

FUTURESCAN 2: COLLECTIVE VOICES





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FOREWORD

THE ASSOCIATION OF FASHION AND TEXTILE COURSES (FTC) IS ONE OF THE UK ART AND DESIGN HIGHER EDUCATION SUBJECT ASSOCIATIONS, SUPPORTING AND PROMOTING RESEARCH IN AND RELATED TO FASHION AND TEXTILES.

Conferences, symposia and events provide forums for discussion and platforms for dissemination of research by established and early career researchers. In addition to supporting research, the overarching aims of the FTC are to:

- Stimulate academic debate across the constituent elements of fashion and textiles and their related areas in order to maintain an informed and current overview;
- Be concerned with all aspects of learning and teaching, scholarly activity and research in fashion and textiles;
- Liaise with public and professional bodies and advise on quality in educational matters;
- Take a proactive role in lobbying in the interests of the sector;
- Identify and share good practice.

Since the 2009 FTC conference *Futurescan: Mapping the Territory*, fashion and textile higher education and industry have responded to numerous external conditions. For higher education, the increase in tuition fees has required institutions to enhance quality and responsiveness to the student consumer. In industry, social networking, online communication and an array of digital technologies have fostered the formulation of non-traditional creative collectives, consumer groups, promotional and sales methods. The customisation possibilities offered by digital design and production technologies continues to promote the 'consumer as designer', challenging the purpose and role of fashion and textile design education in contemporary society. Sustainability remains high on the agenda for fashion and textile departments, courses and companies. The recent

financial crisis, subsequent recession and fluctuating economic climates throughout the world significantly impact upon industry and education. Today, the UK fashion and textile higher education system is required to produce graduates who are knowledgeable, skilled, environmentally conscious, creative, innovative, entrepreneurial, internationally aware, articulate and responsive to continual change.

Within higher education, the impact of the research agenda and drive towards the Research Excellence Framework (REF) has prompted educators to undertake research and engage in knowledge exchange with economic, social, cultural and environmental domains. While educators and creative practitioners have adopted practice-led and practice-based research approaches, others have utilised methodologies from disciplines such as history, philosophy, anthropology, cultural and ethnic studies. Art and design higher education, and in particular fashion and textiles continues to map the possibilities and explore the territory of what research is and could be. The conference *Futurescan 2: Collective Voices* provided a forum for established and emerging fashion, textile and related researchers to come together to communicate and discuss current research. The call for papers targeted submission from three different groups:

- **Emerging voices** – research from early career researchers and postgraduate students surrounding new projects.
- **Existing voices** – research from mid-career researchers around existing and completed projects.

- **Future voices** – potential research, research in the initial stages and speculative projects.

The selected research papers featured in this publication were presented at Sheffield Hallam University, 10th – 11th January 2013, positioned towards the following conference themes:

- **Breaking Barriers:** cross-disciplinary and collaborative teaching, learning and research
- **Emerging and Enabling Technologies:** within education, the design process, networking, commercial application and beyond
- **Past, Present and Future:** historical, archival, socio-political and technologically influenced
- **Design Responsibility:** sustainability, environment and ecology

The keynote speakers provided diverse insights from varying perspectives. Claudia Lieshout, Creative Director, Lifestyle Trends, Philips Design, enhanced understanding surrounding 'the art of trends' and designing for the future. Graduate attributes in a dramatically changing professional environment was the focus of the presentation given by Ben Mears, Head of Menswear, Jaeger. Rhian Solomon of SKINship™ London, discussed collaborative research surrounding the exploration of 'making' at the intersection of pattern cutting and plastic surgery. Associate Dean, Applied Research at Coventry University, Martin Woolley focused on the creative environment within 'rapidly changing landscapes' relevant to fashion, textiles and related creative disciplines. Contributions from each of the keynote speakers follow this foreword.

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THE ONEIRIC REALITY OF ELECTRONIC SCENTS

SCENT | ONEIRIC | DAY-DREAMING | REALITY | BIOTECHNOLOGY



ABSTRACT

THIS PAPER INVESTIGATES THE ‘*ONEIRIC*’ DIMENSION OF SCENT, BY SUGGESTING A NEW DESIGN PROCESS THAT CAN BE WORN AS A FASHION ACCESSORY OR INTEGRATED IN TEXTILE TECHNOLOGIES, TO SUBTLY ALTER REALITY AND GO BEYOND OUR SENSES. IT FUSES WEARABLE ‘ELECTRONIC SCENT’ DELIVERY SYSTEMS WITH PIONEERING BIOTECHNOLOGIES AS A GROUND-BREAKING ‘SCIENCE FASHION’ ENABLER. THE PURPOSE IS TO ENHANCE WELLBEING BY REACHING A DAY-DREAM STATE OF BEING THROUGH THE SENSE OF SMELL.

The sense of smell (or olfaction) is a chemical sense and part of the limbic system which regulates emotion and memory within the brain. The power of scent makes content extremely compelling by offering a heightened sense of reality which is intensified by emotions such as joy, anger and fear. Scent helps us appreciate *all* the senses as we embark on a sensory journey unlike any other; it enhances mood, keeps us in the moment, diverts us from distractions, reduces boredom and encourages creativity.



This paper highlights the importance of smell, the *forgotten sense*, and also identifies how we as humans have grown to underuse our senses. It endeavours to show how the reinvention of our sensory faculties is possible through advances in biotechnology. It introduces the new '*data senses*' as a wearable sensory platform that triggers and fine tunes the senses with fragrances. It puts forward a new design process that is currently being developed in clothing elements, jewellery and textile technologies, offering a new method to deliver scent electronically and intelligently in fashion and everyday consumer products. It creates a personal '*scent wave*', around the wearer, to allow the mind to wander, to give a deeper sense of life or '*lived reality*' (versus fantasy), a new found satisfaction and confidence, and to reach new heights of creativity.

