

# **DESIGNING FOR SUSTAINABLE EMOTIONAL EXPERIENCES: UNDERSTANDING KEY VARIABLES IN ATTRIBUTING EMOTIONS TO TACTILE MATERIAL SENSATIONS THROUGH THE MaTE TOOLKIT**

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## **Abstract**

Supporting a sustainable fashion future requires informed material choices. For this, fashion and textile designers recognise that emotion plays an important role in the way users interact and connect with products and materials, and that building emotional durability is one way to support extending the life of a fashion product. Yet, in the design process, this important aspect of the user experience can often be ignored. Instead, the design of visual effects is often privileged. Additionally, as designers respond and shift towards increasingly digitally driven design methods, there is a critical need to consider how touch and tactile experience are understood in more explicit and thoughtful ways beyond traditionally taught tacit knowledge of studio-based hands on making. To achieve this, there is a need to consider what a user or wearer experiences physically as well as psychologically when they touch a material surface. Although there is extensive research in understanding material physical properties, the psychological aspect of understanding and supporting tactile material choices remain ambiguous and not well-defined.

This paper discusses the complex relationship between material sensations and emotional responses through touch. Based on a series of research studies, this paper outlines a framework for understanding the relationship between material, touch and emotion through the development of the Material-Touch-Emotion (MaTE) toolkit. The MaTE toolkit's purpose is to support fashion and textile designers, makers and educators to better understand key variables in attributing emotions to materials. The toolkit provides a guide and three-step process to create awareness of the potential emotions felt during a specific material interaction and a lexicon (language) for understanding how emotions can be expressed in relation to

touching a material. The paper also speculates on the potential wider applications of the MaTE toolkit within the wider fashion ecosystem.

## **Introduction**

Fashion and textile designers rely on their tacit knowledge of materials based on sensory attributes and ‘material intelligence’ as they navigate through the process of material selection (Adamson, 2018; Igoe, 2010). Traditional design practice and education has focused more on a discipline specific product-centred approach whereas recent years has seen a shift in design thinking towards user-centred and life-centred sustainable approaches (Pastor and VanPatter, 2011, pp 24-25; Lutz, 2022). It is now recognised there is a need to understand the role of human behaviour in designing for experiences for a sustainable future. When focusing on user experience, the design of visual effects is often privileged. However, greater consideration is needed on how touch and the tactile experience are understood. It necessitates understanding touch in more explicit and thoughtful ways beyond traditionally taught tacit knowledge of studio-based hands on making. This emerging interest has shifted focus to affective experience of interaction with the product (Desmet et al., 2016). That all clothing may transform the wearer is an inclusive notion of affective fashion. According to Seely (2013), affective fashion is that when the wearer activates the ‘becoming’ through its constant encounters with other bodies. In this context, Lucia Ruggerone (2017) states that clothes have mostly been looked at through the lens of fashion and identity, in the way that people use clothing to represent themselves; the lens of feelings that one experiences in our clothes have mostly been ignored or less studied. She maintains that selecting and wearing clothes is an encounter between the body and object that initiates an affect through ‘becoming’ with a positive or negative outcome. This innately subjective outcome stimulates an emotional response.

In design literature, emotions are often referred to as something intangible (Desmet, 2002). But the significance of emotions in design has been indicated by designers and design researchers alike, in the way that people interact and perceive products and materials around them (Love, 2003; Desmet and Hekkert, 2007; Karana et al., 2015; Rognoli, 2010; Norman and Ortony, 2003). Induced through external or internal stimulation of the senses, emotions are highly complex and subjective, evoke meanings and elicit emotional responses (Desmet and Hekkert, 2007; Karana et al., 2015). Over the last few decades, there has also been an increasing concern about mental and physical wellbeing (Saxena et al., 2013; McMahon et al., 2017) with the understanding that emotional well-being plays a key part in the all-round well-being of an individual. Emotional development and well-being are suggested to may also be affected by the touch of objects. Examples are comfort blankets or teddy bears used to momentarily sooth a child, or soft walls for dementia patients, and a terry-surrogate mother for baby monkeys to contribute to their well-being (Field, 2014; Sonneveld and Schifferstein, 2008). Understanding the connection between the touch of material sensations to emotion elicitation and ultimately our choices and preferences towards material (or product) selection, is a significant stage in determining why a particular material might hold attachment, thereby ensuring longevity of use. Emotional durability is one way to support extending the life of a product and sustainable emotions equate to sustainable design choices. When designing for an emotional connection, understanding the process of emotional response to the touch of material surface is a significant

