

Design as a Means of Exploring the Emotional Component of Scent

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Abstract:

As more is being discovered about the physiological and psychological mechanisms that govern our relationship with odour, designers are starting to experiment with technologies that might deliver scent in more meaningful ways. This paper explores this forgotten sense through the documentation of a number of research projects that look at scent in relation to the body, fashion, ritual and emotion. Whilst engagement with the visual remains the most significant area for designers, some of the most notable design incorporates a sensitivity to its impact on more neglected sensory stimuli. Tactile interfaces, which have long been explored in design research and education, are finally getting the attention they deserve through developments in wearable technology and the increasing willingness of textile and fashion designers to explore their potential. Similarly, the importance of sound in interface and interaction is becoming a more familiar area of investigation. Evidence suggests that exploring the link between smell and emotion might be an even more fruitful area of development, given its significant role in the triggering of emotional responses. Despite this, the sense of smell has only recently become a respectable subject of serious study, and has received only the most transitory mention in the proceedings of the *Design & Emotion* Conferences to date. Odours drive our emotions, warn us of danger, influence our body chemistry and steep us in luxury. Since smell signals have a direct access to the emotional centres of the brain, the emotional shading of our lives are influenced by the smells around us.

In this paper the authors discuss new forms of aroma delivery that go beyond passive microencapsulated techniques to incorporate microfluidic delivery systems that dispense a selection of fragrances to trigger human emotions, convey information and enhance wellbeing through olfaction stimulation of the autonomic nervous system. In addition, a number of design proposals are presented which demonstrate how designers are able to envision completely new modes of interaction with scent-producing devices. These range from objects that exploit the performative component of scent application to the creation of an individual, smart, interactive “scent-bubble” around the user that can be constantly modified according to mood, environment or time of day.

Keywords:

scent, fashion, emotion, industrial design, technology, aromachology.

Scent provides an important, but poorly understood, component of our perception of our surroundings. It is clear that while many human scent responses to do with danger are universal, or instinctive, others, particularly pleasurable aromas, are linked to memories, which are highly specific and individual. What these responses have in common above all else is their *emotional* component. Along with every other living organism, our ability to detect chemical changes to our environment is extremely important. This may enable us to avoid poisonous, diseased or decaying sources of food, but equally may help us locate a genetically compatible mate (Vroon, van Amerongen, de Vries, 1997). The most easily identifiable and universally replicated responses are linked to survival, and have been shown to be 'hard-wired' to some of the oldest (in evolutionary terms) parts of the brain, but this limbic system, or area, is also that most closely associated with the management of memory and emotion. Beyond this, the scientific understanding of human responses to scent stimulus remains extremely limited. Many studies have been undertaken, but the subjective nature of results makes the elimination of variation through control samples practically impossible.

There are specific areas in the brain where smell memories are received and stored. Smell information goes from the olfactory bulb to centres of the brain that handle strong emotions like aggression, fear and sexual arousal. This centre also plays a significant role in selecting and transmitting information between our short-and long-term memories, evoking memories from the past. Smells arouse emotions of sadness, loss, love, disgust, longing and passion, buried deep in our sub-conscious. Only a few molecules from an odour are required to convey a message to the brain, creating a smell image. This can come from a flower, a memory or place, a person, or time, an olfactive evocation, or alternatively an aggression alarm or warning signal of danger. For artists and designers this powerful sense gives rise to an equally powerful medium of expression.

Whilst the technology has suffered numerous crises and set-backs, from the far-from credible innovations such as Smell-o-Vision of the early 1960's to the collapse of Digiscents in 2001, designers have started to take on the task of translating this technology for a consumer audience. Whilst Disney continues to 'imagineer' additional sensory forms to its theme park rides, and supermarkets and shopping malls continue to pump out odours approximating to freshly-ground coffee or freshly-baked

coffee to its customers, there remains a question mark over the physical form, and mode of interaction this technology may take in the near future.

