	3	5	5	3	0	0	4	3	2	1	0	26
LIGHT-BRIGHT	light, bright, grey, golden	5	4	4	5	0	1	2	2	2	0	1	26
SLICK	slick	2	0	0	2	8	8	0	1	0	0	1	22
DARK	dark	0	1	1	1	3	2	1	2	2	3	2	18
PRECIOUS	precious	1	0	1	0	0	1	1	0	0	0	0	4
COLD	cold	0	0	0	0	0	0	0	0	1	1	2	4
WARM	warm	0	0	0	0	0	1	1	0	0	0	0	2
MATTE	matte	0	0	0	0	0	0	0	1	1	0	0	2
		TOTAL											138



MINES Saint-Étienne

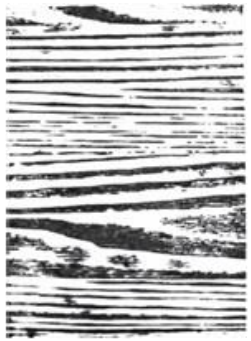

Test 2: Visual
G
SCRATCHY
B
C
A
D
I
H
BRIGHT
TEXTURED
DARK
SLICK
F
J
K
E
Dimension 2 (20.73 %)
Dimension 1 (45.05 %)
2
0
−2
−4
−4
−2
0
2
4

SensoTech : Automated Projective mapping

→ simple and quick technique to obtain product inter-distances
→ No need for trained assessors – can be performed by users/customers
→ Perception of visual and tactile perception of materials and products, separately or simultaneously

For design
Benchmark of existing products / new products
Study of designs that trigger emotions → higher perceived value

For Human
→ Impact on perception of sensory disabilities
Ex. Improve the tactile interfaces for visually impaired persons.

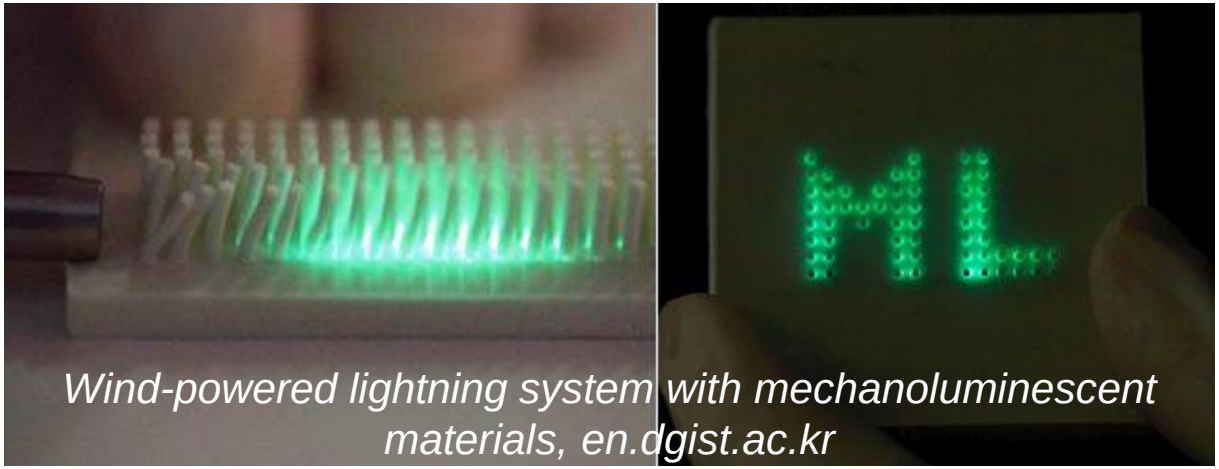


For materials engineering
→ Enhance perceived value of man-made materials
Ex. How best to distribute the information between the visual and haptic channels when countertyping a natural material?

1- Enhance perceived quality of man-made materials ad surfaces

2- Enhance human-product interactions through functional surfaces

What are smart materials?