By combining biology with wearable technologies, we propose a biotechnological solution that can

be translated into sensory fashion elements. This is a new trend in 21st century '*data sensing*', based on holographic biosensors that sense the human condition, aromachology (the science of the effect of fragrance and behaviour), colour-therapy, and smart polymer science. The use of biosensors in the world of fashion and textiles, enables us to act on visual cues or detect scent signals and rising stress levels, allowing immediate information to hand.

An '*oneiric*' mood is triggered by a spectrum of scents which is encased in a micro-computerised '*scent-cell*' and integrated into clothing elements or jewellery. When we inhale an unexpected scent, it takes us by surprise; the power of fragrance fills us with pleasurable ripples of multi-sensations and dream-like qualities. The aromas create a near trance-like experience that induces a daydream state of (immediate) satisfaction, or a '*revived reality*' in our personal scent bubble of reality.

INTRODUCTION

In this paper, a work in progress project is presented following on from a Knowledge Transfer Fellowship with Philips. It introduces the notion of '*electronic scent*' belonging to a new '*oneiric*' sensory dimension in wearable technologies that can be integrated in responsive fashion, textiles and product design/accessories. It seeks to deliver a '*surprising scent*' to the wearer when the body and mind most require it. The project is informed by research on '*Day Dreaming*', as featured in New Scientist, which argues that it is possible to reach new heights of creativity if you let your mind wander (Fisher 2012).

Wearable technologies can be defined as a genre of cloth that functions at the electronic level and is capable of processing information on the moving body (Lee 2005). In this instance, the scent creates a *dream-like* feeling, an almost narcotic state of mind, to evoke and provoke long forgotten

memories and new emotions. It is dispensed under computer-control from clothing elements called *scent cells* which could be disguised in fashion accessories, clip-on buttons and jewellery (such as a pendant) or products.

According to Dr Alan Hirsch, a well-known psychiatrist, neurologist and Director of the Smell and Taste Treatment and Research Centre in Chicago: '*smells act directly on the brain, like a drug*' (Holford and Cass 2001). There are a growing number of scientific studies that support this statement and prove that particular odours have a direct effect on brain activity. Research sponsored by The Sense of Smell Institute (a division of The Fragrance Foundation) since 1988, is helping to reveal the direct relationship between the sense of smell and human health and well-being. A quarter of a century later, the study of olfaction is recognized as a fully-fledged science, involving the respiratory, intestinal or cerebral system in an emotional or unconscious framework. Olfaction scientists are rediscovering what our ancestors in prehistoric times heavily relied on; the importance of smell and the powerful influence this has exerted in human evolution and social development.

The most direct way our brain has of interacting and sharing information with the external world is through the tip of the nervous system inside our nose. Similar to the sense of taste (of which 90% of what is perceived as taste is smell), smell is part of the chemosensory system and one of the chemical senses. It is intimately plumbed into our memory and limbic system so that when we '*sniff*' an object around us, the limbic system apprehends scent molecules floating from the object into the air, like a cloud, or wave. This helps us become aware of our personal smell sensory

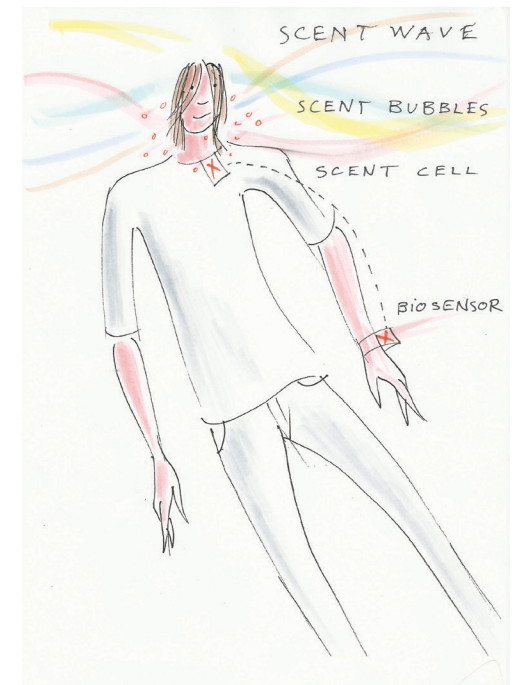
universe and makes our experiences of life and learning unique to us as an individual. In this paper, we call it the '*scent wave*', a euphoric child-like dream in an underwater mist of (scent) bubbles (figure 1).

Fashion is often described as a dream-like fantasy, an *oneiric* experience, a form of expression or desire to interact and communicate. This paper attempts to bring fashion and fragrance together in an innovative and evocative manner; to create a new '*scentsory*' dimension and to integrate the last of the senses (besides taste) into wearable technologies. It describes the future of '*scent communication*' as the power house that takes the user by surprise and changes their reality through one single whiff of fragrance.

The benefit of *electronic scent* expands the sensory capabilities of our bodies through '*scentsory*' fashion that contain a spectrum of scents with dynamic emitters. These mimic artificial scent glands and detectors acting as biosensors, an analytical device, used for the detection of an analyte that combines a biological component with a physicochemical detector. The expanded smell experience is triggered by biosensors that are responsive to individual need and reward the user with an intimate aroma atmosphere as a personal *scent wave* (figure 2).

The applications are wide-ranging; from holistic stress-reducing wearable technologies for health and wellbeing, to designer perfumes embedded in haute couture garments and accessories. One could imagine the 'Google Glass' heads-up display project (Times best invention of 2012) with a splash of Chanel no.5, or customised smart phones that emit neroli to reduce anxiety.

By 2016, the number of wearable technology product categories is projected to increase dramatically as a



2

wide range of new wearable devices are developed. According to IMS Research (2012), a leading supplier of market research and consultancy to the global electronics industry, product areas where wearable technology will have strong impact include smart watches, smart spectacles, sleep sensors, body monitors, military heads-up displays and hand-worn terminals. Future applications will include next generation '*data-biosensing*' diagnostics that '*sniff*' diseases. These will be embedded in our clothes as part of our personalised (body odour signature) security system. Our body odour will be our password and recognised as more accurate than finger prints and iris recognition. This smell awareness will also help us appreciate our senses in the world around us.