step. From a design perspective, the emotional aspect of textile material selection and interaction through touch is not well explored nor defined. Although some studies have used certain materials which are thought to promote calmness or evoke a positive response (Field, 2014; Seo and Aravindan, 2015), there is no definite tool to support fashion and textile designers to understand and evaluate the emotional responses to the touch of textile materials. Designing with materials necessitates an understanding of the sensory modalities as well as consideration of the affective stage of what impacts material choices. Sustainable design concerns not only the physical and technical properties or qualities of a textile or fashion product, but also the psychological aspects of experience and meaning, stimulating an emotional connection to the object to ensure its continuing existence.

This paper discusses the complex relationship between tactile materials sensations and emotional responses, with the idea of supporting fashion and textile designers, makers and educators to understand key variables in attributing emotions to materials. Based on workshops conducted, this paper outlines the development of the MaTE (Material-Touch-Emotion toolkit and MaTE Model, a framework for understanding the relationship between material, touch and emotion. This toolkit provides a three-step process to prompt an emotional response to touching a material, and a lexicon (language) as a starting point for understanding how emotions can be expressed in relation to touching a material. The MaTE toolkit is designed to support fashion designers and educators working with materials to consider what consumers 'feel' or 'emote' when touching a particular material. It is a guide to create awareness of the potential emotions felt during a specific material interaction. By understanding and communicating the relationship between the active touch of material sensations and subsequent emotional responses, the MaTE toolkit assists to support a more informed and considered decision making during the design process.

## **Background review**

Tactile experiences may define positive or negative experiences with the materials and artefacts that they represent, stimulating an emotional engagement. When one deliberately chooses to touch something during material exploration, it is an act of active touch, also termed as haptics (Nicholas, 2010). Active touch through our hands plays an important role while interacting with the sensorial materiality of the world around us. Sensorial properties are those that describe the interaction between materials and users through sensations felt through the senses (Karana et al., 2009). The evaluation of the properties of a textile material is an important step in determining the 'comfort' or 'handle' of a textile in the industry. Texture perception through objective evaluation of surface physical properties have long been studied and objectively understood (Meilgaard et al., 1999; Suelar and Okur, 2007; Kilinc-Balci, 2011; Barker, 2002, Kawabata and Niwa, 1991, Ciesielska-Wrobel and Van Langenhove, 2012; Peirce, 1930; Chen et al., 2009). Subjective handle assessment is a sensory assessment where the subject (designer/user) evaluates and expresses their perception of the textile property such as softness, roughness and so on (Bishop, 1996). Subjective assessment may be dependent on a host of variables dependent on personal attributes of a subject; therefore, to get an unbiased

understanding of the properties of a material, an objective evaluation is essential. But objective measurement and subjective evaluation of the sensorial attributes is only part of the assessment while selecting a material. Recent years has seen an understanding of ways in which materials influence experiences. That there is a distinction between sensation and emotion is supported by psychology (Guest and Essick, 2016); sensations described by sensory words of rough, smooth, warm, cold and so on are usually defined by measurable properties whereas in contrast, emotions described by emotional adjectives usually describe feelings that one associates with those sensations.

Although there is extensive research in understanding textile material physical properties, the psychological aspect of understanding and supporting textile material choices remain ambiguous and not well defined. A designer's vocabulary and understanding of textile material-touch requires a considered understanding of the properties of the material through an objective (material properties) perspective as well as a subjective (experiential) perspective (Karana et al., 2015; Rognoli, 2010b). It was essential to bring a combination of different knowledge systems together of understanding physical and sensorial properties with a textile engineering perspective as well as a designer's tacit knowledge and subjective experiences with a psychology perspective. From a psychological perspective, different emotions can be rated in terms of arousal and valence, as depicted in the representation of the Circumplex Model of Affect in (Figure 1) (Posner et al., 2005). Valence indicates whether the emotion is pleasant or unpleasant and the arousal indicates the level of that pleasant or unpleasant emotion. Many commonly used emotional words used in psychological research are well suited to describe general emotional experiences but may not necessarily be well-suited to describing tactile-induced emotions. Based on a review of relevant literature in the field of emotions specific to material touch, a gap was identified. While there exists established methods for standard utilized use of emotion questionnaires, these were deemed not be suitable for capturing the range of emotions elicited through the active touch of materials. This research addresses this gap.

