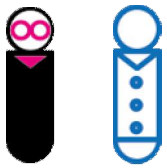
DESIGN DRIVEN
VALUE CHAINS
IN THE WORLD
OF CELLULOSE
DWoC

AN INVESTIGATION ON THE DESIGN DRIVEN APPROACH TO MATERIALS DEVELOPMENT
(In DWoC)

BARRIERS AND ENABLERS FOR COLLABORATION BETWEEN DESIGNERS AND SCIENTISTS IN THE CONTEXT OF MATERIAL DEVELOPMENT



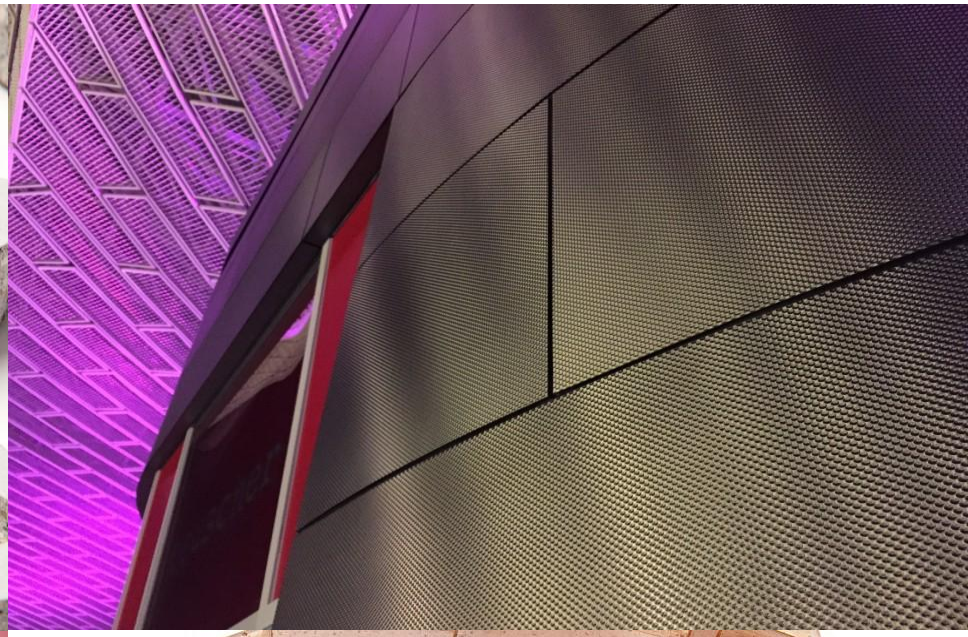
CARLOS PERALTA Ph.D (Cantab)

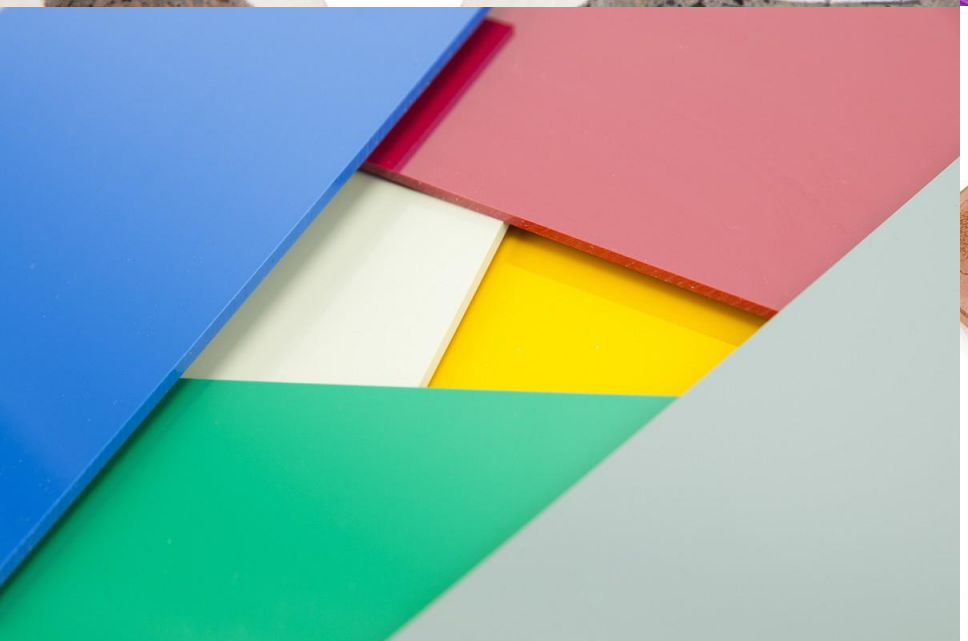
@ Design Museum, Helsinki, 13/June/2017

Tekes Aalto University Tampere University of Technology University of Vaasa VTT

DESIGN DRIVEN
VALUE CHAINS
IN THE **WORLD**
OF CELLULOSE
DWoC

Materials development is...





People experience products through their material properties..

FABRIC DATA

TENCATE Pioneer ENFORCE TECHNOLOGY

FABRIC PROPERTIES		
Fabric Nominal Weight		6.6 osy (225 gsm)
Special Feature		TenCate ENFORCE™ Technology (Patent Pending)
Fiber Blend		DuPont™ Nomex® and Kevlar®
Weave		Twill
Colors		Khaki, Light Gold, Black, Yellow and Spruce Green
Finish		Super Shelltite™
Made in America		Yes
Certifications		NFPA 1971
COMPOSITE TESTING		
TPP NFPA 1971	Quantum3D® SL2i & Gore® Crosstech® Black	41 to 43
	Caldura® SL2i & Gore® Crosstech® Black	40 to 42
	Defender® M & Stedfast Stedair® 4000	44 to 46
	Defender® M & Stedfast Stedair® 3000	44 to 46
THL NFPA 1971	Quantum3D® SL2i & Gore® Crosstech® Black	250 to 270
	Caldura® SL2i & Gore® Crosstech® Black	270 to 290
	Defender® M & Stedfast Stedair® 4000	220 to 240
	Defender® M & Stedfast Stedair® 3000	220 to 240
FABRIC STRENGTH		
Taber Abrasion ASTM D3884		3,000 cycles
Trap Tear ASTM 5587, NFPA 1971 (WARP x FILL)	Initial	45 x 45 lbf (200 x 200 N)
	5X After Wash	45 x 45 lbf (200 x 200 N)
Tensile Strength ASTM 5034 (WARP x FILL)	Initial	350 x 350 lbf (1,555 x 1,555 N)
	10X After Wash	350 x 350 lbf (1,555 x 1,555 N)
FLAME TESTING		
Flame Resistance ASTM D6413, NFPA 1971	Initial	0.5 x 0.5 in (13 x 13 mm)
	5X After Wash	0.4 x 0.4 in (10 x 10 mm)
	After Flame	0 x 0 seconds
Thermal Shrinkage NFPA 1971-2013	Initial	< 1.0%
	5X After Wash	< 1.0%
WATER TESTING		
Water Absorption Resistance AATCC 42	Initial	< 5.0%
	5X After Wash	< 7.0%