Uses of Scent

The ways scent is used as a 'tool, ' or 'cue' in everyday life reflects this biological background. Scent is often added to harmful odour-free gases in order to warn users of leaks. We also use scent to repel insects such as mosquitoes and midges. Scent is used to mask the unpleasant odours present in cleaning products, and is intended to enhance the overall sense of 'cleanliness' following a cleaning process. On our bodies and clothes, scent is used to mask malodour created by bacteria that linger even after washing, as well as enhancing the way we appear to others. In work, retail, entertainment and shopping environments, scent is used to elevate mood, increase concentration, or attract attention to particular products. Clearly these scents are not applied at random. They are concocted by experts in close consultation at every stage with potential consumers to determine their appeal. This is the extension of the perfumer's art in the age of marketing for mass-production, where scent is subject to changes in taste in the same way as fashion, interiors and all other areas of design.

Study of Scent

The 'serious' study of scent is an extremely recent phenomenon when compared to the practice of extracting, refining, mixing and selling scent products that is replicated across cultures and known civilizations since the Egyptians. These processes would be informed through an appreciation of aromatherapy, although this term was not coined until the 1920s (John, Christensen, Boyden, 2003). It relates to the physical healing properties of essential oils, and their ability to relieve conditions such as headache, anxiety, bronchitis, indigestion and high blood pressure. There is some controversy surrounding the effectiveness of such therapies because of the inability to test in controlled environments - the mode of administration of these therapies tends to include massage, breathing techniques and meditation, which might, on their own, be responsible for many of the effects. As such, and in common with other 'alternative therapies' it has been difficult to assess their benefit using scientific tools. More recently, the area of aromachology has provided significant insight since its origins in the early 1990s (The term *aromachology* was coined in 1989 by the Sense of Smell Institute, formally the Olfactory Research Fund, a non-profit research arm of

the fragrance industry). This area of research seeks to further the understanding of the role that fragrance plays in providing temporary, beneficial psychological mood enhancement. These studies employ metrics developed for psychological research to provide data that can help predict the emotional response to particular fragrances, both natural and synthetic. Studies have correlated links between autonomic nervous system responses (ANS), such as skin resistance, skin blood flow and instantaneous heart rate with an hedonic index of emotional responses, such as happiness, surprise, sadness, fear, disgust, anger (Vernet-Maury, E. et al. 1999). Commercial organisations have developed their own tools to further aid in the process of developing new fragrances for particular applications (Warrenburg, 1999).

Forms of Delivery

As the means of measuring responses to individual scents becomes more sophisticated, so too are the means of administering, or dispensing the scent. New technology, in the form of novel materials, microfluidic delivery devices, nanotechnology and 'lab-on-a-chip' style diagnostic and control electronics are allowing designers to completely re-interpret the way we experience and use scent in all areas of our lives. Since the 1960s innovations have paved the way for all sorts of experiments, but in general we still purchase perfume as a suspension in alcohol to be sprayed or dabbed on the skin, in the same way as every generation before us.

In fact, the most significant innovation in this area, the aerosol, is over 70 years old; this has allowed us to experience scent in deodorant and body sprays, hair sprays, air fresheners, breath fresheners, insect repellents and shaving foams, but their mode of operation and user-interaction has changed very little. (It took a long time from the first patents filed by Norwegian Eric Andreas in the 1920s and 30s for the aerosol to be applied in the diverse forms we see today. The first commercial production was by the Oslo paint manufacturer Alf Bjerke. Later, during the war, aerosols were used in insect repellent and insecticide. It wasn't until 1950 that aerosols were used for air fresheners and in 1954 deodorants (which, along with body sprays, now account for the lion's share of production)). A great deal of innovation has occurred in areas such as propellants, nozzle and cap design, canister shaping and printing, but the basic delivery method remains unpredictable, often wasteful, and occasionally harmful. Whilst other forms of scent delivery have appeared over the years, very little has penetrated the mainstream mass-market to compete with aerosols. This is largely due

to considerable challenge of both capturing and then releasing the scent in appropriate concentrations, on demand. With a reliable, precise system for achieving this comes the possibility to employ scent in all sorts of novel applications.

