# NEW MATERIALISM - THE TRANSFORMATION OF INTELLIGENT TEXTILES TOWARDS AN INTERACTIVE *YOU*SER GENERATED INTERFACE

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**Abstract**
New materialism of smart or intelligent textiles represents the next generation of fibers. While textiles previously were responsible for several technological developments, today the rapid change of new technologies show their significant influence in the development of smart textile materials. As varying as their definitions are, are their applications. It is without any doubt that the most exciting developments today are taking place in the field of nanotechnology textiles. While lots of research in this area is connected with materialism research, there is a need of developing new models for creative applications and new design strategies. These novel materials generate new types of expressiveness and have the potential to transform craft and textile design into new types of artistic practice. Along with the shift from a passive functionality of static textiles towards mobility and active behavior, the users role itself is changing drastically. A multisensory and intermodal movement of thinking characterizes the intercourse with this new materialism of textiles.

**Keywords**: Smart-textiles, technology, interactive interface, consciousness

Key-characteristics of these intelligent materials are their interactivity, functionality and ability to communicate, which consequently generate a new user behavior. While textiles and technology already have a longstanding common background on several levels, new technologies are able to transform textiles into intelligent interactive interfaces. This paper focuses on the shift from functionally passive and static fabrics to active behavior and dynamic expression of interactive interfaces towards a *you*ser- generated content and change of consciousness.

**Introduction**
The initial stage of development and exploration of smart textiles is already history. A wide range of possible expressions is already tested; their potential is explored and practical limits experienced. What will follow next? New developments, many of them based on a new materiality are happening continuously, but the basic principles don´t change drastically for now. However, what urgently is needed at this stage is to develop new design strategies for these novel materials. *What* and *how* can we design with smart textiles? How do they influence traditional design practices? What happens after the first hype and how can we shift these materials to the next level? What does it mean to design with smart textiles and how do they effect on our physical environment?

Lots of questions are still open and needs to be discussed. The material based research is one part, but at the same time it is equally important to take a closer look at the characteristics of this new materialism which comes along with a new methodological thinking which consequently leads to new design strategies. To explore the above-mentioned questions it is essential to develop a better understanding of the function and characteristics

of such materials and becoming aware of how they can create entirely new systems. We are not only talking about a piece of textile anymore, which is "just" smart, instead it is important to realize we are confronted with an active system which is embedded in an certain environmental context which is situated in space and time and develops its own life.

Many research projects in this area are based on material research and are closely linked with industrial applications (smart TEXBOOK). On the other hand it can be observed that there is still a huge gap between highly artistically inspired prototypes and commercially conducted industrial developments. At the same time designers have to realize that there is a need to re-think the material world, looking outside existing technologies and industries to anticipate future needs, desires and challenges. This implements shifting the existing boundaries and combine interdisciplinary research with an intermodal movement of thinking.Social, ecological, biological, technical, sustainable and functional solutions ask for a fresh approach, which moves beyond an appealing and pretty surface and request new visions for future materials.

## From passive to active Textiles

Smart textiles clearly introduce a shift from passive functionally and static fabrics to active behavior and dynamic expression. These new types of expressiveness transform craft, design, and artistic applications into new types of artistic practice. Consequently new ways of production, displaying and communicating artistic works emerge along with these developments.

Comparing traditional textile techniques with smart textiles clearly indicates a shift towards functionality and a more content-driven development of production and design. Textile design is not only reduced anymore exclusively to create an interesting and decorative surface. The design or content can move from the surface into the material itself (Dimitrescu, 2013).Decorative elements once applied on the fabric transform towards a content-driven functionality. Not the visual appearance is necessarily the main goal, but what the material can do or how it is reacting becomes essential (Hibbert, 2012).

What is hidden underneath or is embedded under the surface might not necessarily be visible at first glace, but can create a certain functionality of the material. This signifies what is first invisible can become visible through its function or is triggered by an interactive impulse initiated by a person or through the surrounding environment. Such characteristics clearly leads to a new user/viewer behavior compared to traditional textiles and initiates a new aesthetic approach.