As designers are expected to design products with 'meanings', it is essential that they understand what the material conveys to them and to the user. Concepts in understanding product emotions have been put forward by Desmet and Hekkert in the framework for product experience which introduces the concept of aesthetic experience, experience of meaning and emotional experience in the user-product interaction (Desmet et al., 2016; Desmet and Hekkert, 2007). Within the field of user centred design and emotional design, Norman (2004) proposes that a real emotional experience with a material/ product/ object involves three levels of processing—visceral, behavioural and reflective. The importance of experiential knowledge of materials in design has also been studied extensively presenting design tools such as the Meaning-Driven Materials selection (Karana, 2010), the Expressive-Sensorial Atlas (Rognoli, 2010a), the Material Aesthetic Database (Zuo, 2010) and a toolkit to assist an experiential characterisation of materials (Camera and Karana, 2018). To express what a material conveys, requires explicit, implicit and tacit knowledge of the physical and sensory as well as the emotional nature of the materials surface that make up the product. If we are to design for a particular experience or for designers to consider emotional responses in their design process,

it is essential to understand material sensorial aspects as well as what those sensations elicit in users in terms of emotions. This paper brings together knowledge bases from the disciplines of design, material science and psychology. The relation between tactile material sensations and emotions related to materials could bring a fresh dimension into looking at fashion and textiles.

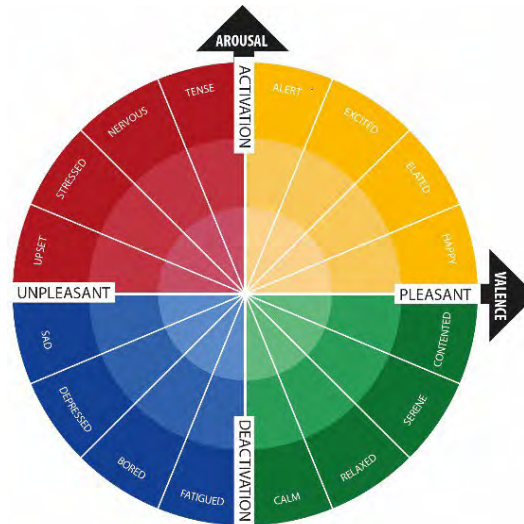


Figure 1. A graphical representation of the circumplex model of affect.  
Source: Rashmita Bardalai

## Method

The research design sought to understand the less tangible, tacit, sensual associations of emotional responses by bringing in knowledge bases from psychology and correlating it to objective and subjective evaluations of tactile sensorial attributes through knowledge bases of material science and design. A mixed method approach was followed to record abstract qualities of association and emotion and correlating it to the measurement of surface sensorial properties. The development of the MaTE toolkit was undertaken in two workshops. Outcomes from the first workshop, undertaken to address the need for a language to assess emotional responses based on tactile sensations, resulted in the (Material-Touch-Emotion) Lexicon tool (Bardalai et al., 2020) and the SensAE (Sensation-Appraisal-Emotion) tool (Bardalai and Underwood, 2022). The second workshop translated the sensorial attributes of the materials used in the first workshop into textile materials with a view to validate the MaTE Lexicon and the SensAE tool. This resulted in the MaTE (Material-Touch-Emotion) model, a framework for understanding the relationship between material, touch and emotion. Together they form the MaTE Toolkit to support designers and researchers working with materials, and specifically textile materials to consider and articulate what people ‘feel’ or ‘emote’ when touching a particular material.

The first workshop, included 77 participants aged 18 to 30 years old. The collection of materials represented a range of everyday textures which were loosely categorised into bi-polar sensorial groups of smooth vs. rough, dry vs. sticky, warm vs. cold and soft vs. hard, and adapted from previous studies on touch perception (Chen et al., 2009; Nogueira et al., 2009; Kayseri et al.,

2012; Guest et al., 2011). The materials were presented to the participants to touch by hand, one at a time, laid flat in a cardboard box, out of sight (Figure 2). The second workshop included 15 participants aged 29 to 46 years old. The bi-polar sensorial attributes from the first workshop was translated into textile materials and were presented to the participants to touch by hand, one at a time, laid flat in a box, out of sight. The workshops were conducted in three steps. In the first step, participants were asked to freely associate emotional words to depict each material. In the second step, participants were asked to plot what the material communicated to them in a grid based on the graphical visualisation of the Circumplex model of Affect. In the third step, participants were asked to rate the touch attribute and given a list of emotion words and were asked to indicate those they found relevant. An iteration in the second workshop involved amending Step 1 to incorporate the SensAE tool and amending Step 3 to include words taken from the newly developed MaTE Lexicon.