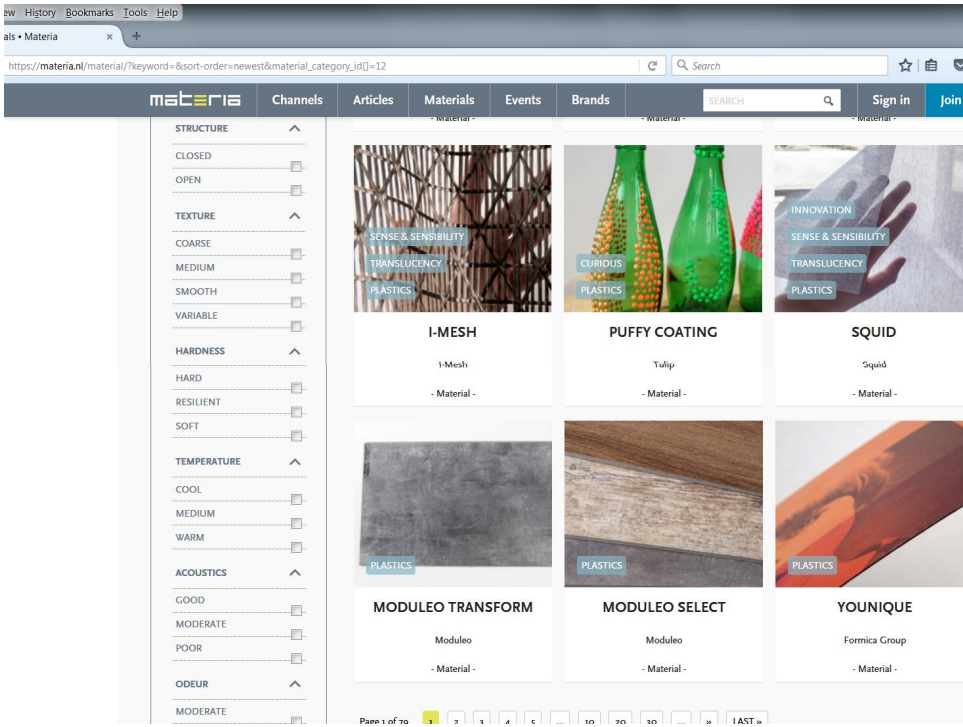
TENCATE protectivefabrics

6501 Mall Boulevard
Union City, Georgia 30291
USA

+1 (770) 969-1000

TenCateFabrics.com

TenCate-Freedom.pdf | Version 08192015A

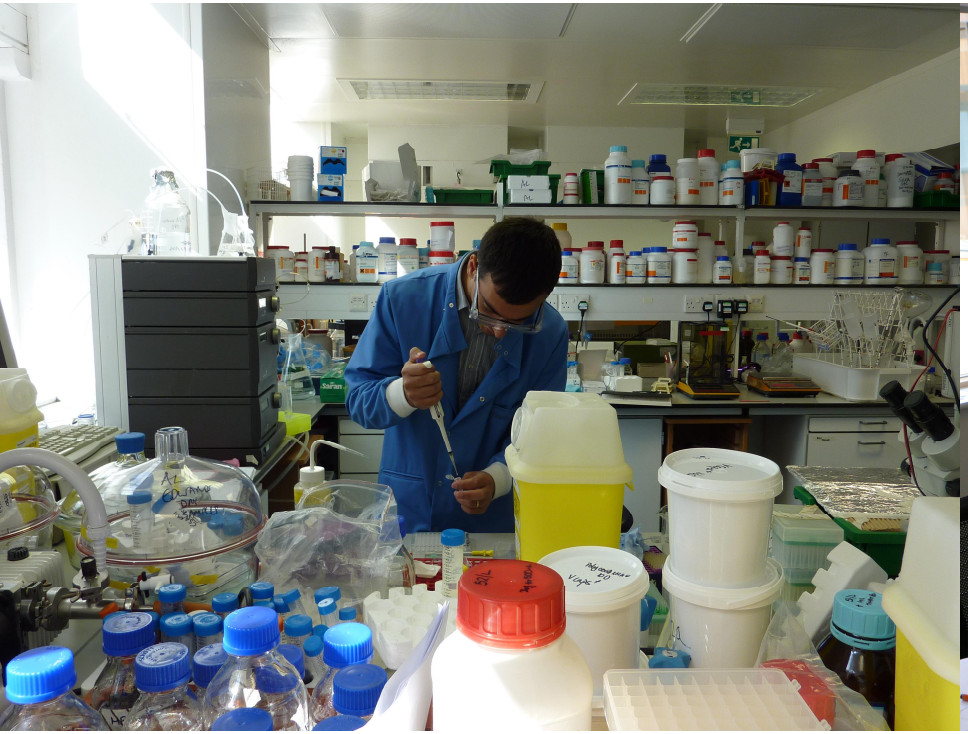


Therefore developing the technical and sensorial material properties is important and necessary...

DESIGN DRIVEN
VALUE CHAINS
IN THE WORLD
OF CELLULOSE
DWoC

...and having Designers & Scientists collaborating for an integrated development of material properties makes sense