This vibrant shift towards experimental crossroads of textile materials in combination with art, science and technology demands new concepts of the creative process (Nilson, Vallgarda, Worbin, 2011). The main focus of researchers and material developers has long been on advances in technology rather than creating new perspectives for applications and new design models. Designers working with intelligent materials must have a comprehensive understanding of the purpose, the interaction between the material and the user, as well as the context of use.

## Interaction Textile Design

The interactive element of textiles causes a new perspective of fabrics. This implements a different understanding for both, the creator and the user, compared to traditional textiles. While in the field of media art interactive works already moved into established Institutions and Museums, relatively few artists integrated intelligent fabrics so far into their interactive projects. Through my personal longstanding background of working with textiles I have experienced that textiles often generate an appealing desire for touch by

the viewer. These tactile and haptic characteristics of textiles could be used even more effectively in combination with intelligent and interactive applications.

ErkkiHuhtamo, Professor in Cultural History and media archaeologist, explains in his article on *Touchscapes*(Huhtamo, 2009)"how aesthetics in Western art is based on distance and as the doctrine goes, to contemplate the work, one has to step back to appreciate the harmonious blending of elements into an overall form. In the nineteenth century when the commercial art market began to emerge and the public gained access to museum institutions, art was intended as a delight for the eyes only, he explains." [103]

Interactive textiles or artworks initiated the process to redefine the relationship between the viewers and the work in a radical manner. Many of the interactive works explicitly ask for an active and continuous interaction with the viewer/user. Sometimes the physical presence can already initiate a process, but many other works invite the visitors to a tactile interaction through physically touching and experiencing the work. The fact that the viewer can immediately see the result of actions leads to a relatively new, user-generated behavior. Peter Weibel brings this tendency to the point, describing it in the following:

"The participation of the public in the creation of artworks in a museum is like a training field for the emancipation of the consumer. Visitors to these installations are in the center of attention; they are the emancipated consumers. YOU are the content of the world. As a participant, YOU the YOUser have the chance to change the world."[104]

Shifting the *you*ser into the center of the work is certainly also one of the key characteristics of smart textiles. Designers, artists and scientists who create such materials demand in many cases the active participation of the user. But does the user always know what to do with these materials without explicit instructions? It might be an essential difference for what purpose the material is developed. Commercially orientated products most likely will be promoted in a way to address the novel advantages of intelligent materials. But artists who are integrating such materials in their projects can´t always premise the visitor's education.

Some projects might need instructions; others simply might work by intuition or by watching other users. However, new methods of information change the user behavior.  A passive perception moves towards an active participation generated through interaction. On the other hand it has to be clearly distinguished if a concept is developed for a singular user or for a wider range of audience, which can lead in addition to a social interaction. If a common social interaction is taking place, different parameters will come into the picture (Schülke, Czegledy, 2009). Every form of interactivity is created through the discourse of input and output.

Sabine Seymoure (Fashionable Technology, 2008), expert when it comes to smart textiles and fashion, gave an excellent technical overview on possible solutions how such systems can be integrated in smart textiles. In the following I will provide an extended and supplemented form of examples for possibilities of integrating inputs, outputs and sensors in relation to smart textile applications.

**Input**
- Person
- Pressure, bend, motion, data
- Sound, visuals, humidity, proximity

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[103]Huhtamo Erkki. 2009. Interactive Art Research, Christa Sommerer and Laurent Mignonneau. Springer- Wien New York. p. 32

[104]Weibel Peter. 2009. Interactive Art Research, Christa Sommerer and Laurent Mignonneau. Springer- Wien New York. p.19

- Displacement, smell, acceleration
- Environment
- Light, humidity, sound, temperature, microprocessor, visual

**Output**
- Visual, LEDs, thermochronic ink, photochronic ink, display
- Sound, speakers, buzzers
- Touch
- Conductive yarns or fibers, conductive fabric
- Smell, scent capsules
- Energy

**Sensor**
- Body sensing technologies (close to the body)
- Motion sensors (proximity detection)
- Data capture (humidity, light, temperature, sound)

**Textiles that communicate**

Interactivity, functionality and "communication" can be seen as the essence of smart textiles. This form of communication between a human being and a technically created system in combination with a textile material is able to create content, meaning and interaction. Despite that, there is much more happening than just "something" that is sent from one to the other. This something could be described as the author.