Figure 2. Experimental setup: Participant inserting their hand to touch a material in the box.  
Source: Rashmita Bardalai

Using mixed method research design analysis involves the combination of statistical analysis techniques as well as thematic techniques (Teddlie and Tashakkori, 2009). In the first step, in order to determine the frequency, patterns and trends of words used in the textual information there was a systematic coding and categorising approach taken by content analysis as a qualitative data analysis approach. Content analysis helped determine the frequency of use of certain emotional adjectives used against certain materials and at the same time thematic analysis helped in developing underlying themes within the narrative. The second and third step was statistically analysed quantitatively using descriptive methods and inferential techniques in SPSS. The independent results of the qualitative analysis of the data using thematic and content analysis and independent results from the quantitative analysis using descriptive and inferential statistics were then be linked, combined, compared or integrated to make conclusions.

## **Findings and Outcomes The MaTE Toolkit**

Building on previous research in psychology, design and material experiences, and reflecting on the workshops conducted, the MaTE (Material-Touch-Emotion) Toolkit was developed.

The MaTE toolkit (Figure 3) consists of three interconnected elements:

1. The MaTE Lexicon tool – a descriptive language for understanding how emotions can be expressed in relation to touching a material.
2. The SensAE (Sensation-Appraisal-Emotion) method – a three-step process to prompt an emotional response.
3. The MaTE model – a holistic framework for understanding the relationship between material, touch and emotion.

These three elements come together to support fashion designers and educators to consider emotional responses based on tactile sensations when touching a particular material. Each of these elements are explained in more detail in the subsequent sections. The toolkit highlights the importance of tactile sensations in the process of emotion elicitation during the active touch of a material surface by bringing in knowledge bases from psychology and material science through a design perspective.