However designers & scientists ARE different and this can be challenging



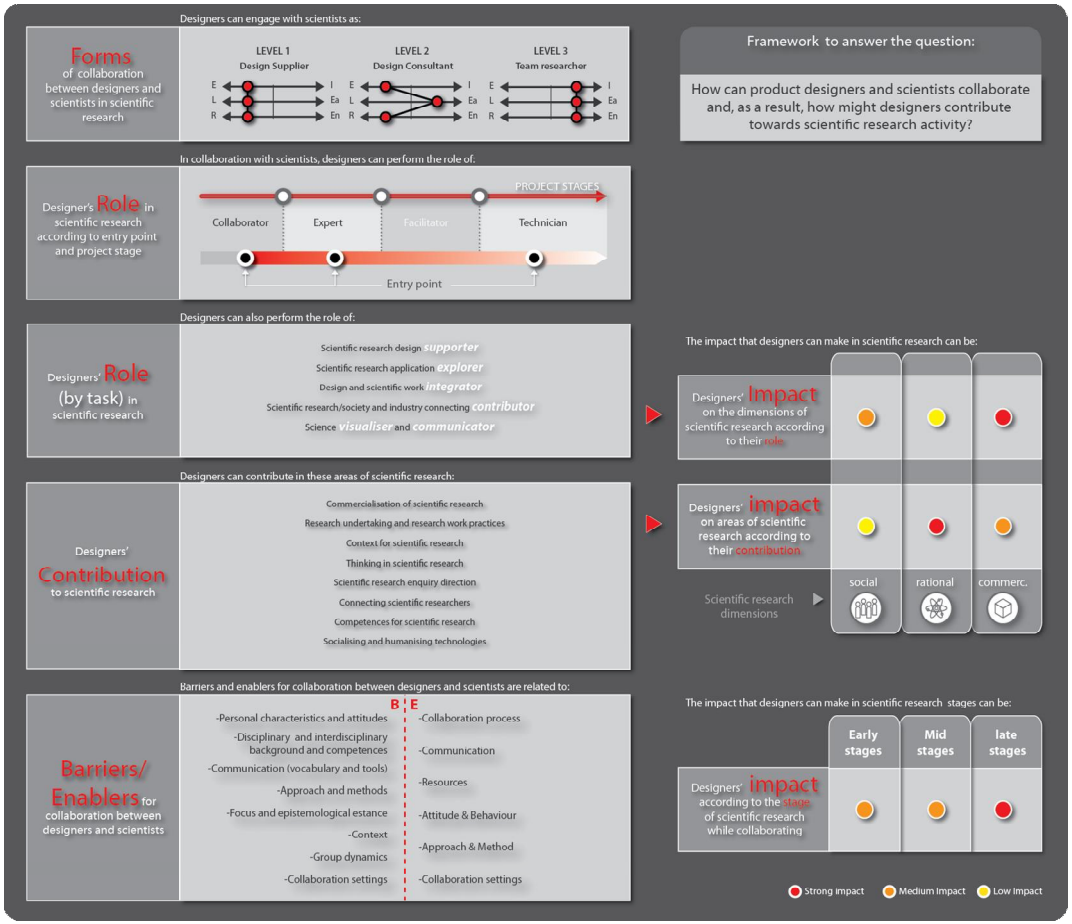
Collaboration between designers and Scientists has been studied...

Collaboration between Designers and Scientists in the Context of Scientific Research

A thesis submitted to The University of Cambridge
For the degree of Doctor of Philosophy

Carlos Peralta
ID, MA ID (Domus)

University of Cambridge
Department of Engineering
Robinson College
February 2013



and Barriers and Enablers have been identified...

Barriers for Collaboration Summary (2/2)

Area of collaboration	BARRIERS
Personal characteristics and attitudes	
	A poor "designers' self-image" leading him/her to be relegated to a "subsidiary role"
	"Possible Collaborators" may not recognize designers' contributions
	Lack of disciplinary recognition
	Social and psychological impediments: Resistance to innovation, mistrust, insecurity, marginality
	Limited transaction memory: Unawareness of other people's knowledge
	Social overload: Senior researchers reluctant to collaborate
	Fixed and narrow preconceptions about design and designers
	Unrealistic or imprecise expectations about design and designers
	Passive role of scientist
	Lack of motivation
	Fixation on own ideas/lack of flexibility
Disciplinary and interdisciplinary background and competences	
	Participants may lack: Integrative skills, system thinking, and familiarity with interdisciplinarity
	Different disciplinary language
	Inexperience of designers (For example working with very small scales)
	Science abstruseness and distance from designers' normal experiences and knowledge
Communication (vocabulary and tools)	
	Little terminology knowledge
	Different ways and styles of communication e.g visual vs. written
	Communication difficulties the participants had due to the lack of "any shared formal language"
	Designers lack of communication about own disciplinary competences
Approach and methods	
	Different approach to problem solving
	Different methodological approach (intuitive/subjective vs. Scientific rational and objective)
Focus and epistemological estance	
	Project focus divergence (what is important)
	Disciplinary assumptions (status quo vs change) (real insight vs on their behalf)

Barrier empirically proved *Barrier drawn from design literature* *Barrier drawn from interdisciplinary literature*

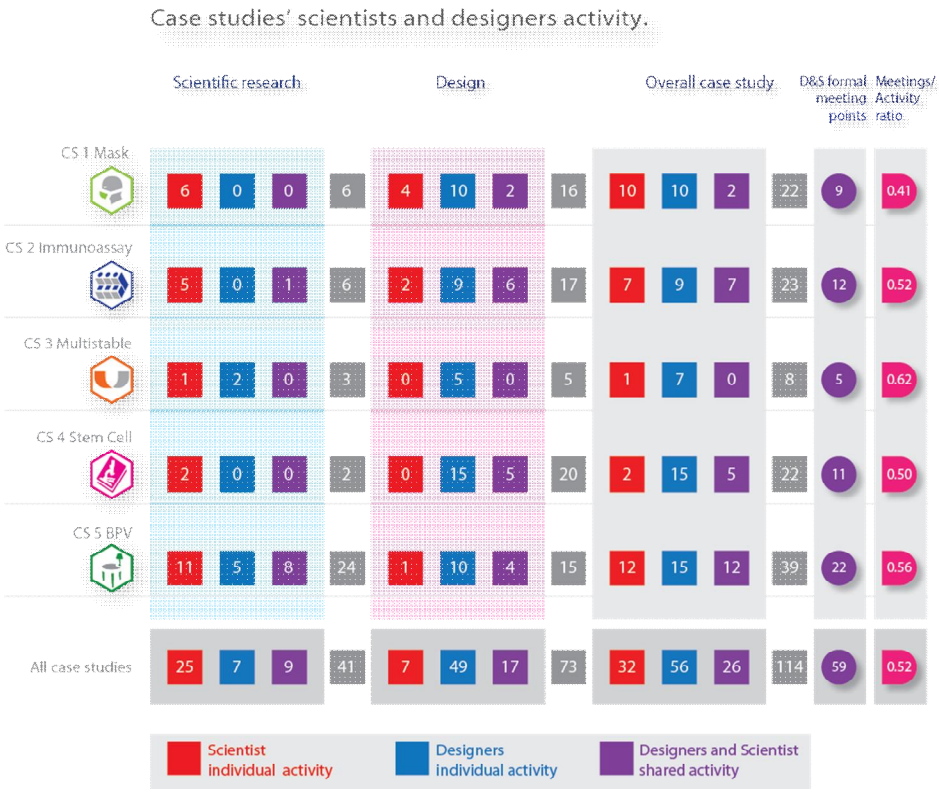
Enablers for Collaboration Summary (1/2)