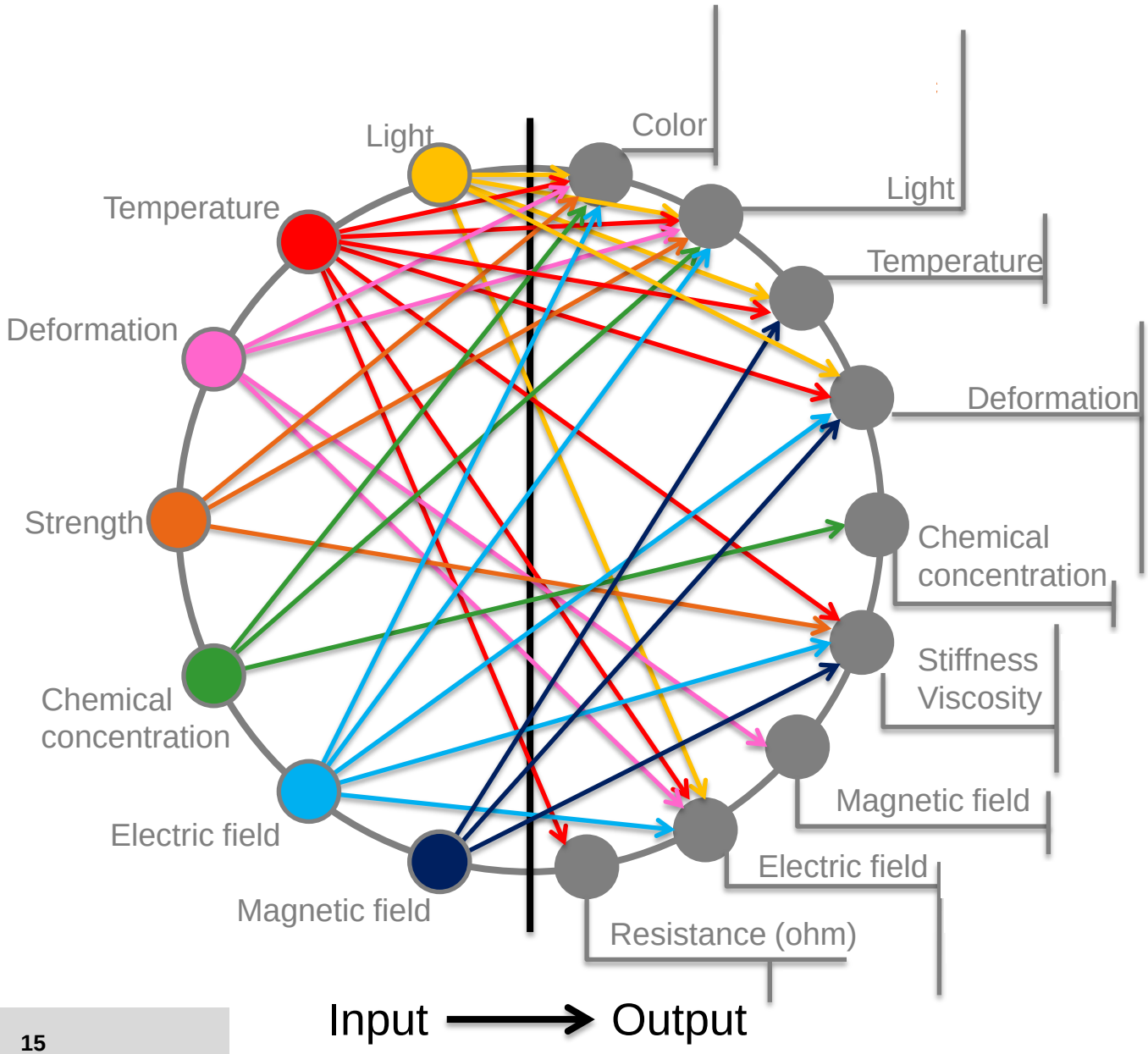


Wind-powered lightning system with mechanoluminescent materials, en.dgist.ac.kr

Smart materials provide designers with opportunities to create new products or transform existing ones, creating smart products and imagining new user experiences.

[1] Smart Materials and Technologies for the architecture and design profession, D. Michelle Addington, Daniel L. Schodek