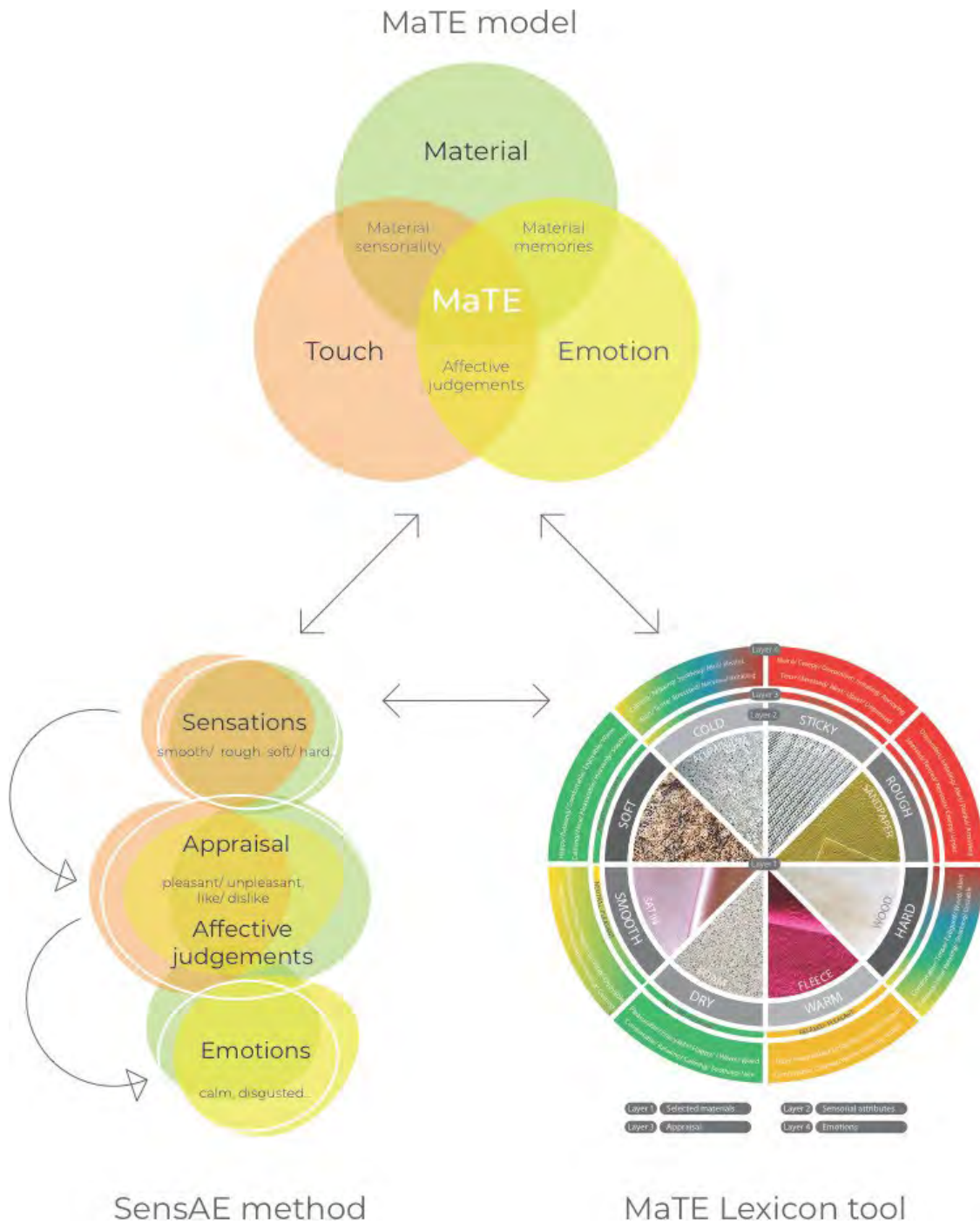


Figure 3. Overview of the MaTE toolkit

***The MaTE Lexicon tool***

To understand the relationship between the touch of a material surface and emotion response to that touch, it was first necessary to have an emotion word list to describe these emotions. Commonly used emotional words may be well suited to describe general emotional experiences but may not necessarily be well suited to describing tactile-induced emotions. Although some studies have successfully compiled emotion word lists, there was no lexicon to articulate



emotions based on active touch of material surface. Building on previous studies by Guest et al. (2011) and Davis (2015), the first step in this toolkit was to narrow down a list of emotional adjectives used to describe the active touch of a material surface, thereby identifying and developing a material-touch-emotion lexicon.

The MaTE (Material-Touch-Emotion) lexicon tool (Figure 4) was developed as a response to a lack of a language to articulate emotions to the active touch of material surfaces. It is a tool to consider and evaluate emotional responses to material sensations of bi-polar opposite attributes. The MaTE lexicon (Bardalai et al., 2020) is intended to be a guide, a starting point for a language that could be applied to investigate Material-Touch-Emotions. The MaTE lexicon tool constitutes of four levels: the first level, specifies the materials used (as physical sample or visual representation); the second level indicates the bi-polar sensorial attributes for these selected materials; the third level refers to whether the material has been appraised as pleasant/ unpleasant (Valence) and the level of this pleasantness/ unpleasantness (Arousal level) stimulating/ relaxed. The colours indicate the emotion quadrant that the material falls into, based on the circumplex model of affect (Figure 1). The fourth and outer level provides a guide to possible adjectives expressing emotional responses to the active touch of the specified materials.



Figure 4. MaTE (Material-Touch-Emotion) Lexicon tool The SensAE method

The development of the MaTE lexicon led to the crucial reflection that there was a general lack of awareness and a systematic approach to understanding emotion elicitation through material-touch. It became evident that there was a need for a visual tool to facilitate awareness of the emotional connections to the active touch of textile materials, to educate and guide designers and users in the physical/sensorial and psychological/emotional aspects of material choices. The SensAE (Sensation-Appraisal-Emotion) method (Bardalai and Underwood, 2022) supports designers and users to understand the multi-layered process of emotional response to the touch of materials. The SensAE method (Figure 5) proposes a three-step guide to prompting an emotional response to material-touch. First, there occurs a sensation to during the active touch of a material surface as a consequence of the material sensorial properties of the material surface. Second, based on this sensation, occurs an appraisal of whether that sensation is positive, negative or neutral founded on affective judgements of past experiences with the sensation or ‘material memories’ linked to the tactile sensation. This affective judgement is the catalyst for the emotional response. Thirdly, based on how the tactile sensation was appraised or judged affectively, there occurs an emotion towards that material.