BACKGROUND

This paper builds on earlier research at Central Saint Martins College of Art & Design which investigates the growing art and science of **Scentsory Design®**, an on-going project in the Textile Futures Research Centre (TFRC) at the University of the Arts London (UAL). It is part of the TFRC wellbeing platform that explores sustainable design strategies to investigate social change and improve health and wellbeing.

Scentsory Design® investigates ‘digital olfaction’ wearable technologies for fashion and wellbeing applications. The initiative undertakes international collaborations across disciplines from aromachology, psychiatry, psychology, life sciences, olfaction sciences, complementary medicine and anthropology. It contributes towards a new future of *digitising smell*, in line with touch, vision and hearing senses which have long been digitised. It focuses on the targeted and controllable *electronic scent* delivery on the body.

The research fuses the ancient art of perfumery and complementary therapies with contemporary design and advanced technologies (e.g. lab-on-a-chip, micro-electro-mechanical-systems (MEMS), printed electronics). The aim is to create an emotional support system that is worn on the body to change behaviour through smell.

Scentsory Design® includes diverse knowledge sources and scholarly work on wellbeing and sustainability, involving a number of award-winning projects funded by the Art & Humanities Research Board/ Council; “*SmartSecondSkin*” sensory prototype dress (2003) inspired by neurobiological delivery systems found under skin (figure 3), *Fontenay-aux-Roses* bag (2005) inspired by the novel ‘A Rebours’ by Huysmans (figure 4), “*eScent®*” wireless sensory

SCENT CAN TOUCH US LIKE NO OTHER SENSE. IT IS THE MOST EMOTIONAL OF ALL OUR SENSES AND YET OLFACTION, HAS BEEN THE FORGOTTEN SENSE. 21ST CENTURY TECHNOLOGY HAS EXTENDED THE SENSORY WORLD OF THE ARTIST EVERYWHERE WE LOOK.

jewellery (2005) inspired by the defence mechanisms in insects (figure 5) and “*Smell The Colour of The Rainbow*”, Knowledge Transfer Fellowship that focused on therapeutic wearable technologies and products for sleep and stress disorders (2011), inspired by Sir Isaac Newton’s prism and colour spectrum (figure 6).

The aim of the fellowship was to explore the technological use of scent on product concepts and ideas to reduce stress, post-natal depression and anxiety, promote sleep, regulate mood, physiological and psychological state and improve self-confidence in social situations. The research can be precisely defined by a quote in John Gray’s (2003) novel ‘Straw Dogs’ (on modern civilisation and political philosophy):

‘New technologies do more than transmit information, they change behaviour by propagating moods’.

DIGITAL OLFACTION SCIENCE
Scent can touch us like no other sense. It is the most emotional of all our senses and yet olfaction, has been the forgotten sense. 21st century technology has extended the sensory world of the artist everywhere we look. Sounds can be digitized and combined to give sublimely eccentric new music which in some cases exceed the evolutionary development of our brains, the painter has provocative colours, textures and materials which are used by artists to conjure-up the images of the world inside our brains, computer graphical art outmatches

the sensory repertoire of our central nervous system, taste is opening up new gourmet artforms for the culinary arts, edible photovoltaic food, molecular cuisine and shape-memory alloys, synthetic biology and other exotic organic compounds give us a new world of living architecture.

Smell on the other hand is a complex medium to work with. Beyond the mass of supermarket plug-in air fresheners, the growing trend of retailers using scent marketing tools to sell products (e.g. Starbucks, Burberry) and attempts to combine scent with the internet (e.g. Olfacom, Scent Sciences), there has been little movement in wearable electronic scent that builds on earlier **eScent®** research at Central Saint Martins (Tillotson 2005) and PhD thesis on ‘*Interactive Olfactory Surfaces: A Science Fashion Story*’ at the Royal College of Art (Tillotson 1997). Recent examples include a group in Tokyo and Singapore who have created the ‘Sound Perfume’ eyeglasses equipped with speakers and scent emitters (Choi et al, 2012) and technology projects at the University of Cambridge using a patented scent dispensing system (Lowe et al 2011) for consumer goods, gaming and the next generation of mobile phones.

Until recently there has been little understanding of the way in which chemical information is translated into the way we perceive a fragrance. This is now changing with the need to move towards a ‘**Digital Olfaction Science**’ to enhance human health,

create a perfume language and a new way of communicating. Scent can link together the experience of reality and yet mysteriously, the language for olfaction remains limited. We intuitively know the odours we smell but cannot eloquently describe them in words; this is because the vocabulary simply does not exist beyond examples such as ‘*peppermint-ish*’ or ‘*lemon-ish*’ or the language of perfume such as ‘*fruity*’, ‘*floral*’ or ‘*leather*’.

The 21st century will see a major turning point for the sense of smell as the field of digital olfaction is expected to dramatically expand over the coming years. In order to bring together all scientific data related to digital olfaction, an international organisation has recently been created called the **Digital Olfaction Society** (DOS) to gather, exchange and clarify the breakthroughs and prospects of leading-edge technologies related to olfaction (Edeas 2012). DOS paves the way toward a different world in order to understand the complexity of research and development in digital smell technologies. Their aim is to move from the prehistoric stone age of odorous substance toward a modern age by means of digital olfaction and innovative smell technologies.

Building on the work of 2004 Nobel prize winners on physiology and

medicine who discovered how parts of the mechanism for communication work between the nose and the brain (Buck and Axel 1991), it is expected that during this century the full theory of odour will finally be understood. When this happens, it should be possible to digitise fragrance to create our own fully synthesised ‘*scent palette*’ on a micro-chip and will open up many opportunities for sensory effects in responsive fashion, textiles, jewellery, product/accessories and HCI. It will allow us to apply, enjoy, appreciate and understand the wonder of scent.

We may even experience the sense of smell in different ways (since we all perceive olfaction differently), as vibrantly described in the science fiction story ‘*Desertion*’ by Clifford.D.Simak which illustrates life on a faraway planet:

“Pleasant scents seeped into his body.

And yet scarcely scents, for it was not the sense of smell as he remembered it.