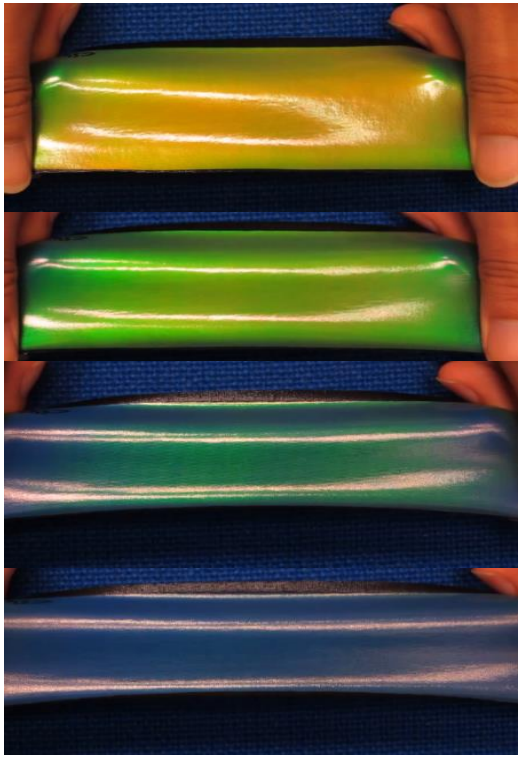
Classification of smart materials



MINES Saint-Étienne

Smart materials – Temporality of effect

Spontaneous



Opal polymer, www.np.phy.cam.ac.uk/

Delayed effect

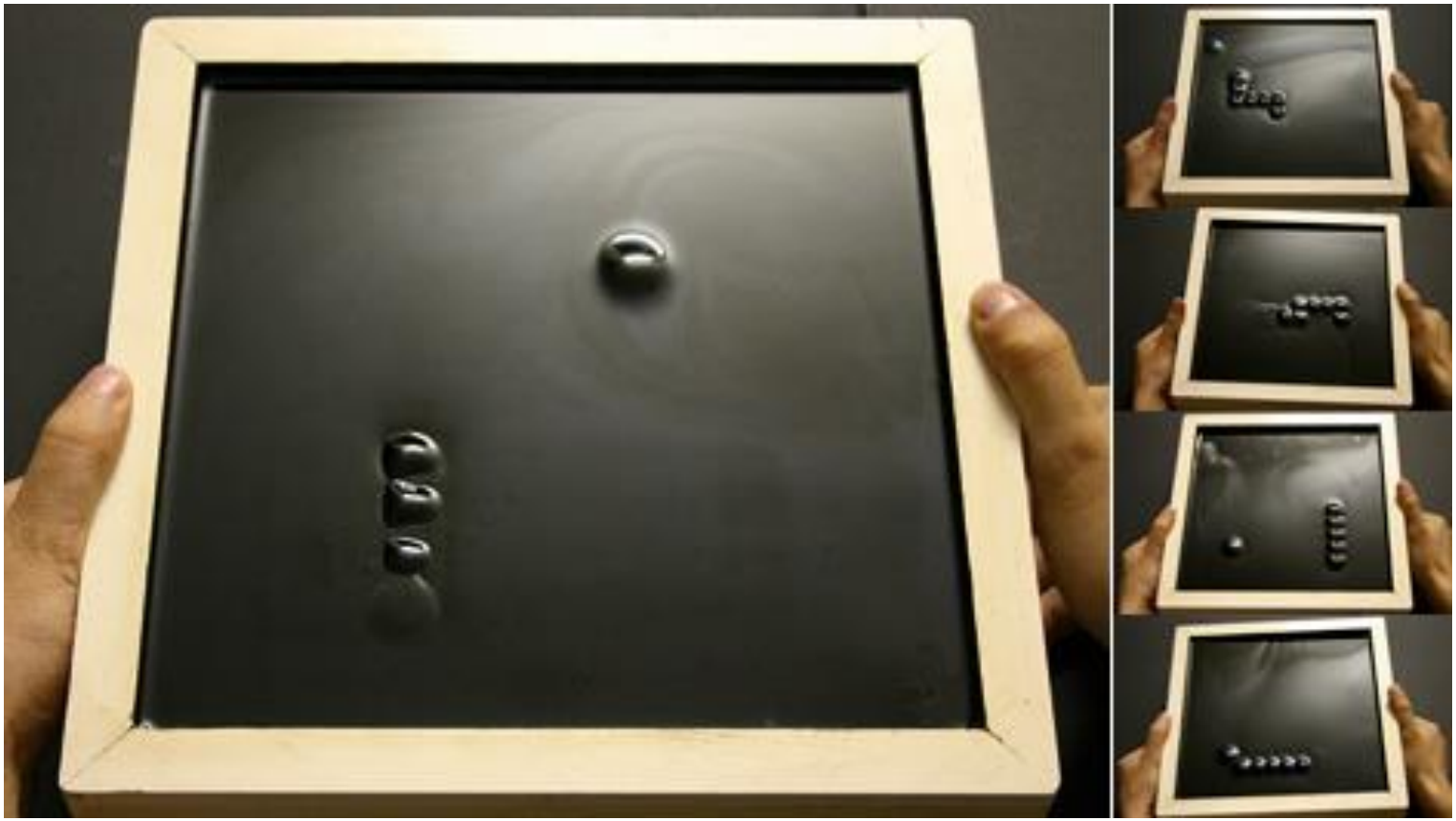
Photoluminescent road markers, www.lucedentro.com

Smart materials – Local output

Thermochromic table, “Linger A Little Longer” by Jay Watson design, www.jaywatsondesign.com