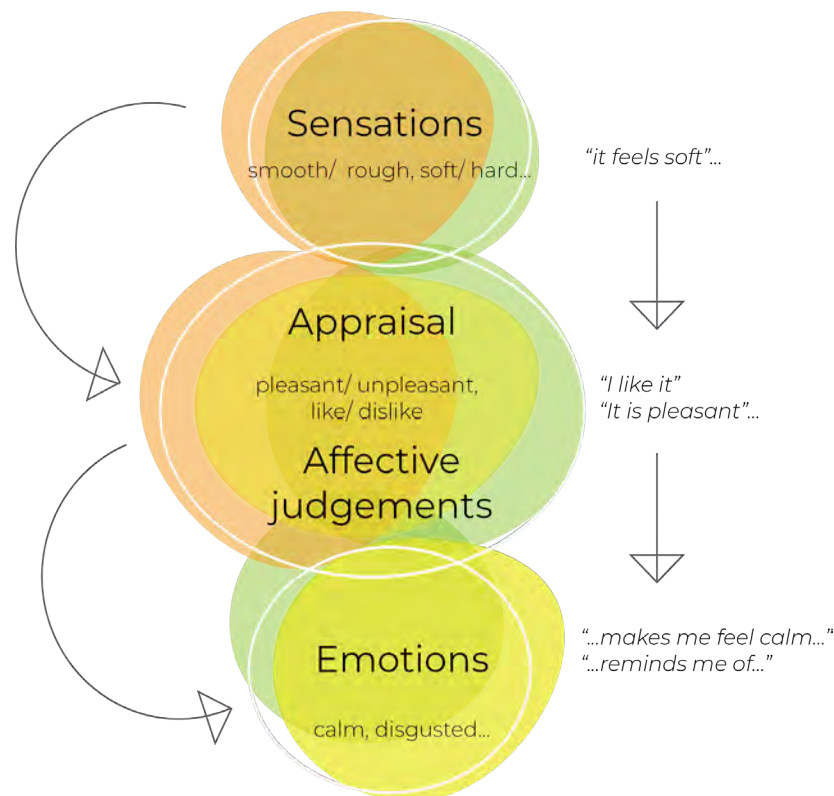


Figure 5. The SensAE (Sensation-Appraisal-Emotion) method

### ***The MaTE model***

The Mate Lexicon and the SensAE tool demonstrate a clear relationship between the touch of a material surface and emotional responses. There are three components at play, the material, the touch, and the emotion. The material with its own sensorial properties, which when touched by the hand (active touch) brings about an emotion towards the felt material sensation.

That there is distinct overlap between materials, the touch of the material surface and emotions is illustrated in the MaTE (Material-Touch-Emotion) model (Figure 6). At the juncture of materials and touch, lies material sensoriality or sensations. In between touch and emotion, occurs an appraisal and affective judgement towards that sensation. At the intersection of materials and emotions lies material memories or past experiences linked to that material sensation.