Roy Ascott, founding President of the Planetary Collegium and Director of the CAiiA-Hub (Centre for advanced Inquiry in Interactive Arts) describes such form of communication in telematics systems as "dispersed authorship". This happens when the system may be the interaction itself, when the context includes artificial memory in a Telematics system. From my point of view I do see a close connection and similarity between intelligent materials such as smart textiles and Telematic-systems. Ascott refers in the same context to these systems as dealing with human interaction, language, meaning, and memory. He quotes from Humberto R. Maturana and Francisco J. Varela´s study on cognition:

"According to the metaphor of the tube, communication is something generated at a certain point. It is carried by a conduit (or tube) and is delivered to the receiver at the other end. Hence there is something that is communicated, and what is an integral part of that which travels in the tube. (…) According to our analyses, this metaphor is basically false. It presupposes a unity that is not determined structurally, where interactions are instructive, as though what happens to a system in art interaction is determined by the perturbing agent and not by its structural dynamics. It is evident, however, even in daily life, that such is not the case with communication: each person says what he says or hears according to his own structural determination….communication depends on not what is transmitted, but what happens to the person who receives it. And this is a very different matter from "transmitting information." [105]

Maturana and Varela analyze the importance on the individuality of what each person perceives in interactive systems, even when the main parameters stay the same. Consequently, interaction design can be seen as a very personal interpretation. According to the above-discussed parameters I will provide in the following two figures a visual graphic of

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[105]Ascott Roy. 2003. Telmatic Embrace, Visionary Theories of Art, Technology, and Consciousness. University of California Press. p. 213

how content can be generated in interactive smart textile systems. As both figures will demonstrate, it can be distinguished between a linear and non-linear communication.

**LINEAR COMMUNICATION - INTERACTION**

USER ⟷ INTELLIGENT TEXTILE

GENERATION OF MEANING

Figure 1. Visual illustration of linear generated meaning through intelligent textiles

Figure 2. Visual illustration of a non-linear multilayered communication through interaction in smart textiles systems

ENVIRONMENT **NON-LINEAR MULTILAYERED COMMUNICATION**

COMMUNICATION - INTERACTION

USER INTELLIGENT TEXTILE

DIALOG between SURROUNDINGS USER, INTELLIGENT TEXTILE and SPACE
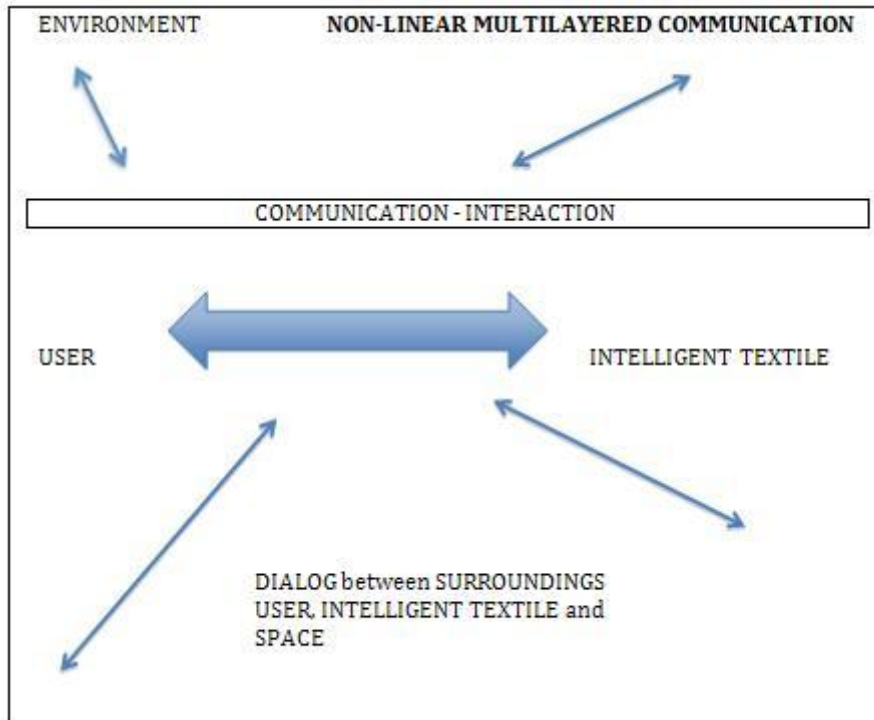
In such systems we can observe that the communication can change from linear to a non-linear form. The dialog can be expanded and implements not only two parties anymore; instead additional arises a discourse with the environment, the surrounding space or the outside world. Many, mostly invisible lines between the user/observer, the "thinking systems" and the surrounding surroundings can be established. There is no more isolation and separation. Different systems can communicate without any limits or borders or time frames.