Aspect of collaboration	Enablers
Collaboration process	
	Designers' visualising of scientific processes, devices, etc/tool for understanding and revealing tacit information
	Thorough evaluation of designers' ideas by scientists
	Integration of feedback and joint design sessions
	Early Involvement of the scientist in the design process (brainstorms)
	Participation of designers on some day to day scientific activity
Collaboration settings	
	Clarity about the scope and limitations of collaboration, and the expected contribution of each member of the team
	Clear definition of project responsibility according to disciplinary abilities
	Involvement of 3rd parts moderating/feed backing/fostering collaboration
	None of the researchers close than the others to a solution at the beginning
	Clear allocation of responsibilities
	Having a team leader or an altenative a work model in which decisions are taken by consensus
	Having "facilitator" to ease communication between members of the team
	Initial added time for researchers' mutual knowledge and adaptation
Resources	
	Provision of materials, equipment and space for designers' experimentation
	Resources for design development costs
	Access to labs, people and information
	Designer's ample range of skills / Right design skills for the project requirement
	Using socialising setting to discuss project
Communication	
	Intensive and constant communication
	Scientist "De technifying" language to the right level
	Scientists extra efforts to explain scientific concepts to the designers
	Fundamental terminology established early and reviewed regularly
	Attention paid to unnoticed specialised use of same words that have different meaning in each discipline
	Developing a common language and making explicit the meaning of certain key words
Attitude & Behaviour	
	Active participation, engagement and time dedication
	Good will and enthusiastic attitude from scientists and designers
	Proactive attitude to overcome the science knowledge barrier by the designers
	Recognition of disciplinary strengths and abilities
	Additional motivations different to the professional interest on the project topic
	Being receptive, open minded , ready and proactive in learning from others, and having a sense of humour.
	Personal empathy between researchers
Approach & Method	
	Research topics are equally interesting for all disciplines involved
	Reciprocity: giving back to the subjects studied by sharing with them the research developments and findings
	Parity: competing disciplinary points of view should be weighted by the team and balanced
	Agreement on measurement must be reached
	Reformulation of research problem inmediatelly done after an agreement on collaboration has been reached

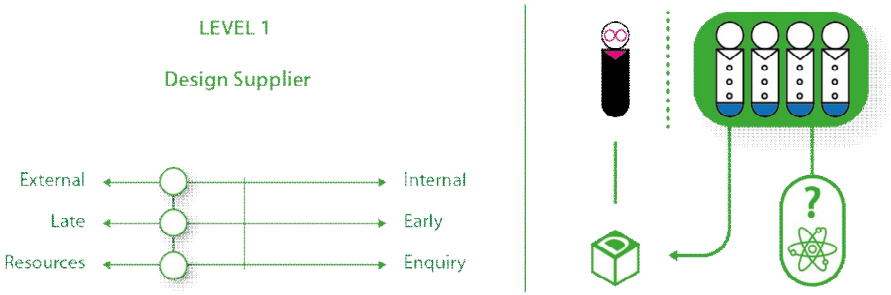
Enabler empirically proved *Enabler drawn from interdisciplinary literature*

However Peralta (2013)'s study does not apply entirely to the context of material development as it was:

-Done for Scientific research, not for material development

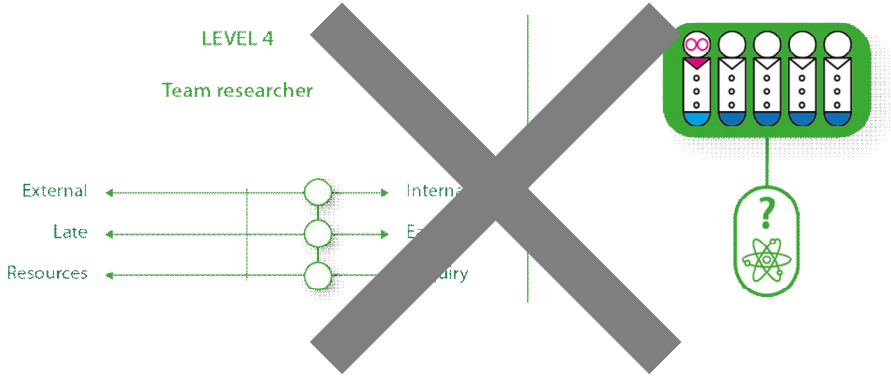


However Peralta (2013)'s study does not apply entirely to the context of material development as it was:



-Done for Scientific research, not for material development

-Designers acted as design providers, not as fellow researchers



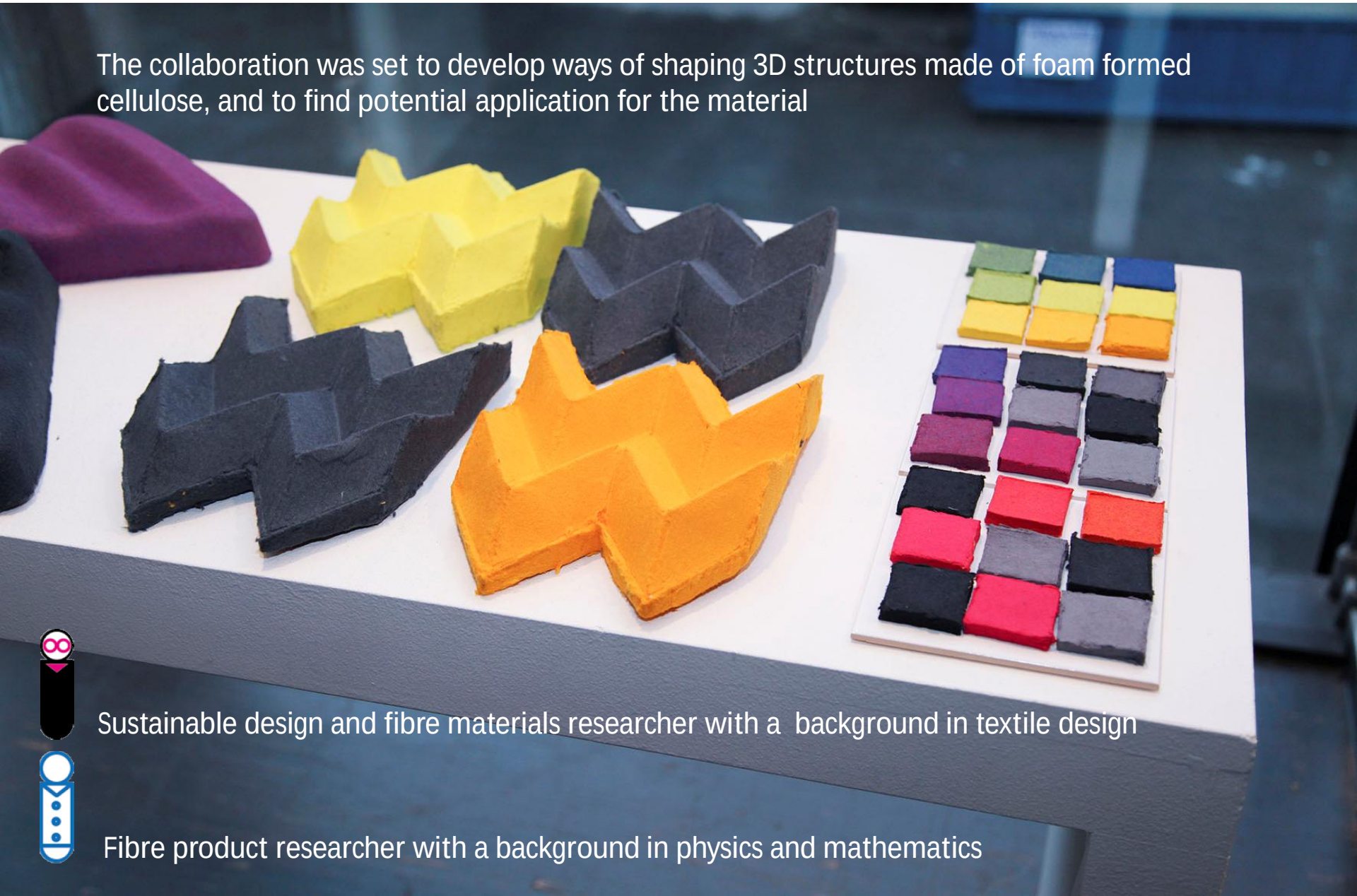
The Study

This study attempts to identify what barriers to and enablers (B&E) of collaboration are in collaborative work between designers and scientists in the context of material development.

It also intends to establish if there are
B&E that are inherent to collaborative material development.

Case 1

Foam formed cellulose 3d shaping



The collaboration was set to develop ways of shaping 3D structures made of foam formed cellulose, and to find potential application for the material

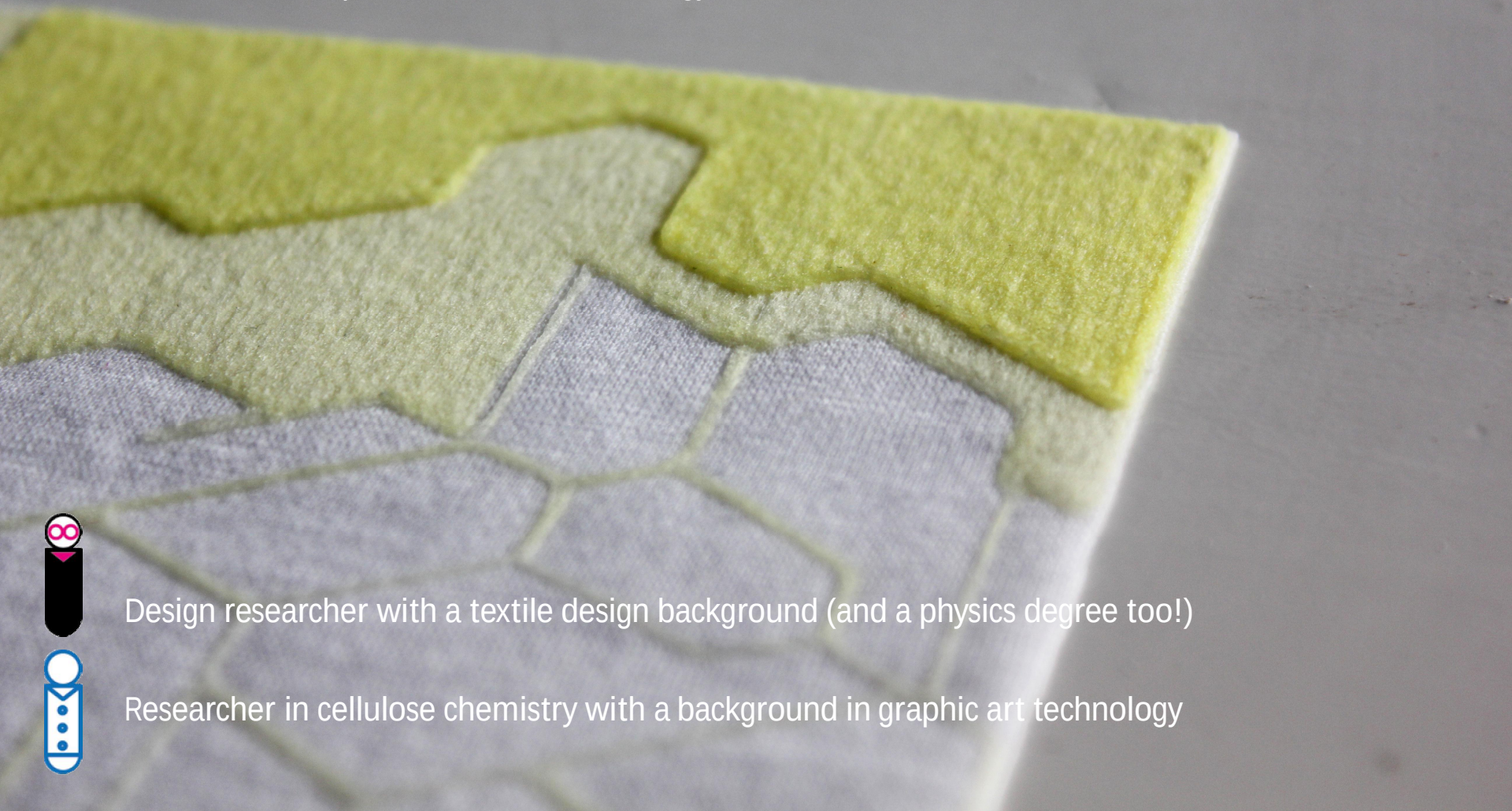
Sustainable design and fibre materials researcher with a background in textile design

Fibre product researcher with a background in physics and mathematics

Case 2

Exploration of functional textiles structures with 3D printing technology

The collaboration was established to explore future applications of cellulose based 3D printing technology on functional textiles. In addition, to manufacture demonstrators that would communicate the potential of the technology



Design researcher with a textile design background (and a physics degree too!)