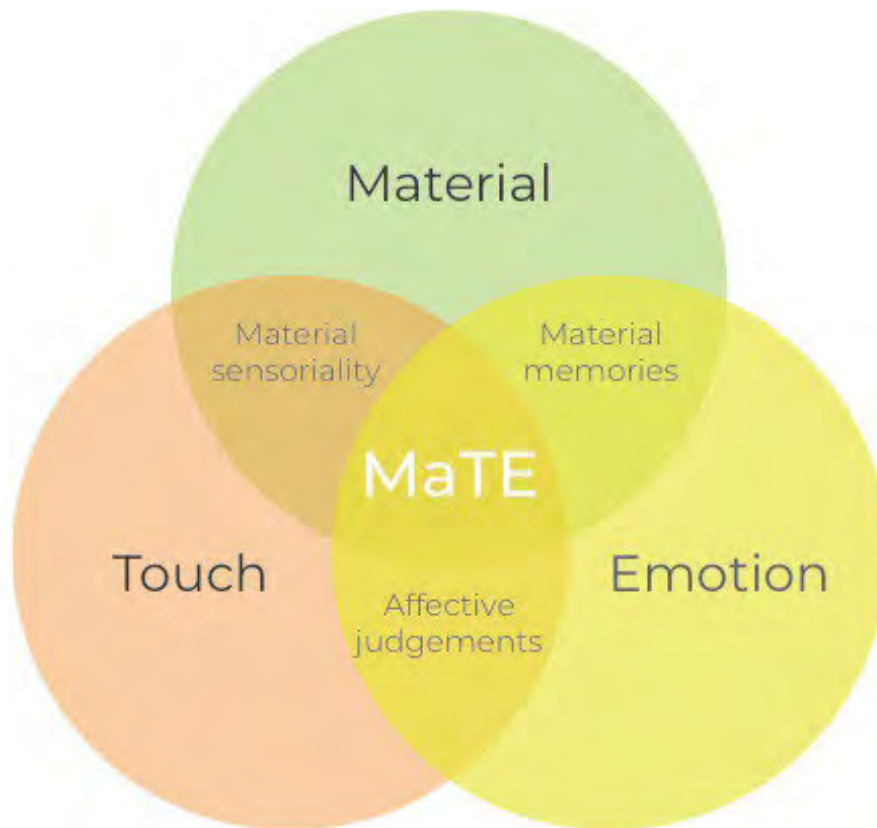


Figure 6. MaTE (Material-Touch-Emotion) model

### **Textile MaTE Lexicon: application of the MaTE Toolkit**

Following the development of the MaTE Toolkit, it was tested in a second workshop with selected textile materials. The Textile MaTE Lexicon is a validation of the application of the MaTE lexicon tool and illustrates how the method/ protocol followed in the SensAE method could be used as guides to investigate one's own material-touch-emotion interactions. The Textile MaTE Lexicon (Figure 7) is based on the MaTE Lexicon tool and constitutes four levels. Layer 1 (inner circle) represents the textile materials; the images have been kept black and white so as to give the reader an idea of the textile material used, but to try and keep the reader from forming an opinion visually. Layer 2 indicates the tactile sensorial attributes. Layer 3 reveals which quadrant the textile material falls under- whether it has been appraised as pleasant/ unpleasant and stimulated/ relaxed. Layer 4 (outer circle) displays the most used emotion words along with the colour from the quadrant that they fall into.

It must be noted here, that due to limitations of the research, only eight sensorial attributes were investigated. There is, however, immense potential to further this research, to adopt and apply this framework to different product types and for diverse user groups to reflect and identify the different material touch emotion responses for different situations and contexts. For example, fashionwear for an occasion, sleepwear verses a car interior or textiles for a commercial office space would each result in different material requirements and different tactile experiences and emotional responses. The MaTE toolkit enables for more specific user engagement, rather than being a one size fits all approach. This could lead to the potential development of a database of emotional categorisation of materials using varied materials for different contexts.