Numerous promises were made in relation to products from the 1950s to the present day, but all suffered from one flaw or another. Many of these innovations were in relation to scent as part of an immersive entertainment experiences. The first of these dates back to the 1900s (The first use of scent at the movies was in 1906, when a cinema owner from Pennsylvania added the scent of roses to the Rose Bowl Football Team), but the first attempt to enter the mass-market came in the form of *Smell O Vision*, in 1960; *'Scent Of Mystery,'* starring Elizabeth Taylor was released in this medium. Cues to the identity of a murderer were given by aromas, relayed to each seat via a complex system of pipes. This had been preceded by *Aromarama* in 1959 and was followed by *Sensorama* (Rheingold, 1991) in 1962. What these systems claimed to deliver, but which proved technically too demanding in each case, was the ability to reproduce olfactory stimulus at precise moments in synch with a film, or performance – in some cases, through the addition of a 'smell-track,' to sit alongside a soundtrack. This craze was ultimately damned as kitsch through films such as Matinee and John Waters' Polyester, the audience of which were provided with scratch'n'sniff cards to accompany on-screen cues. Sensory entertainment still endures in Disney and other theme parks around the world, but here the experience is more akin to a fairground ride than a cinema, and the films' content is more closely linked to the effects than any narrative. Whilst these developments have little to do with scent as it is understood in relation cosmetic or well-being applications, they clearly illustrate the complexity and pitfalls of working with novel control mechanisms in this way. The form of delivery here generally relies on airbrush style technology, which is both complex and difficult to control.

Recent innovations which offer considerable improvements include solenoid-controlled perfume reservoirs, fan and/or heat assisted dispersal of scented wax/liquid/polymer, mechanized scratch and sniff elements, and inkjet micro-sprays. Numerous patents have been filed in each of these areas, and companies built upon their potential for development to market. Little has emerged, though, that might evolve into a credible standard, with the necessary versatile and robust characteristics. This is due in part to the pace at which a reliable technology is being developed but

may also have something to do with the way in which the technology has been interpreted from an interaction design perspective. It seems that design has not been considered as part of the development process, far less involved as a tool for developing worthwhile, compelling solutions. What the emergent technology offers is the ability to control scent in ways that are far more precise than previously imagined. This affords all sorts of possibilities in terms of application and interpretation and one that desperately needs the sensitivity of a design perspective to create appropriate solutions.

Design for Scent

Several companies have created solutions for scent delivery, but with little success to date. Investors' hands were burned with the collapse of Digiscents in 2001 (Platt, 1999 and Abramson, 2001), and despite a crowded field including Trisenx, Olfacom, Scentair, Procter and Gamble, Scent Communication, Aromajet and Aromasys, there are very few products on the horizon which seem to fully explore the emotional potential of the technology with an integrated approach to their design. What emerging technology has enabled is the complete re-interpretation of the mode of delivery and interaction with fragrances. Designers' work in this area has started to link the emotional component of the fragrance itself with the objects used to store and deliver it. This paper looks at how several projects have taken a fresh look at how scent might be incorporated into products in the future. These projects involve individuals from several areas of practice including electronic engineering, fluid dynamics, aromachology, fashion, packaging and industrial design.