**Interactive interfaces are pushing the boundaries beyond traditional textiles**

The fusion between humanity, technology and artificial intelligence of textiles mutates increasingly to an interface, processing various forms of data. The interface becomes like a living organism characterized through its flexibility. Roy Ascott describes such systems:

"The essence of the interface is its potential flexibility; it can accept and deliver images both fixed and in movement, sounds constructed, synthesized, or sampled, written texts, speech. It can be heat-sensitive, body responsive, environmentally aware. It can respond to the tapping of the feet, the dancer´s arabesque, the direction of a viewer´s gaze. It may not only articulate a physical environment with movement, sound, and image, it *is* an

environment in the sense that it actually constitutes an area of data space in which art comprising this human-computer symbiosis can be acted out."[106]

Many of the smart textiles operate with data, which is an essential part of an entire system, the fabric, the viewer/user and the surrounding environment. All these various components together are producing meaning, mostly initiated by a process of transformation.

The meaning, which is produced through such systems, can be seen as interaction between the user and the system. The content often is embodied in data, which is primary pure electronic until it has been reconstituted at the interface. Accordingly to these analyses it can be said that smart textiles combine a material based with a non-material component and entirely new systems will be created based on future textiles.

Carole Collet, director of the Textiles Futures Research Center explains:
"Designers will need to adapt and learn different tools to be able to understand how to work with these new living manufactures. They will have to grasp a brand new world where material and technology have effectively become one entity. The old fashioned concept of using a technology as a means to transform a material will be redundant. These new living materials are also the technology that shaped them. And if we think that the introduction of computing technologies has radically changed the design toolbox in the last two decades, imagine what these new living materials will lead to. Living technology is about to re-map the material and technological landscape as we know it. "[107]

Carole Collet exemplified future visions on the relationship between textiles and technologies, which effectively leads to a fundamental transformation of one of the oldest materials of mankind. High tech fabrics, nano-textiles, new functionalities and applications will certainly change the use and characteristics of textiles, which essentially is altering people's relationship with these novel materials. However, lots of research is already conducted, but still many questions remain unsolved which asks for further research.

## Conclusion

We are now witnessing a radical change of the material world.  A new form of living technology will re-shape our material environment. We are just at the beginning of exploring the analog interaction between the human and entirely new living systems based on technology. This brings along a need to reconsider the ethics of the forthcoming where everything is reduced to programmable coding. Textiles can no longer been seen as "dead" material, instead they are mutating into complex systems interacting with the environment and the user. A shift from passive functionality to an active behavior characterizes these novel textile materials. The designer or artist is increasingly involved in designing context instead of transmitting content or expression. Within these new parameters the viewer/user is able to construct meaning and experience, consequently a radically different outcome emerges which urgently asks for new design strategies.

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[106]Ascott, Roy. 2003. Telmatic Embrace, Visionary Theories of Art, Technology, and Consciousness. University of California Press. p. 225
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