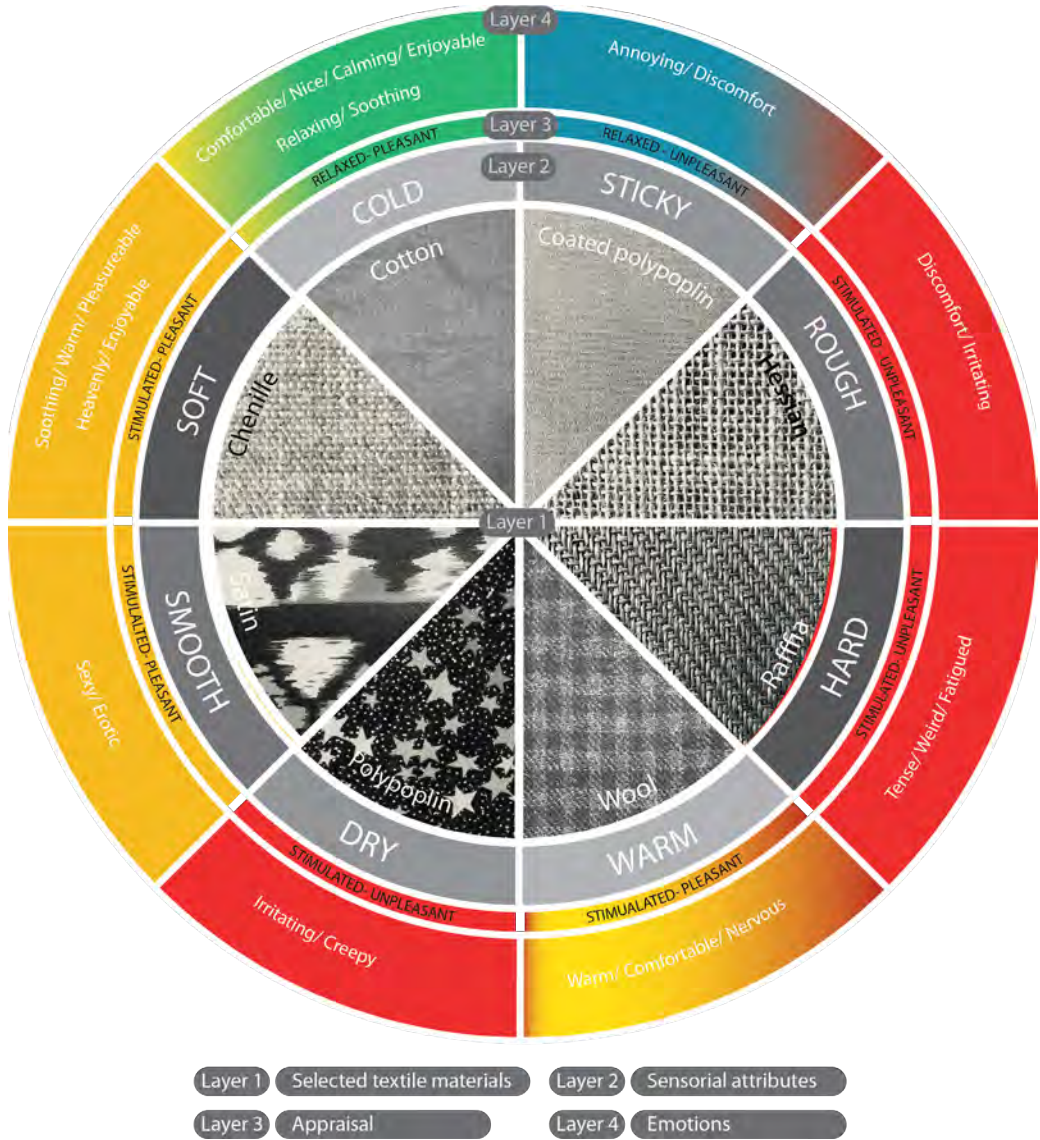


Figure 7. Textile material-touch-lexicon based on selected bi-polar sensorial attributes.



## Discussion and Conclusion

Building emotional durability through material selection supports a designer to strengthen and create attachment and subsequently prolong the life of a product. Supporting a sustainable fashion future requires informed material choices for emotional durability and considered emotional experiences. It is important for a designer to consider a material from a user's perspective; how might an individual experience a material; how can they articulate their appraisal of a material sensation and an emotion towards that material. Findings from the steps based on the SensAE method, demonstrated how material-memories and our tacit knowledge is integral in triggering associations linked to a tactile sensation which in turn is instrumental in eliciting an emotion. The Textile MaTE lexicon demonstrated how the MaTE lexicon tool could be applied as a starting point to guide the investigation of emotional responses with similar bi-polar sensorial attributes. With the intention of supporting designers with the considerations for factors that play a role in an individual's material-touch related emotions, the MaTE Toolkit:

1. provides an approach to investigating, understanding and articulating emotions elicited during material touch;
2. intends to be an informative, inspiring and a supportive tool to understand key variables in attributing emotions to materials and to identify how sensations, appraisals and material memories are interconnected; and
3. helps to guide and express and define emotion patterns to support more informed and considered materials choices.

This toolkit has the potential to benefit designers, design teams and communities in the development of material-led design projects in the wider fashion ecosystem, in areas of sustainable emotional design, digital design where knowledge of tactility is at risk of being overlooked, well-being and healthcare services, architecture, community and self-care spaces and environments. In the context of designing and motivating a behaviour based on sustainable emotions, this research on haptic sensations and emotional responses is a guide to making more informed and contemplated choices by understanding and communicating the relationship between the active touch of material sensations and subsequent emotional responses. In relation to emerging technologies in fashion design, digitally driven design methods, e-commerce and virtual environments, the MaTE Toolkit can be applied as a starting point to investigate emotional responses to tactile sensations and how that could be incorporated into a virtual haptic experience such as for online shopping. The toolkit as is currently, is proposed to be used as a guide for material selection process and to add to a growing database of materials -in the material-touch-emotions domain in different contexts through additional studies. There may be predictable similarities but also variances which is meant to be inspiring and prompt a new thought process in material investigations.

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