Scent Bubble

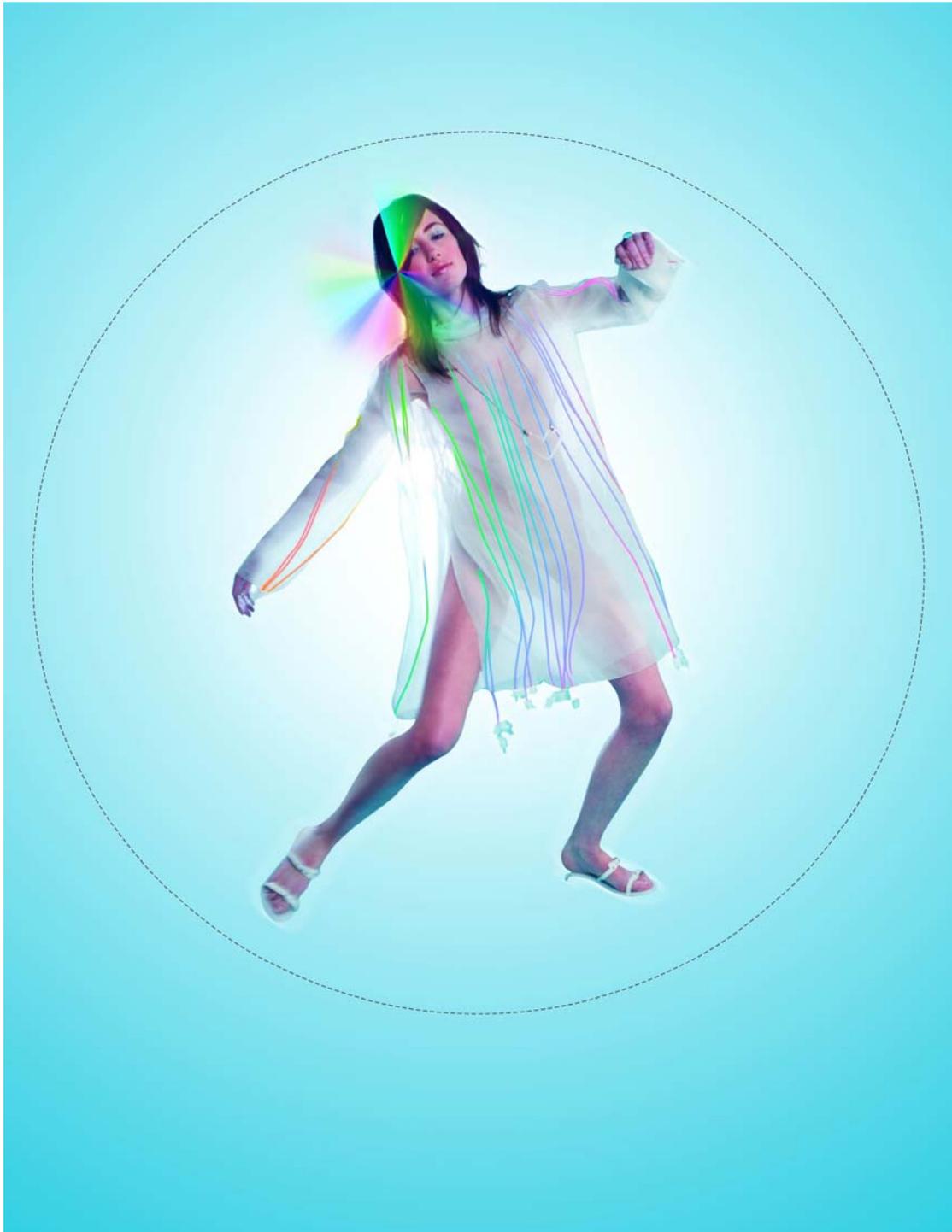


Figure 1. Scent Bubble, by Dr Jenny Tillotson

The authors' work detailed in this paper forms part of an AHRC innovation award funded research project, in the area of *Scentsory Design*[®]. This aims to add new sensations into the fashion palette to create radical properties with tangible benefits. The project proposes scent as a new tool to improve quality of life, by exploring smart fabrics that go way beyond current passive microencapsulated techniques. *Scentsory*