It was as if his whole being was soaking up the sensation of lavender – and yet not lavender.

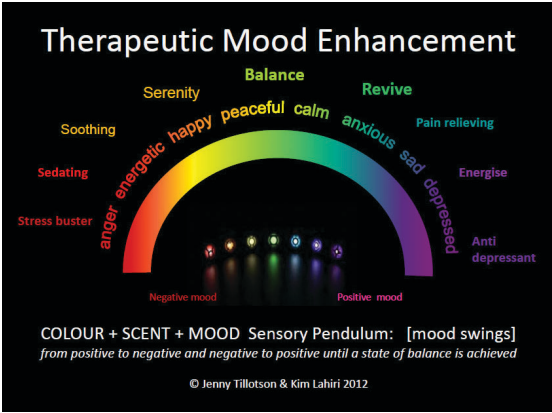
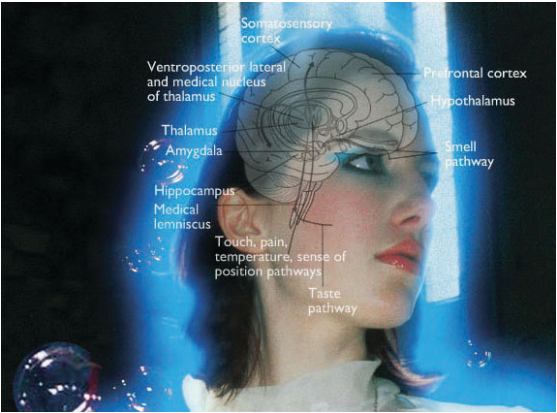
It was something, he knew, for which he had no word”

(Simak 1944)

THE SENSE OF SMELL

Smell is our most evocative and direct chemical sense. The olfactory bulb is the ‘*hotline*’ wired directly into the emotional centre in our brain and is strongly tied to life experiences. Scents are carried directly by the olfactory nerves to the limbic system, a primitive part of the brain that acts as an emotional switchboard. It has access to our feelings, likes and dislikes. As human beings, we vary in our ability to smell depending on health, age, gender and what we have eaten, etc. In one day, we take approximately 20,000 breathes, so without knowing it we are smelling at all times. In the air that we breathe, we are able to recognise 10,000 different odours – but unlike the other non-chemical senses (touch, vision, hearing) we cannot switch it off.

The findings of a number of scientific studies have also shown that odours can readily influence emotional states and moods in different situations (Baron 1990, Baron and Bronfen 1994; Dunn et al 1995; Kirk-Smith and Booth 1990; Knasko 1992; Van Toller 1988). Pleasant smells tend to evoke positive memories and equally unpleasant smells evoke negative memories (Ehrlichman and Halpern 1988). However, pleasant smells linked to “traumatic” memories can also remain with us until we die.





It is widely acknowledged that olfactory signals induce emotional reactions whether or not a chemical stimulus is consciously perceived. The neuronal pathway in the olfactory system first delivers the information to the limbic system which includes more primitive areas of the brain concerned with memory and emotion (figure 7). The limbic system evaluates sensory stimuli and registers pleasure or pain, safety or danger with corresponding emotions such as joy, fear, anger, attraction or repulsion. A particular scent unlocks and retrieves specific memories because smell as our primitive sense has the longest recall of all five senses. This explains why smells are so powerful; they can evoke positive emotions of love and security, whilst negative emotions conjure up anger, disgust and fear.

GOOD FEELINGS BAD FEELINGS

Science has proved that with evolution, living organisms have adapted so that they are inclined to shift toward 'good' situations that are favourable to their health and wellbeing and away from 'bad' situations that are less favourable. Human beings are the same; experiential representations of such stimuli have evolved as feelings of pleasure or displeasure, or 'good' or 'bad' feelings (Ehrlichman and Bastone 1992). Odours are always experienced as either pleasant or unpleasant smells, it is not often that we find odours that are regarded as neutral smells.

According to Prof Tim Jacob, an expert in the psycho/physiology of olfaction at Cardiff University and a consultant on the AHRC Knowledge

Transfer Fellowship in 2010, this makes evolutionary sense, given that one of the primary functions of smell is to accept and approach a pleasant odour, or reject and avoid harmful substances. Smells therefore become associated with feelings or (positive or negative) "mood states".

AROMACHOLOGY

There is increasing evidence in the growing field of 'aromachology', i.e. the study between scent and psychology, that certain essential oils can reduce stress by influencing mood, physiology and behaviour (Herz 2009). Certain fragrances have been shown not only to reduce depression and operator error, but stimulate sensory awareness, enhance concentration, social and sexual relationships, work performance and boost personal confidence and self-image. It is known that citrus oils can alleviate stress (Kiecolt-Glaser et al 2008), lavender can promote sleep (Goel et al 2005), and sandalwood can decrease blood pressure (Heuberger et al 2006).

SANDALWOOD

Sandalwood can also trigger *day-dreaming*. Since ancient times, sandalwood has been utilised in ceremonies in Asia. Its use for meditation, deepening the breathing of yogis intent on reaching the state of Samadhi, calming the mind and, connecting mind and spirit with dreams is well established. It introduces a sense of serenity and insight which permits the user to travel to that dream-like state where vision and enlightenment ensues. Sweet, woody and balsamic, this aroma inspires and encourages mind states, whilst aiding a return to our earthly domain gently grounding with reality.

A little known fact that backs up the comforting security of sandalwood is that its chemical make-up resembles the same molecular elements found in the scent of human skin. Profoundly



grounding yet animalistic in its comfort, it is perhaps the reason why sandalwood allows the mind to enter the silent surreal state of meditation to feel safe. Sandalwood is mentioned in the ancient vedic scriptures. This parasitic wood has been traced to tombs in Egypt, where it was used in embalming and preservation along with other resinous materials such as myrrh, frankincense and benzoin. With its multitude of uses, sandalwood is a powerful *electronic scent* tool for use in contemporary design, to create an instant short meditative state of wellbeing (for example in yoga).