Researcher in cellulose chemistry with a background in graphic art technology

DESIGN DRIVEN VALUE CHAINS IN THE WORLD OF CELLULOSE DWoC

Case 3

Moulding development for cellulose foam forming technology

The collaboration was set to explore applications for foam forming technology and to develop its associated moulding technology

A design researcher with an MA in Industrial and Strategic design

A researcher with a background in Science Engineering and Energy studies

Case 4

Cellulose application for architectural applications

The collaboration was initiated to develop new and future applications of cellulose-based materials in architecture and interior spaces

A design researcher with a background in spatial and industrial design as well as in architecture

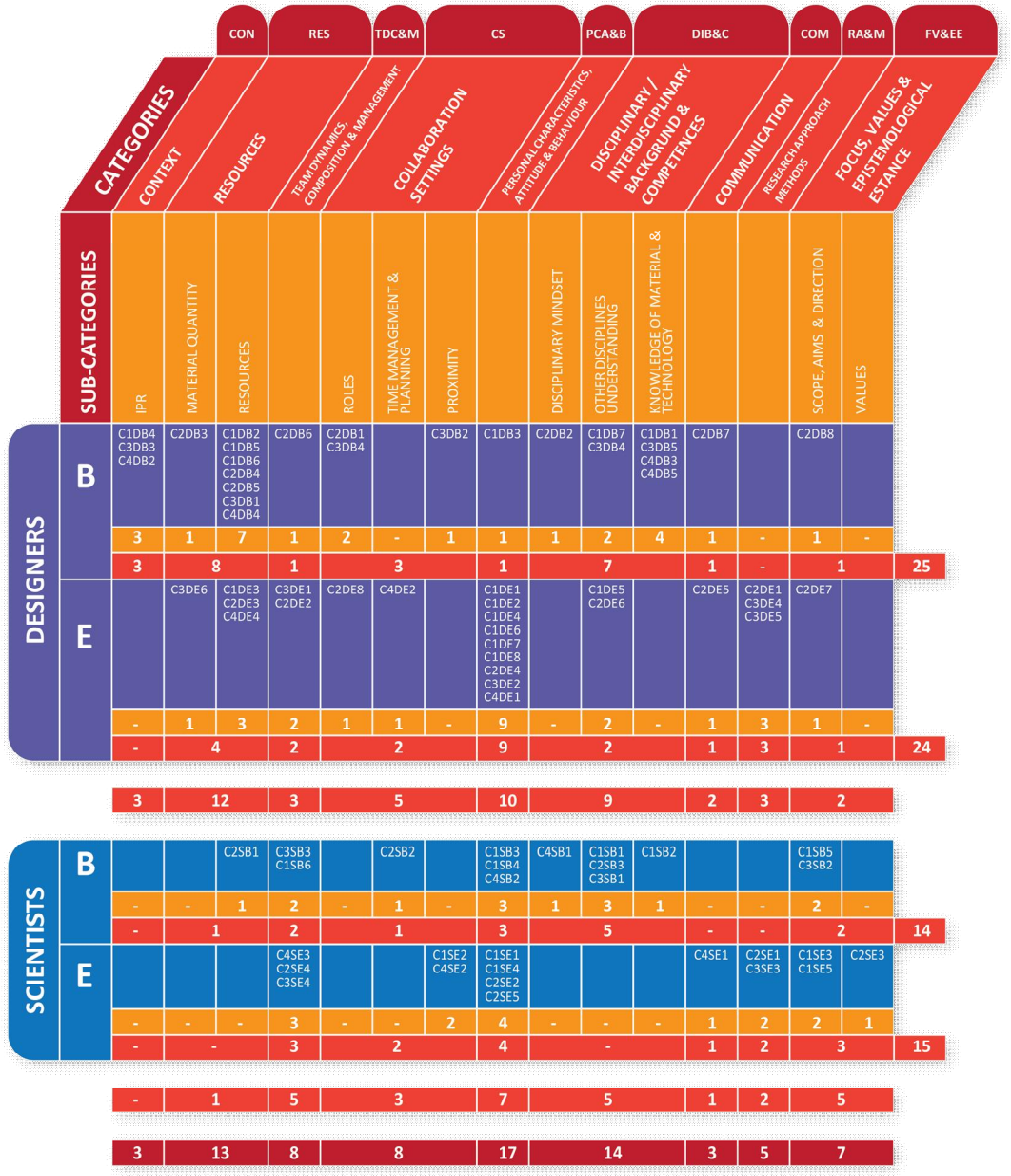
A researcher with a background in technical technology specialized in papermaking science