Design aims to create a framework for exploring ‘*Emotional Fashion:*’ responsive clothes integrated with wireless sensor networks that offer social and therapeutic value in a desirable fashion context. The clothes are designed for psychological end benefits such as stress-reduction, by incorporating body sensors and microfluidics to initiate fragrance delivery. The sensors detect stress via physiological diagnostic tools and the microfluidic pumps dispense beneficial chemicals in highly controlled doses which respond to personal needs. Part of this project has involved the visualisation of a responsive garment that senses and responds to psychological and environmental changes in order to enhance mood and wellbeing, treat skin allergies and prevent insect-borne diseases. Research into these microfluidic systems and collaboration with scientists working in the field has enabled the design and production of devices that deal with extremely small volumes of liquid and can deliver very accurate fluid control, which might be described as ‘fragrances on a chip.’

Figure 1. illustrates a garment that mimics the human body with its own ‘nervous system,’ allowing the user to experience and control the different emotional states of a garment. Embedded in the fabric is a network of micro-tubes resembling the body’s own capillaries which pulse nano-litre size droplets of fragrance targeted to key points of the body, enabling the user to surround themselves with a personally tailored ‘scent bubble.’ By linking a remote sensor with a fragrance-dispensing unit it is also possible to link items of clothing so that messages may be transmitted from one garment to the other, releasing scent in a localized area, enabling the user to act on visual cues or detect aromatic signals as ‘coded’ messages. This affords immediate delivery of fragrance whose effects might be healing (e.g. lavender), protective (e.g. insect repellent) seductive (e.g. pheromones) or informative (e.g. burnt toast). In order to develop this concept further, and to visualise intermediate technologies that would afford some of the same effects, several objects were designed and produced. The aim here is to create working prototypes to test not only the engineering principles involved, but also the potential of various modes of interaction with the technology from user perspective. This is where design becomes invaluable as a research tool to visualise, and *interpret* how technological objects might evolve. The first device, figure 2, shows the electronics embedded in a shoulder bag. This allowed ample space for housing the batteries, control systems and fragrance, whilst dispensing the fragrance via a system of tubes, through the strap where it is needed to create the desired ‘scent bubble.’



Figure 2. Fontenay Aux Roses 1, by Ben Hughes, demonstrated at Fashion in Motion show, CTIA Wireless Show, 2005.

This version incorporates three fragrance reservoirs, whose dispersal ratios could be adjusted in response to time, environmental or physiological changes. These principles were further refined and miniaturised to create a second device, *Fontenay aux Roses 2*, figure 3, a brooch with several interchangeable covers to deliver fragrance at user-defined intervals, through an integrated button.



Figure 3. Fontenay Aux Roses 2, by Ben Hughes, 2005.

These devices explore and illustrate how the scent bubble might be achieved using inkjet microfluidic technology, and they give the chance for users and designers to test the process of interaction for real. In some ways, however, the design is compromised by the need to house the power supplies and delicate control circuitry. In reality, it is anticipated that these devices would deliver enhanced functionality in a smaller package so that their size could be reduced further.

NOKIA Scentsory phone concept.



Figure 4. Three operational modes of Scentsory Phone by Kimberly Hu, 2006.

This project, by Kimberly Hu, a research student at Central Saint Martins, was undertaken as part of a collaboration with Nokia to look at future trends in mobile technologies from 2015 onwards. It is a novel mobile communication device that works through an integration of senses of smell, sight, hearing, and touch. It gives users the ability to experience remote communication on multi-sensory levels. In addition to including basic audio-visual features, it can detect, transmit and emit smells. It can also radiate colors, lighting, and temperature from the caller's environment. In addition, the device will have wellness aromatherapy and owner scent identification features. Not only does this provide a more comprehensive account of how fragrance might be incorporated into a communication device, but the design contains several subtle metaphorical cues relating to its function and mode of interaction. The phone has three modes of operation: the first, when the panels are flat, in portrait format, is for regular voice calls; the second, when the panels have been reconfigured so that the two LCD screens are alongside each other, is for text, email and video calls; the third mode, when the phone is folded between these two states, is for olfactory communication through interior scent detectors and emitters. In this way, the phone styling and interaction is a clear expression of the mode of use. The most evocative of these is the 'cupping' gesture that suggests holding a flower or glass of wine in order to magnify the scent sensation.

