

POLITECNICO
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Functional materials for Design

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Which opportunities can bring functional materials to designers to create new user experience?

The main problematic of the research is to connect the stimuli-responsive behaviour of functional material to the end-user experience. To make this connection, the research was divided in layers, from the most technical at the bottom, to the most designerly at the top. The objective is to propose a set of chained tools that will eventually allow a seamless journey through all the layers and provide support for designers to use functional material in their projects.

End user experience

We consider that user experience is composed of aesthetic experience, meaning experience and emotional experience [1], with a focus on the last. Functional materials bring to the designer new possibilities for each component of the experience: the aesthetic experience becomes dynamic, and the meaning experience is reinforced by the information processed and conveyed by the material. Through these features, the final emotional experience is enhanced and totally different from the one obtained by classical materials.

Material experience

The material experience is the perception the user will have of the behavior of the material.

The map "Functional materials for Sensory experience" gives a first account of the user interaction with a dynamic product using functional materials. To read it, a designer will start from the inner circle, which represents the sensory modalities engaged by the changeable features of the product, which are represented on the next circle. Then these features are connected with the functional materials that can be used to implement these, which are in turn connected to their stimulus by a color code on the outmost circle. Icons next to the stimuli indicate if the functional materials are activated by the user, the environment or a system [2].

Functionalities

The main particularity of functional materials is their ability to change one or more of their properties under a defined stimulus. This particular functionality represents the meeting point between material science and design: the information transmitted and the way it is transmitted can be directly linked to the user experience, but also to the stimuli-responsive phenomenon.

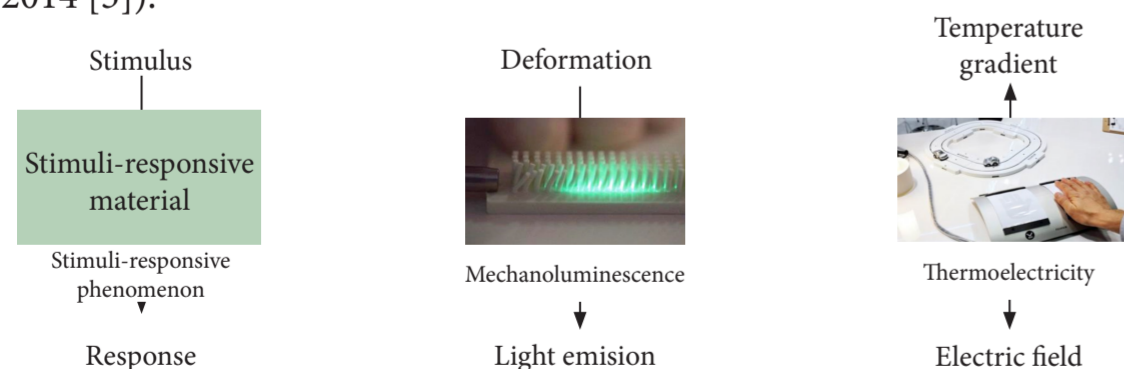
To achieve in joining the two areas of research, tools are being created at their interface. One of them is a database prototype that describes functional materials' properties and behavior. Its structure and surrounding selection tools are aimed at representing the perceptions and user experiences elicited by functional materials

We use CES constructor as a support for our proposition.

The organization of the behaviors starts from the possible responses of functional materials, and then links them to their stimulus.

Stimuli-responsive phenomena

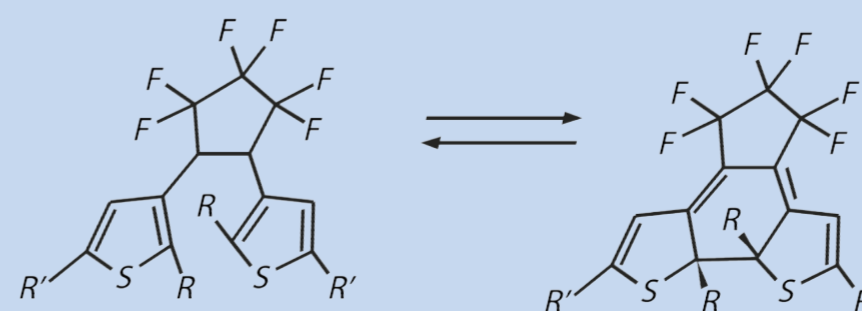
The stimuli-responsive phenomenon is the behavior of a functional material. There are many kind of functional materials: the variety of possible behaviors are illustrated by the adjacent graph, which connects "inputs" (i.e.: stimuli) to "outputs" (i.e.: responses) (Source: Lefebvre, 2014 [3]).