STRESS REDUCTION

Chronic stress is a psychological condition that can lead to the risk of heart disease, stroke and obesity, and also unhealthy behaviour, such as over-eating, smoking, drug or alcohol abuse (caused by boredom and unhappiness), as well as affect the subsequent risk of cancer. Life pressures cause an overwhelming negative effect on the mind and body resulting in stress with unpleasant side effects including depression, headaches, back pain, insomnia and irritability. According to MIND, the mental health charity, British businesses lose an estimated £26 billion every year due to work-related stress (McManus et al, 2007). With one in six workers experiencing stress, depression and anxiety, MIND suggests that businesses could save £8 billion a

year through greater awareness, mental health support and building wellbeing programmes for employees.

Recent research from Mintel on British Lifestyles through the eyes of the consumer has shown that 40 million British people admit to suffering from stress, depression and anxiety, with the top five concerns being money (40%), problems of friends and family (25%), health (24%), stress at work (22%) and employment (21%) (Richmond, 2010). However, in terms of stress mitigation, only 3% of all fast moving consumer goods launched across personal care, household and healthcare claim to 'de-stress' and 'relax' the body.

With the increased trend in wellbeing and Complementary and Alternative Medicine (CAM), up to 2 million adults are using over-the-counter alternatives to sleep products and stress-relief products. This opens up new avenues to *manage stress* through novel stress-relief tools that utilise *electronic scent* as the key component to improve overall wellbeing.

SMELL THE COLOUR OF THE RAINBOW

The findings of the AHRC Knowledge Transfer Fellowship in partnership with Philips, explored the use of *electronic scent*, offering an unique slant on the physiological and psychological manifestations of moods. As a collaborative project with joint

expertise in design, olfactory science, fragrance, aromachology, colour, consumer lifestyle and technology, the research centred on a selection of therapeutic essential oils for stress and sleep as the basis for wearable technologies.

These elements were introduced into the world of health and wellbeing using mood enhancement as the route. Essential oils were validated by Cardiff University to alleviate sleep and stress disorders. These were correlated with specific colours in a *therapeutic sensory spectrum* that represented a personalized 'therapeutic rainbow'. In this instance, the spectrum can be demonstrated as a sensory pendulum, ranging across *de-stress/relief-calm/peaceful/relax-super-energise* (figure 8).

The sensory pendulum was conceived to combat 'mood swings' with a spectrum of therapeutic essential oils housed in 'scent cells' and designed to fit in a pendant-cum-bed unit that centres on the colour green to represent balanced wellbeing (figure 9).

A deep understanding of the therapeutic nature of the oils in terms of physiological and psychological effects on the body were found and demonstrated in working prototypes (figure 10 and 6) and designed specifically to suit Philips businesses (AVENT and 'Vitalite' and 'Lumichrome' products). Clinical evidence on the properties of lavender and sweet

orange were critically reviewed and scientific data was extracted in support of the value of essential oils which were known by association to alleviate the negative effects of stress, sleep and post natal depression.

A product range was created by jewellery designer Slim Barrett. This included a sensory bed unit with seven interchangeable aromachology mood-enhancing pods that corresponded to the colours of the rainbow (figures 6) and matching 'aroma-pod' pendant (figure 10). Further ideas included the use of *electronic scent* to reduce boredom, and increase learning capacity, a concept that is being investigated in the home entertainment industry to bring the fourth dimension as pleasurable experiences to gaming and tablets.

LIFT MY MIND

Building on from the Fellowship work, recent electronic scent prototypes include *"Lift My Mind"* (Tillotson 2012), a collaborative project funded by industry involving TFRC and CEROMA Ltd, a spinout company from the University of Cambridge. This invention was embedded in a North Face technical rucksack as a concept to demonstrate computer-controlled scent-output for sports endurance and to energise runners (figure 12).

Exhibited at a private world summit to showcase the latest global textile innovations by VF Corporation (e.g. Eastpak, Vans, Timberland), a replaceable cartridge system the size of a SD-cartridge was designed to fit a small unit and customised in the front panel of a rucksack.

The unit had the capacity to dispense three evidence-based aromachological compounds and centred on research conducted by NASA on peppermint oil to increase mental performance and enhance long-distance running. Next generation prototyping would align with personal sports performance and

self-tracking biofeedback goals for mood monitoring ('Quantified Self') and dispense aromas depending on the personal needs of the user.

BOREDOM AND DAY-DREAMING

In 2009, a London think-tank called The New Economic Foundation reported that out of 22 European nations, UK citizens were the fourth most tired and bored (Toohey 2011), enduring six hours of 'boredom' a week. The act of 'day-dreaming' is the most common by-product of boredom. Neurologists have shown that certain areas of the brain are not dulled by day-dreaming and so a youthful habituation to boredom can produce some immediate benefits.

Psychologists have shown that as humans we daydream for one-third of our waking hours. The results from researching the benefits have shown that learning how to tread the line between 'focusing in' and 'zoning out' could help people arrive at a breakthrough they might otherwise have missed out on. Jonathan Schooler is a psychologist from the University of California who is well-known for his research on 'mind-wandering'. These experiments have shown how the mind is constantly drifting from the present, whilst other researchers at the University of Illinois in Chicago claim 'the best way to solve a problem is not to focus' (Wiley and Jarosz 2012).

From a scientific standpoint, topics of daydreaming and fantasy are complex. Day-dreaming is an essential component of peoples' equipment for functioning and to organise events in the mind as one goes about daily life. For most people it is a category that has meaning and hence needs a definition. Mind-wandering can be defined as a spontaneous thought which is unrelated to an ongoing activity – and also instances when people decide to daydream about something, such as a fashion

collection or holiday, and then let their minds run undirected into whatever fanciful directions occur to them. One kind of daydream may constitute one form of fantasy, but fantasy on the other hand implies a departure from concrete reality and is not necessarily a mental process in that it may also be a physical representation such as fashion, a work of art or literature (Klinger et al 2009).