DESIGN DRIVEN
VALUE CHAINS
IN THE **WORLD**
OF CELLULOSE
DWoC

-78 barriers and enablers

-15 collaboration Sub-categories

-9 main collaboration categories



DESIGN DRIVEN
VALUE CHAINS
IN THE WORLD
OF CELLULOSE
DWoC

Collaboration categories

-Context

-Disciplinary / interdisciplinary background & competences

-Team dynamics, composition & management

-Communication

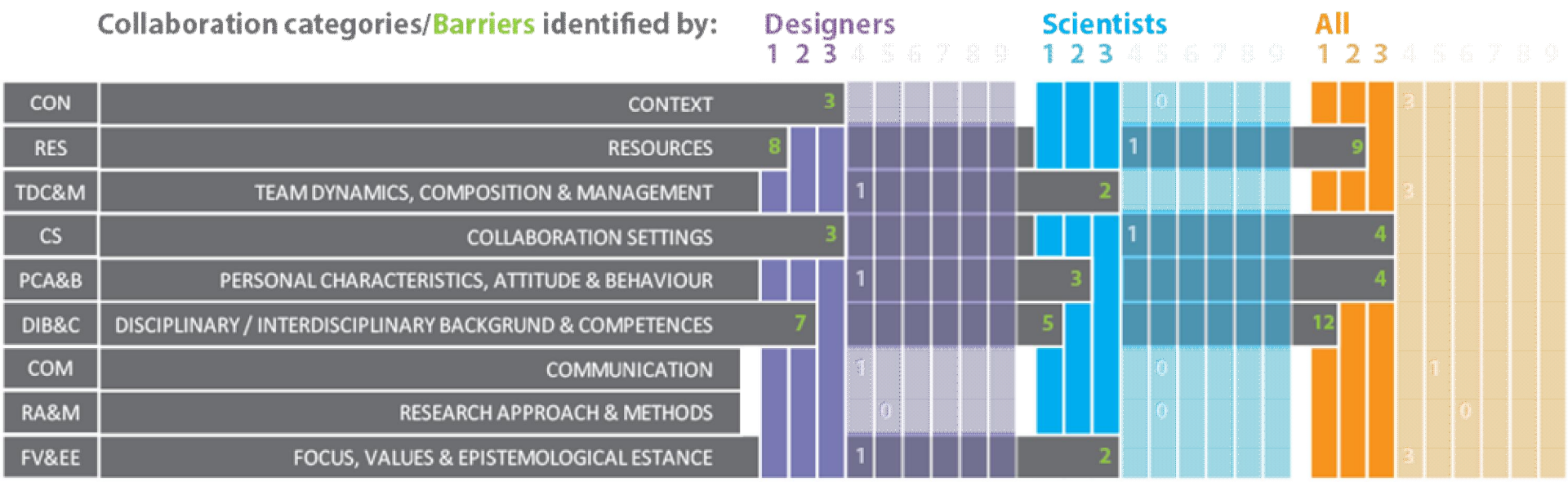
-Collaboration settings

-Research approach & methods

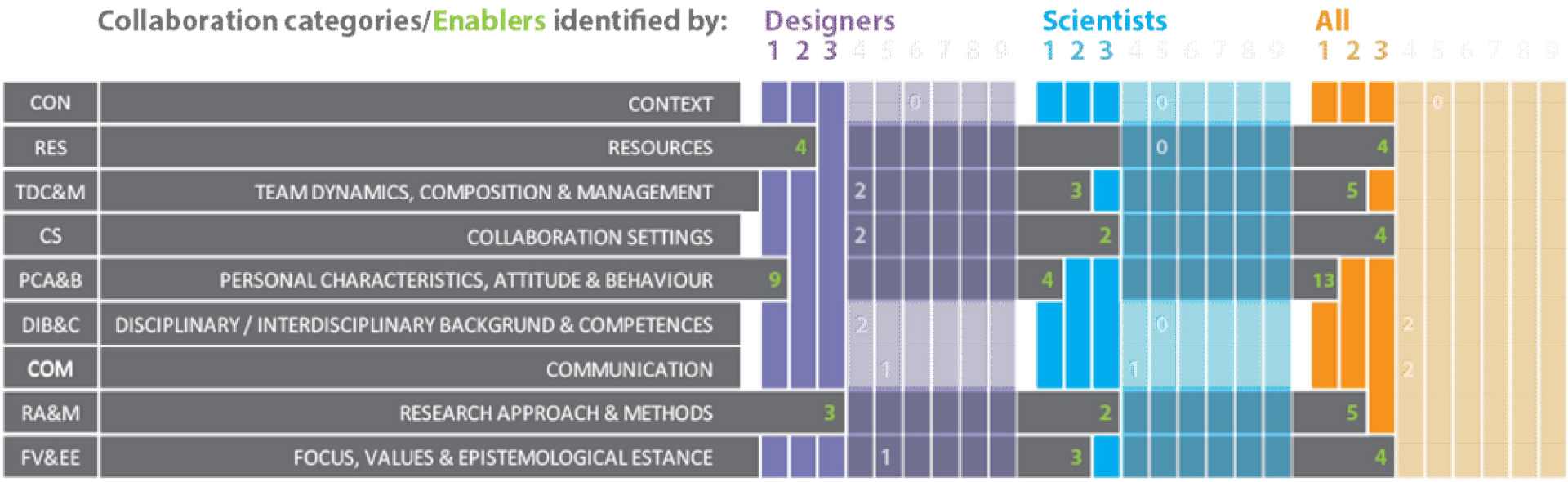
-Personal characteristics, attitude & behavior

-Focus, values and epistemological stance

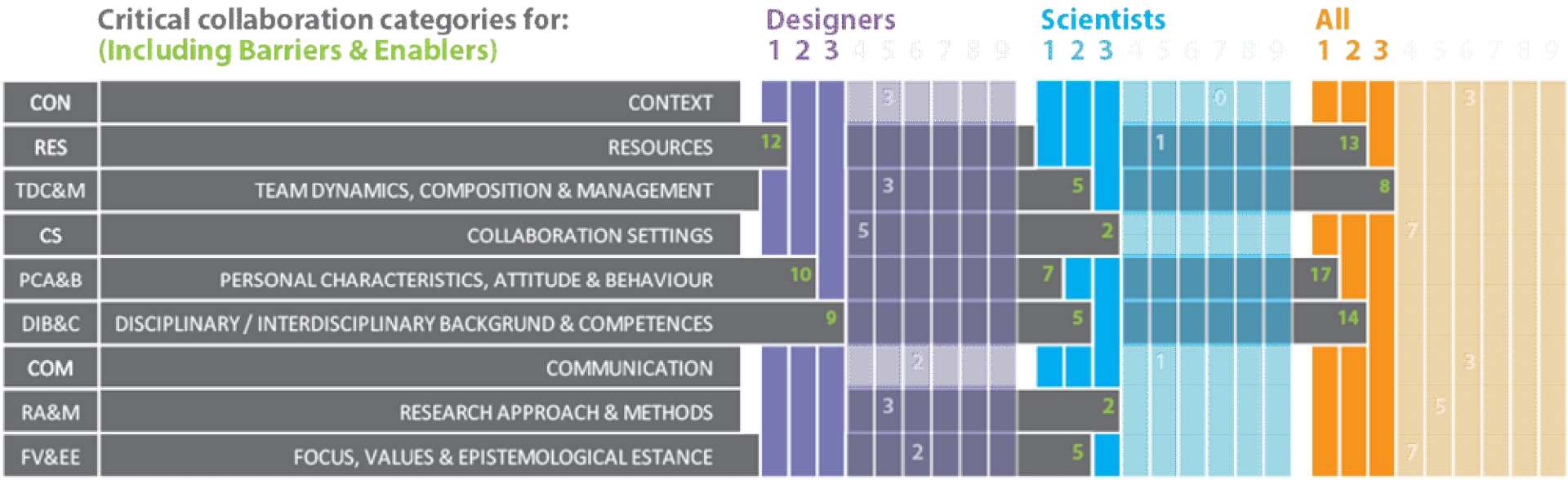
BARRIERS


Collaboration categories/Barriers identified by:
Designers
Scientists
All
1 2 3 4 5 6 7 8 9
CON
CONTEXT
3
RES
RESOURCES
8
TDC&M
TEAM DYNAMICS, COMPOSITION & MANAGEMENT
1
2
CS
COLLABORATION SETTINGS
3
1
4
PCA&B
PERSONAL CHARACTERISTICS, ATTITUDE & BEHAVIOUR
1
3
4
DIB&C
DISCIPLINARY / INTERDISCIPLINARY BACKGRUND & COMPETENCES
7
5
12
COM
COMMUNICATION
1
0
0
1
RA&M
RESEARCH APPROACH & METHODS
0
0
0
FV&EE
FOCUS, VALUES & EPISTEMOLOGICAL ESTANCE
1
2
3