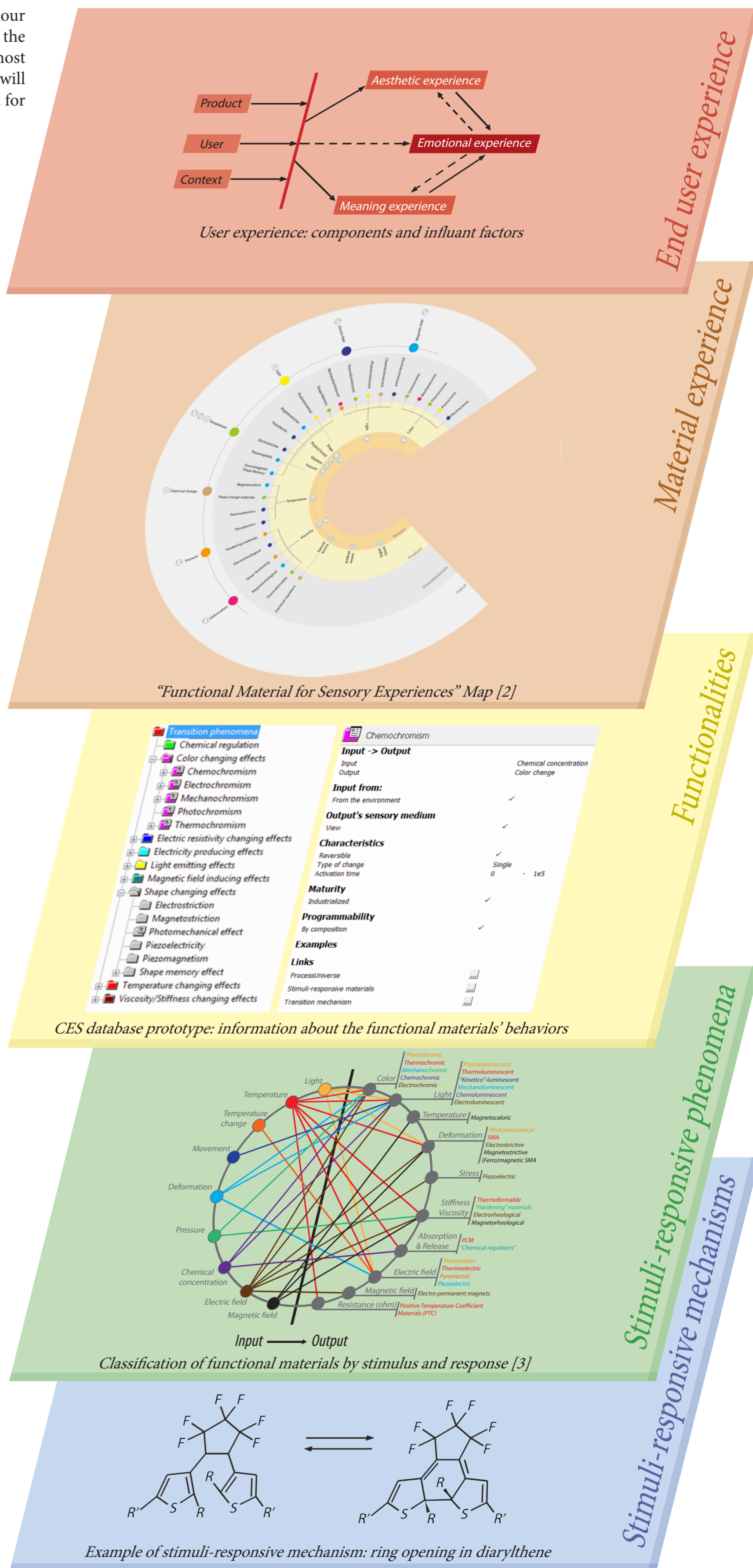
Stimuli-responsive materials: definition and examples

Stimuli-responsive mechanisms

The stimuli-responsive mechanism is the physical phenomenon that leads to the functional material's behavior. For example, diarylethenes exhibit photochromism (change of color under UV) through a ring opening in the molecule.



Example of stimuli-responsive mechanism: ring opening in diarylethene



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[1] Desmet Peter and Hekkert Paul (2007). "Framework of Product Experience". International Journal of Design, Vol 1 No1

[2] Bergamaschi Sara, Lefebvre Esther, Colombo Sara, Del Curto Barbara, Rampino Lucia (in press). "Material and Immaterial". The International Journal of Designed Objects.

[3] Lefebvre Esther, Piselli Agnese, Faucheu Jenny, Delafosse David, Del Curto Barbara (2014). "Smart materials: development of new sensory experiences through stimuli responsive materials." In A Matter of Design: Making Society trough Science and Technology. Proceedings of the 5th STS Italia Conference. Milano, 367-382