Sensaria and Ice Fizz



Figure 5. Sensaria perfume array by Nick Rhodes, 2002.



Figure 6. Ice Fizz perfume applicators by Nick Rhodes, 2002.

Nick Rhodes is a designer who has spent several years looking into the area of perfume brand and packaging, both from a commercial and research perspective. His work has incorporated fragrance design and development commissions for brands including Puma, Mexx, Naomi Campbell, Strenesse, Chiemsee, Marc O'Polo, Cindy Crawford, Yardley and Bruno Banani. Through this work Rhodes is attempting to challenge what he regards as "the narrow scope of expression permitted in the commercial realm which has stripped scent of its potency, its cultural and historical significance." This interest led to the development of a series of speculative design work intended to provoke debate amongst both clients and the industry. 'Sensaria' and 'Ice-Fizz' are shown here as further examples of how designers are seeking to reinvigorate the objects used to package and apply scent. These are from a suite of projects initiated by Rhodes that interpret the process of application of scent in terms of a 'ritual.' In the first case (Sensaria), this relates to preparation rituals and the Dressing Table as domestic typology. The second example (Ice Fizz), is intended to explicitly link skin sensation and olfaction. The perfume is held in a water base as opposed to the conventional alcohol, which then melts, before evaporating, when coming into contact with the skin. Both examples make strong use of additional sensory cues in the application of the perfume and provoke a very different form of relationship between the user and the product. In each case it is desirable that the user makes and spends time to savour the process, thereby creating space for novel forms of ritual.

This approach links the work to ideas that are held by many other packaging designers working at the forefront of the field; that to fully understand the relationship between users and packaging, one must develop an appreciation for enhanced experiential models of engagement. One consultancy that leads the way in 'Experiential Branding' for packaging design is Tin Horse. Their aim to create 'Big Dreams for Everyday Things,' has led to a sophisticated understanding of how people relate to products and packaging, and informs their phenomenological approach to design and innovation. Director Peter Booth describes how perceived product flaws, such as the viscosity and product flow of Guinness, have been turned into benefits, by linking the 'delay' in product delivery, either in a glass or a can, to the completion of a process that enhances 'quality.' These ideas have been illustrated to great effect through provocative packaging proposals developed and presented by the consultancy. These include a prototype PET Champagne bottle with screw-cap that emphasises the strong

relationship between product and package in this case. These ideas have also been employed by Tin Horse in relation to fragrance products both for commercial clients and for research. Booth describes the significance of ritual in this case in relation to activities which are either *sacred* and *profane*. “If you consider the terminology for a moment, you start to realise that it’s completely inappropriate. We talk about the ‘application’ or ‘delivery’ of perfume, which denies the potential to create beautiful objects. It leads, instead, to the design of ‘applicators’ and ‘delivery systems,’ rather than something more poetic.” Current modes of engagement, therefore, are *profane* when mapped in relation to the *sacred* within the context of consumer culture, as explored by Belk, Russel and Sherry in their influential 1989 text. This suggests that a great deal can be gained through an understanding of anthropological readings of ritual. This is especially the case when looking at the marketing of fragrance products. These, more than any other, invite the designer to exploit their ephemeral, performative, personal and emotional characteristics.