THE 'ONEIRIC' DAY-DREAM DIMENSION

The word *oneiric* comes from the Greek language *oneiros* and portrays something that resembles dreams. It tells a story or describes a painting that plunges a viewer into the artist's idiosyncratic, *oneiric* universe or dream reality. It can be used in film theory to describe the dreamy elements of a movie. Likewise, fashion designers create a vision and imaginative story for a fashion collection as their dream-like oneiric reality. An example of this is Karl Lagerfeld (2011) who described his Pre-Fall 2012 collection 'Chanel Paris-Bombay Métiers d'Art': *'India for me is an idea. I know nothing of its reality, so I have a poetic vision of something that may be less poetic'*.

Lagerfeld had a different vision in 1982 when he described his reality of the future of the fashion industry. As head designer at the House of Chloe, he predicted computerised fabrics and a dangerous future:

"Will fabrics eventually become computerised? Everything will be, us included. People are becoming programmed. It is dangerous, but it is the future... Deep changes in fashion will come with new developments in fabric technology. The body is the most important thing of the future and was not designed for life outer space, not yet anyway".

(Khornak 1982)



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ACCORDING TO A REPORT FROM IMS RESEARCH (2012), THE MARKET FOR WEARABLE TECHNOLOGY IS EXPECTED TO EXCEED £4BILLION BY 2015 (ADAMOME 2012).

PERFUMERY AND WELLBEING

A successful fine fragrance also eludes a powerful vision, fantasy and dream-like fiction which feeds the reality of designer perfumes and helps strengthen the brand. An example of this is best-selling perfume 'Angel' by Thierry Mugler with images of faraway stars (star bottle, crystal star). Perfumery marketing gives an oneiric quality to the branding process, and with the fashion industry predominantly funded by the global fragrance industry, this is crucial to its survival. According to a Euromonitor market research report, the global market for fine fragrances was worth £22billion (\$44billion) in 2011 of which premium brands accounted for 54% (Walker 2011).

Thierry Mugler also shared his reality on a future of fashion in 1982, but linked to personal wellness:

"Fashion will change dramatically in the coming years. One will find it less and less important to be 'fashionable'. Good clothes – garments well designed and well made for the purpose of protecting the body and enhancing the personality – will prevail. Fashion will be more human, closer to the needs of the people in terms of their being and wellbeing, not "well showing".

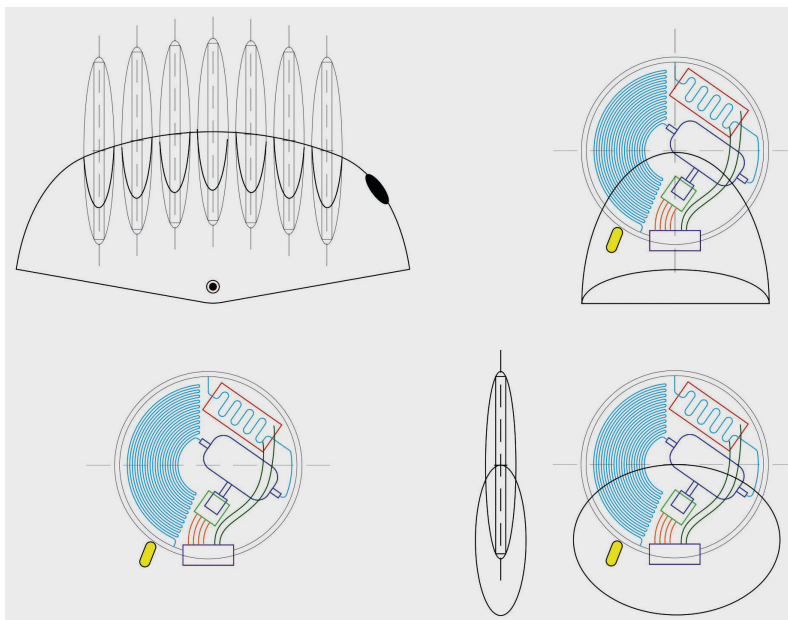
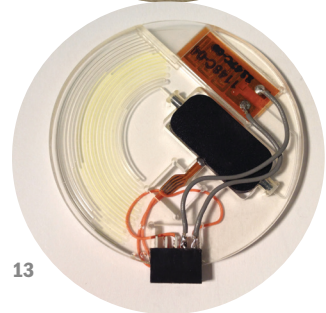
(Khornak 1982)

DATA SENSES: THE BIOTECHNOLOGY REVOLUTION

The fusion of wearable technology and smell introduces the new 'data senses' as a unique sensory platform that triggers and fine tunes the senses with fragrances. According to a report from IMS Research (2012), the market for wearable technology is expected to exceed £4billion by 2015 (Adamome

2012). The relevance of smell for wearable technologies will have many exciting benefits, beyond wellbeing, fine fragrance, fashion or entertainment. The perception of a particular aroma can be technologically induced by electrical stimulation to enhance user experience; a personalised and controllable 'scent bubble' can be released on demand – to trigger memories and tailor specific moods.

At the University of Cambridge, scientists in the Institute of Biotechnology have developed (inexpensive) smart polymer based optical biosensors, specifically utilising holograms that change colour to monitor and detect a range of analytes in real time, such as measuring blood lactate used to monitor exercise performance in sports medicine (Lowe et al 2006). The next generation includes novel colour-changing



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IN THE NEAR FUTURE, DISEASES LIKE BREAST CANCER COULD BE DETECTED BY 'SCENTORY DIAGNOSE' CLOTHING EMBEDDED WITH MICRO 'ELECTRONIC NOSE' SENSORS, IN THE SAME WAY AS DOGS SMELL CANCER.

holographic biosensors for appropriate stress biomarkers such as cortisol (in bodily fluids) and 'scent cells' which will deliver calming scents when stress levels reach a certain threshold.

In the near future, diseases like breast cancer could be detected by 'Scentory DiagNOSE' clothing embedded with micro 'electronic nose' sensors (figure 12), in the same way as dogs smell cancer. One can imagine clothing that pre-warns early stage diseases, or captures odours, turns it into digital data and transmits anywhere in the world. On the 1st April 2013, Google launched the 'Google Nose BETA' new 'scentsation' (olfactory) search engine as an April fool (Google 2013). This idea might currently seem far fetched, but it will only be a matter of time before this sensory technology is possible.