Smart materials - Selectivity

controlled input → controlled output



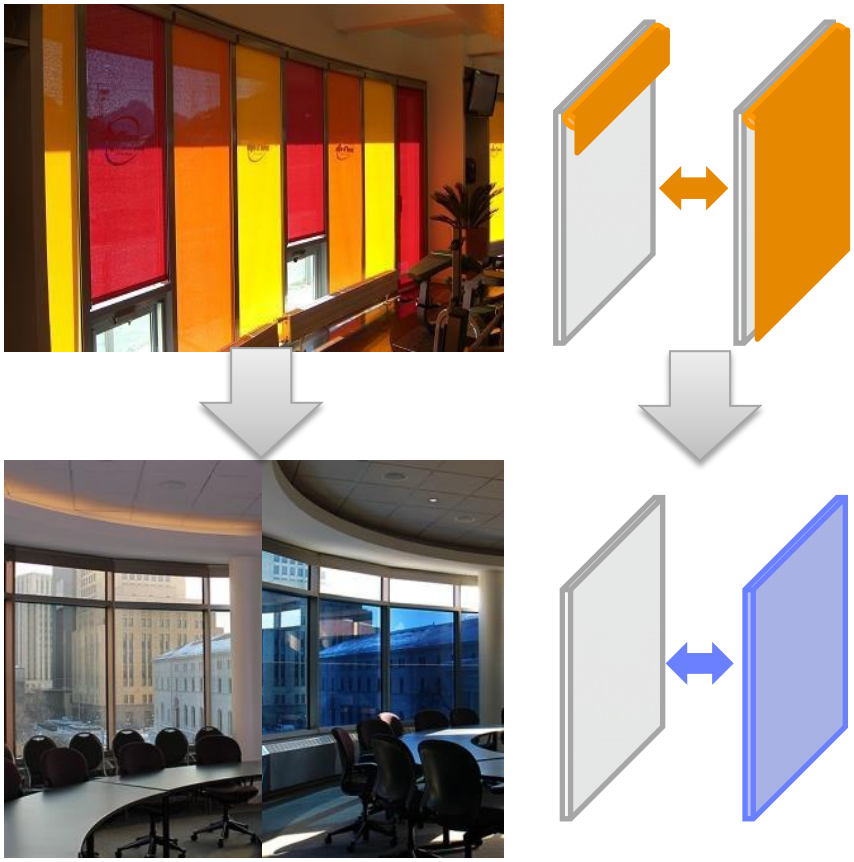
Ferrofluid display, SnOil by Martin Frey, http://www.freymartin.de/

Smart material – reversibility

Spontaneous or triggered

Squidlondon's hydrochromic umbrellas, www.squidlondon.com

Smart materials for Design



Electrochromic windows,
http://sageglass.com

TO SIMPLIFY

Less components to get the same functionality

Ex. smart materials instead of electronic function in smart textiles

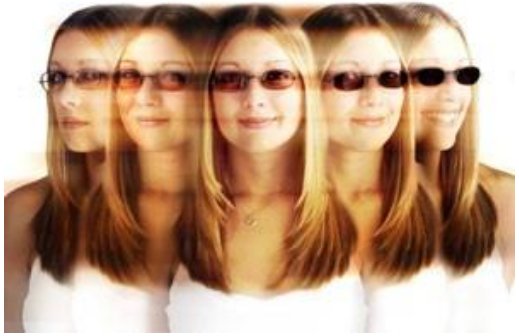
But can change

- the shape of the product

- Induce a different user experience

Smart materials for Design

Thermochromic spoons indicating the food is too hot, http://newcolorchem.com



Photochromic glasses, with Reversacol dyes, www.vivimedlabs.com/

TO AMPLIFY

Bring an additional feature to an existing product

Increase the user experience

Add a communicating function

Create a database for browsing and selection of smart materials

End user experience
Story of the object's usage
"When I see the blue drawing appearing on the kettle, I know that the water is hot"

Material experience
What does the material/surface feels like?
The surface changes from white to blue color

Functionalities
Information proceeded
The kettle changes color when the boiling temperature is reached

Stimuli-responsive phenomena
Effect: from the input to the output
Thermochromism

Stimuli-responsive mechanisms
Physical mechanism leading to the transition
Polymer ring opening

ONE tea kettle,
by Vessel Ideation

Create a database for browsing and selection of smart materials

→ increase awareness of designers on smart materials

- Drag the materials properties into suitable-for-use materials solutions and develop demonstration products

- Build the foundation of a comprehensive toolkit for co-created materials and products

→ For a closer partnership between actors from materials sciences and design

in particular for smart materials that are not industrially mature yet

→ need for process developments.