Perfume Atomiser Fan

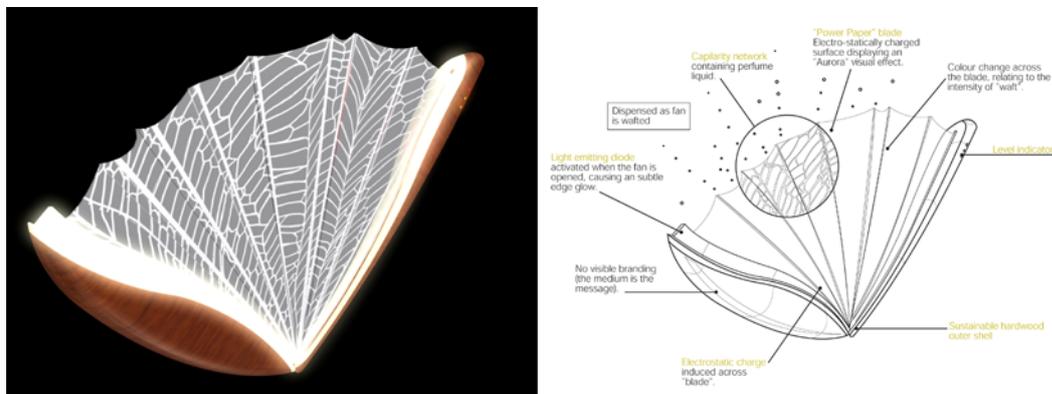


Figure 7. Perfume Atomiser Fan by Jason Morenikeji, 2004.

This project, by Jason Morenikeji, was undertaken in response to an invited brief to packaging innovation consultancies including PI3, a leader in this field. It was first shown at The Innovations Show at the Total Packaging exhibition at the NEC, Birmingham, where it won the Best in Show award. It is significant in relation to the other innovations shown, in that it is an extension of the gestural, and performative potential of perfume application, that is so little understood and explored in contemporary packaging design. The designer has taken insights from fields of research that deal with non-verbal communication, such as Kinesics in order to better understand the less-obvious psychological functions of perfume. This mode of

interaction is reinforced throughout each part of the process: on opening, the device activates an electrostatic charge across its Power Paper 'blade' and then, through a process of wafting back and forth, vaporization of the liquid perfume occurs. The intensity of the wafting action determines the strength, or localized concentration of the fragrance. Therefore, depending upon the users' intuitive control, the fan may be used to apply perfume to the body and clothing, or to create a soft aroma-therapeutic effect within the environment of, and to benefit, the user as a relaxation or mood-enhancing device. In addition, the fan may be used to create scent 'messages' in the air as an aid to seduction rituals. This reinvention of the mode of interaction with fragrance was driven by the designer's observations of what he perceives to be a particularly stagnant market in terms of innovation: "The industry demonstrates a breathtaking lack of innovative thinking. Given the number of blue chip companies who compete in this sector and the significant gross margins achievable, a clear opportunity exists for a radical rethink of the product basics. Structural packaging can then move away from packs which are merely about the containment of a pleasant liquid which look great on a shop shelf and at home on a bathroom cabinet towards a total packaging solution which aims to deliver an engaging experience in terms of how, when, where and why it is applied. The scent industry needs to adopt a creative methodology which takes account of female rituals, experiences and the desire for self-expression, which are not being addressed with current perfume packaging."

Conclusions

Design for fragrance is an area where fashion, industrial and packaging designers can provide a great deal of insight and stimulus for market innovation. 'Ritual' style interaction with products is well established and understood by those at the forefront of packaging design, but these ideas have been very slow to emerge in the fragrance industry. This is partly due to the slow delivery of long-promised revolutionary technologies, but these are now beginning to see the light of day. The intelligent integration of these technologies into appropriate devices would enable users to completely re-evaluate their use of scent. Deodorant and body sprays, which currently account for the most ubiquitous form of consumption of fragrance could become just part of a vast array of smart scent devices that will serve not only mask unpleasant odours, but may also repel insects, treat allergies, administer medicine, aid communication, augment entertainment experiences, aid concentration, enhance mood

and help to manage emotional states.

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