DATA SMOG

As humans living in the modern world, we have grown to underuse our senses. We may not even be fully aware of using our olfactory system as it has been replaced by the other senses, particularly the audio/visual senses. In the animal world, smelling is vital for survival – searching for food, sniffing out danger, marking territory and finding a mate.

Our ancestors relied heavily on what we underuse, cognition of the imperceptible changes of light, colour, smell, sound and touch that were essential to keep them alive. Their sensory appreciation taught them how to diagnose disease, how to sense danger, what foods to avoid, when to sow and reap or when to procreate. Animals still rely on individually discriminating those changes. We humans have not lost those sensory faculties, but due to excessive information overload (e.g. 'data smog') we have grown to rely on

data presented to us in another way. In 1965 this was, eloquently described by American theoretical physicist, J. Robert Oppenheimer:

"There are children playing in the streets who could solve some of my top problems in physics, because they have modes of sensory perception that I lost long ago..."

A further statement from the 1960's which has inspired this paper is from political activist Susan Sontag. In her novel 'Against Interpretation', she said:

"Ours is a culture based on excess, on overproduction, the result is a steady loss of sharpness in our sensory experience."

All the conditions of modern life – its material plenitude, its sheer crowdedness – conjoin to dull our sensory faculties. What is important now is to recover our senses. We must learn to see more, to hear more, to feel more."

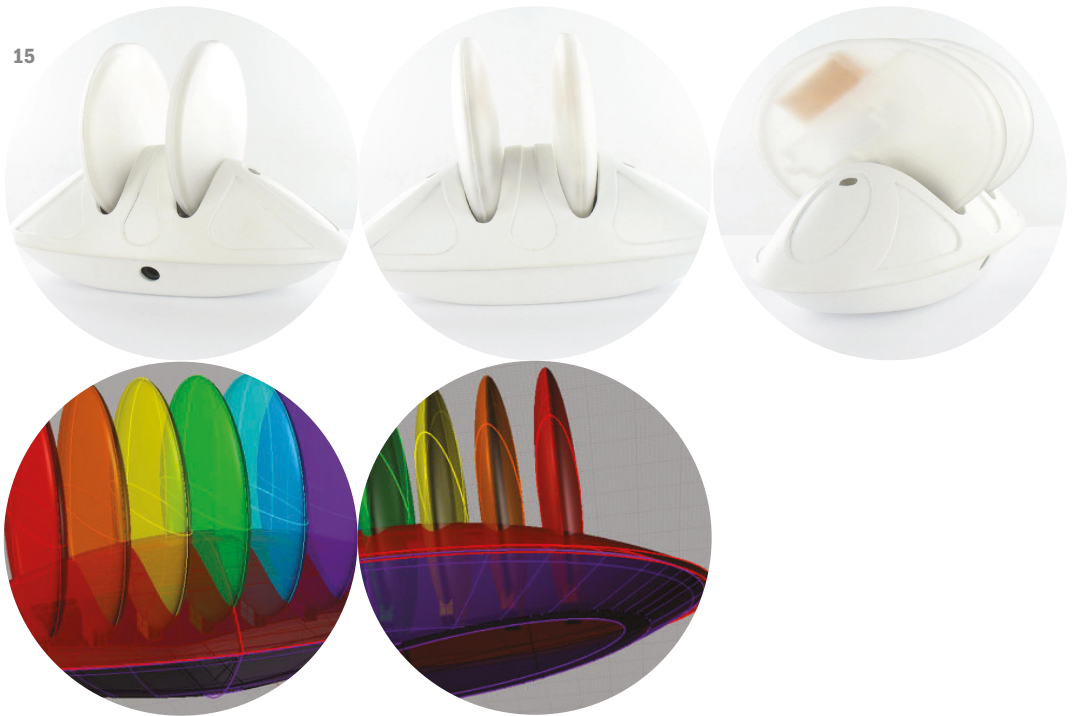
(Sontag 1964)

Although Sontag's statement was about art criticism, this paper endeavours to show how the 'reinvention' of our sensory faculties is possible through emerging and advanced technologies – and particularly biotechnology.

SCENT 'CELLS' AND 'PODS'

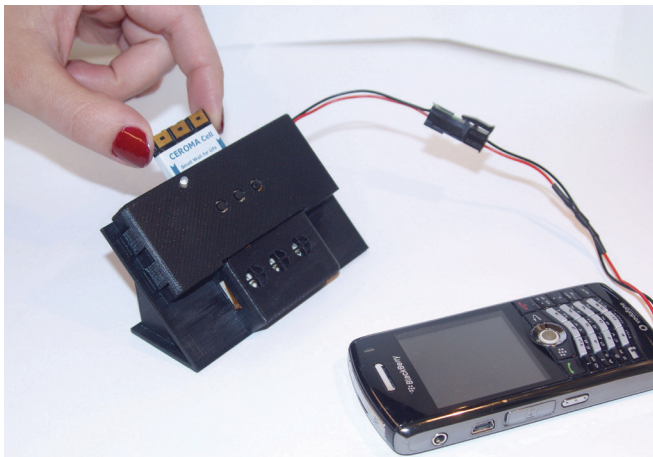
This patented research offers a wearable extension of perfumery or aromatherapy. For the realization of responsive fashion, textiles and product design/accessories, it has the capability of dispensing a personalised 'wardrobe of fragrance' in response to a stimulus e.g. biometric sensor that measures an emotional response (Tillotson et al, 2006). Using MEMS or solid-scent polymer technology, the aroma is contained in novel clothing elements, replaceable 'scent pods' (figures 13,14 and 15) or 'scent cell' SD-card cartridges (figure 16 and 17); these are incorporated into wearable products or mobile devices and tailored to the individual needs of the person's mood or requirements.