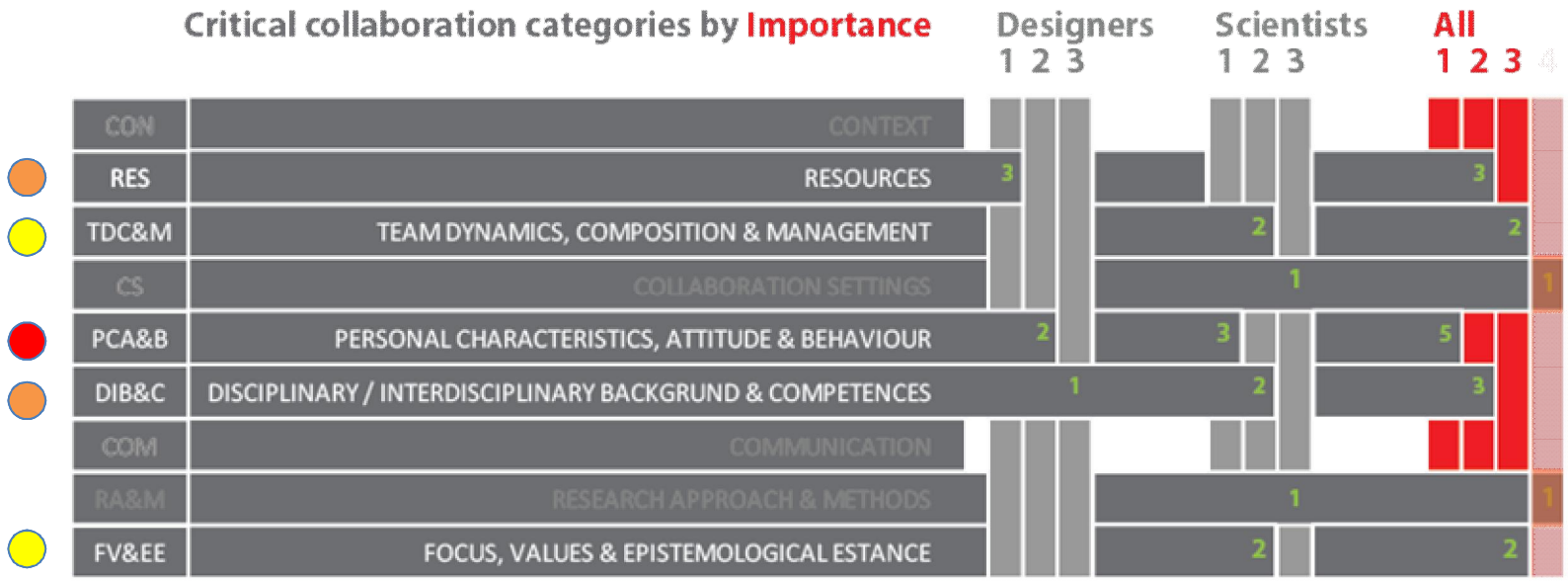
ENABLERS


Collaboration categories/Enablers identified by:
Designers
1 2 3 4 5 6 7 8 9
Scientists
1 2 3 4 5 6 7 8 9
All
1 2 3 4 5 6 7 8 9
CON
CONTEXT
0
0
0
RES
RESOURCES
4
0
4
TDC&M
TEAM DYNAMICS, COMPOSITION & MANAGEMENT
2
3
5
CS
COLLABORATION SETTINGS
2
2
4
PCA&B
PERSONAL CHARACTERISTICS, ATTITUDE & BEHAVIOUR
9
4
13
DIB&C
DISCIPLINARY / INTERDISCIPLINARY BACKGRUND & COMPETENCES
2
0
2
COM
COMMUNICATION
1
1
2
RA&M
RESEARCH APPROACH & METHODS
3
2
5
FV&EE
FOCUS, VALUES & EPISTEMOLOGICAL ESTANCE
1
3
4

CRITICAL COLLABORATION CATEGORIES



CRITICAL COLLABORATION CATEGORIES



KEY BARRIERS & ENABLERS

Materials quantity

Designers can do more than products

Joint prototyping

Carlos Peralta Ph.D (Cantab)

THANKS!

Images sources/credits

SLIDE 2

https://materia.nl/material/ultra-high-performance-concrete/ultra-high-performance-concrete-con127-5/
http://www.rimexmetals.com/en/applications-detail.html?appid=1397&famid=
https://materia.nl/material/europlex-ppsu/
https://materia.nl/material/mastalmond/

SLIDE 3

https://www.dynomighty.com
http://www.telegraph.co.uk/culture/culturenews/8904643/Damien-Hirst-skull-to-go-on-show-at-Tate-Modern.html
http://cf.injohnnaskitchen.com/wp-content/uploads/2014/09/blanket-600x494.jpg
http://www.ikea.com/us/en/catalog/products/80089927/
https://materia.nl/article/apparition-soft-transparent-cow-skin-leather/

SLIDE 4

http://www.veridian.net/_managedFiles/listings/files/1472239644.png
https://materia.nl/

SLIDE 5

Picture by Eeva Suorlahti

SLIDE 6

Pic by Carlos Peralta
Pic by Alex Driver

SLIDE 7-10

Images from Peralta, C. (2013). Collaboration between designers and scientists in the context of scientific research (doctoral thesis).

SLIDES 5,12-15, 17, 22

Pictures by Eeva Suorlahti

SLIDES 9, 16, 18-21

Images from Peralta, C., Niinimäki, K., & Kääriäinen, P. (2017). Barriers to and enablers for interdisciplinary collaboration between designers and scientists in the context of materials development (Paper in progress)