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Research underway, which builds on this work includes digital olfactory solutions for people living with:

1. early-stage dementia; to recall memories and train the olfactory mechanism;
2. chronic mental health conditions (e.g. bipolar affective disorder), to help manage lifestyle as a sensory 'WRAP' (wellness, recovery, action, plan) tool and for preventing stress and insomnia triggers i.e. depression and/or mania (and *not* as an alternative to orthodox treatments for mood stabilisers).

CONCLUSION

This paper has attempted to map out a new design process through the use of contemporary *electronic scent* and advanced technologies for health and wellbeing in a rapidly changing landscape. With an impending stress and depression epidemic that is threatening to increase the risk of heart disease, we have highlighted the importance of olfaction science on human wellbeing.

FASHION: THE NATURAL HIGH

Science suggests that each of us may live in our own idiosyncratic smell sensory universe. Smell affects us deeply and immediately. It gives a sense of the '*feeling space*', which opens up many opportunities for designers to enhance a person's sensory world, or '*scent wave*'. It expands the sensory repertoire of fashion and textile disciplines and becomes almost like a drug that gives an instant natural high (figure 18).

Based on psychology research identified in this paper, *electronic scent* has the potential to encourage *mind-wandering* applications in fashion and textiles and potentially turn boredom into day-dreaming. At the same time it has the power to '*de-focus*' from actual reality in a short, sharp instant '*still point*'. It creates a sensation of total bliss, a trance-like state of meditation, a relaxed mind which increases creativity and ideas. It gives a sense of satisfaction and therefore improves general wellbeing.

At TFRC, we are working with world leaders at the University of Cambridge

to develop new design solutions to advance wellbeing for the benefit of human science. Potential projects underway utilise novel scent technology, biosensors, point-of-care diagnostics and mobile health devices embedded in jewellery and clothing. Our bigger vision takes us back to our roots and *reinvents* our sensory capabilities. As Thierry Mugler predicted thirty years ago, with the rise of biotechnology we are now at an age where fashion has become closer to the needs of the people; the introduction of *electronic scent* improves healthcare, 'enhances personality' and should contribute towards a sustainable '*wellbeing*' fashion industry, whilst also benefitting the perfumery industry as a new way of marketing fine fragrances and telling stories.

THE 'SURPRISING SCENT'

The hypothesis behind this research argues that *electronic scent* can take you by surprise, relieve boredom and potentially interrupt the flow of consciousness. As the fourth most bored European Nation (Toohey 2011), this research could be relevant to the

future health of the UK. Boredom can be a powerful stimulus for creativity when it is turned into *day-dreaming*. This paper endeavours to show how the use of *electronic scent* applications generates an unexpected sensory experience. It transports the wearer to another dimension; to evoke memories, change moods/create moods, enhance feelings, desires and other sensory phenomena.

This is a promising field for *electronic scent*, because it can spark the imagination into pleasurable and meaningful experiences until we reach a short instant "*still point*" in the flow of satisfaction. Time seems to disappear while playing, surfing, creating,

inventing or *day dreaming*. In addition, compared to the traditional application from a perfume bottle, *electronic scent* differs because it does not offer the anticipatory experience (cold moist, sensation) and a familiar aroma (an expected associated memory or its therapeutic effect or the smell of ethanol) – in comparison, it offers a novel, unexpected experience.

On the simplest level, *electronic scent* takes the wearer on a poetic journey. The surprising scent is picked up by the limbic system in the brain and triggers the memories of (life-long) feelings, whilst also creating an augmented and different reality. These new elements instantly create a state

of *day-dreaming*, a short moment which is out of focus from reality. The *electronic scent* induces a state which allows us to stop for a moment, but then to start again in a '*revived reality*'. It is a moment of pleasure in the shape of past memories, but of a strange detachment where problems in the mind may potentially be resolved, situations simplified and artistic block is overcome. It allows free movement of ideas, pictures, brighter visions, ambitions, deep desires, vivid aspirations, free association of concepts; and as described in the novel 'Problems of Creativeness' by Tomas.M.Disch (1967): '*Creativeness is the ability to see relationships where none exist*'.



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FIGURE CAPTIONS AND CREDITS

Figure 1: A child-like dream and the ‘scent wave’. Photograph, by Marc Rolland.

Figure 2: ‘Scentstory’ fashion: riding the ‘scent wave’, illustration by Marc Rolland.

Figure 3: SmartSecondSkin Dress, collaboration with Adeline André. Photograph Guy Hills.

Figure 4: Fontenay-aux-Roses mood-enhancing bag designed by Ben Hughes. Photograph Daniel Alexander.

Figure 5: eScent® wireless sensor system broaches, designed by Don Baxendale. Photograph Don Baxendale.

Figure 6: InterchangeableTherapeutic Rainbow bed unit/pendent designed and copyright by Slim Barrett.

Figure 7: Neuronal pathway in the olfactory and limbic system of the brain, illustration Wendy Latham. Photograph Guy Hills.

Figure 8: Therapeutic rainbow pendulum, designed by Kim Lahiri and Jenny Tillotson.

Figure 9: Sensory pendulum for ‘mood swings’, illustration Wendy Latham. Photograph Guy Hills.

Figure 10: InnoScent pendent designed and copyright by Slim Barrett.

Figure 11: Lift My Mind sports endurance rucksack. Photograph Jenny Tillotson.

Figure 12: ‘Scentstory DiagNOSE’ clothes, illustration Wendy Latham. Photograph Guy Hills.

Figure 13: Custom-made ‘pod’ and liquid scent MEMS designed and copyright by Slim Barrett.

Figure 14: Mechanical (MEMS) scent system for jewellery/products designed and copyright by Slim Barrett.

Figure 15: Interchangeable aroma pods for jewellery/everyday products, designed by Slim Barrett.

Figure 16: CEROMA ‘scent cell’ multiple scent channel (three aromas). Photograph, Colin Davidson.

Figure 17: CEROMA ‘scent cell’ for mobile phone and The North Face rucksack. Photograph, Colin Davidson.

Figure 18: Fashion as a natural sensory ‘high’, illustration Wendy Latham. Photograph, Guy Hills.

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