Design meets Neuroscience:

Future directions for developing and implementing design probes

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KEYWORDS:

Multidisciplinary design; Design probes; Designing probes; Design research; Design-based research; T-Probe; Emo-T™ Probe; SwatchaThinking™ Probe; Intersecting Neuroscience and Design

Abstract

The frontiers of design and neuroscience are rapidly shifting as a result of recent advances in neuro-technologies, and the pivotal role user experience design plays across a wide range of analogue and digital applications at individual, community, and global level. These applications range from learning and education interventions to innovation of large-scale healthcare options. Every day new frontiers are forged as neurobiologists and cognitive scientists look beyond the mere structure-function neuronal correlations of thought, emotion, and behaviour. This has direct impact for design research and design-led probe development. Translating this growing evidence-base through a mind well-trained in critical, rigorous, and creative thinking, and an attitude of equitable collaboration and mutual respect, heralds immense potential for unfolding ground-breaking design probe applications through the intersection of neuroscience and design.

Introduction

In 1999 when Bill Gaver and colleagues put together a variety of cultural probes for presentation to a group of ten elderly residents of the small village of Peccioli in Italy, their intent was to gather *"inspirational data"* (Gaver Dunne & Pacenti, 1999, p.21) through provoking, inspiring, engaging, and assisting participants via probe artefacts, to share their thoughts, ideas, feelings, desires and lived experience of being an elderly resident of that town. This creative endeavour in engagement design came about in response to a European Union funded research call to develop technologies that would facilitate increased presence of the elderly in their local communities. These beginnings and subsequent applications of design probes in varying contexts ranging from experience of living with dementia (Wallace et al., 2013), to dealing with bereavement (Massimi & Baecker, 2011), establish context, i.e., the bigger picture, the ground, the soil, the zeitgeist so to speak, as the primary and preceding factor that gives meaning, purpose and value to design probes and designing probes.

Given that context is the seed from which the process of developing and designing probes begins to sprout and grow highlights the need to clarify the cross-disciplinary underpinnings of this paper.

Ours is a multidisciplinary partnership – a space – in which design and neuroscience intersect to innovate and create pathways to better experiences and improved futures for individuals and organisations. On a day-to-day basis we live the experience of the 2016 Design Research Society's (DRS) future-directions call for *"rigorous interdisciplinary collaboration"* (Atkinson & Rae Oppenheimer, 2016, p.2) between designers and members of other disciplines.

In practical terms this means developing a mutual respect and openness to central concepts, ideas, insights, methods, practices, and vagaries of each other's discipline. These are also qualities of an empathetic mindset which is at the very heart of user experience design. A case in point that is directly relevant to the theme of this paper is how design and neuroscience define and think about probes.

Design Research or Research Design?

Design and neuroscience as disciplines with their respective distinguished and experienced practitioner communities, view and relate to probes with discipline-related understanding that includes differences and commonalities. In designing and presenting probes to a specific population, our approach has been to:

- Embrace the added levels of complexity that emerge in any multidisciplinary research or collaboration (Flory & Ivanova, 2019);
- Explore conflicting perspectives (Hooper et al., 2013), and;
- Strive to create pathways that lead to rich user experience by interweaving the methodological approaches, underlying philosophical and scientific perspectives, and research and practice culture that inadvertently influence and drive research, design and intended outcomes (Flory & Ivanova, 2019).

Beginning with definitions, an often-quoted definition of design research which includes the application of probes in design research, is that of Jane Fulton Suri (2008, p. 54):

> *"Design research both inspires imagination and informs intuition through a variety of methods with related intents: to expose patterns underlying the rich reality of people's behaviours and experiences, to explore reactions to probes and prototypes, and to shed light on the unknown through iterative hypothesis and experiment."*

Fulton Suri's definition of design research includes the words "research", "imagination" and "intuition" in the same sentence. This is an anomaly in terms for the scientist whose research training is in controlling as many variables as possible that might "interfere" with the research aim and objectives. Has the scientific landscape shifted at all from this paradigm? In the last two decades, design research has been steadily gaining recognition and application in some areas of scientific research and application (Sandoval, 2014). It is however, referred to by terms such as, "design-based research" and "design experimentation" (Sandoval and Bell, 2004). For the science community, this terminology ensures that design research, i.e., design discipline

research methodology, is not confused with the systematic scientific methodology of “research design”.

The role of design research has been especially appreciated and applied in the learning sciences where designers work with educational psychologists to innovate novel and creative environments and approaches to learning, problem solving, improved memory and focused attention in the classroom and other formal teaching and learning settings (Anderson and Shattuck, 2012). Thus, through design interventions that are developed for real-life educational contexts, learning research scientists and educational psychologists are able to develop relatable and usable theories of education, training and learning. The cross-pollination of design thinking with its attending research methods and processes have been pioneering pathways to fulfilment of the DRS’s call for interdisciplinary collaboration and co-creation via multidisciplinary project teams in the field of educational psychology.

In educational research, the remit of scientist and designer differ. In the case of design probes, the overall design thinking, methods and processes adopted by the designer is guided by the question, *“what effect am I looking for on user thinking, behaviour and experience?”* (Penuel & Frank, 2016). User experience in the context of the classroom is therefore the conceptual basis for designer engagement, innovation and creativity in this case. Beyond the remit of learning science however, user-centred design probes that enable positive experiences through creative activities have been introduced in a diverse range of contexts and projects addressing the needs of vulnerable populations such as the elderly (Mattelmäki, 2003), the deafblind community (Ivanova, 2015), survivors of domestic violence (Clarke et al., 2013) and vulnerable women in secure hospital settings (Thieme et al, 2013). Hannington’s Human-Centred Design Model (2003) succinctly sums up the design probe and probe design approach as creative, participative, visual, requiring cognitive, emotional and behavioural engagement of both the designer and the user, in order to extract and yield understanding of patterns, themes, affinities, aversions, and other cognitive and behavioural responses.

In scientific disciplines ranging from earth and space science to biological life sciences, probes are designed technologies used primarily for collecting information and data. Twenty-first century space probes, DNA probes, neural probes – and an ever-growing list – are all technology-based innovations aimed at detecting, diagnosing, decoding, mapping, measuring, and monitoring patterns, connections, anomalies, changes, and activities of their host. Probes in their own wake contribute to developing and expanding the scientific research and knowledge base. They play a major role in developing solutions to current and recurring problems, predicting outcomes, and informing future scenarios planning (Flory, reflective journal, 2014 - 2019).

Blending the best features of design research and design probes with research design and research-based outcomes of design and neuroscience respectively, has led Flory to establish Neuroscience for Design Worldwide (NfDW) – a consultancy wherein the integration of neuroscience and design is focused on raising the potential to design creatively and efficiently for human health, happiness, behavioural change and user experience (MindRheo, 2019). This multidisciplinary model of practice and application depicted in Figure 1 is about fulfilling the aim of expanding the role of design research and design probes in scientific enquiry, clinical applications, and subjective wellbeing. This is demonstrated through the Emo-T™ and Swatchathinking™ probes the authors developed and applied in 2015 (Flory & Ivanova, 2016), and continue to do so, in a variety of circumstances.

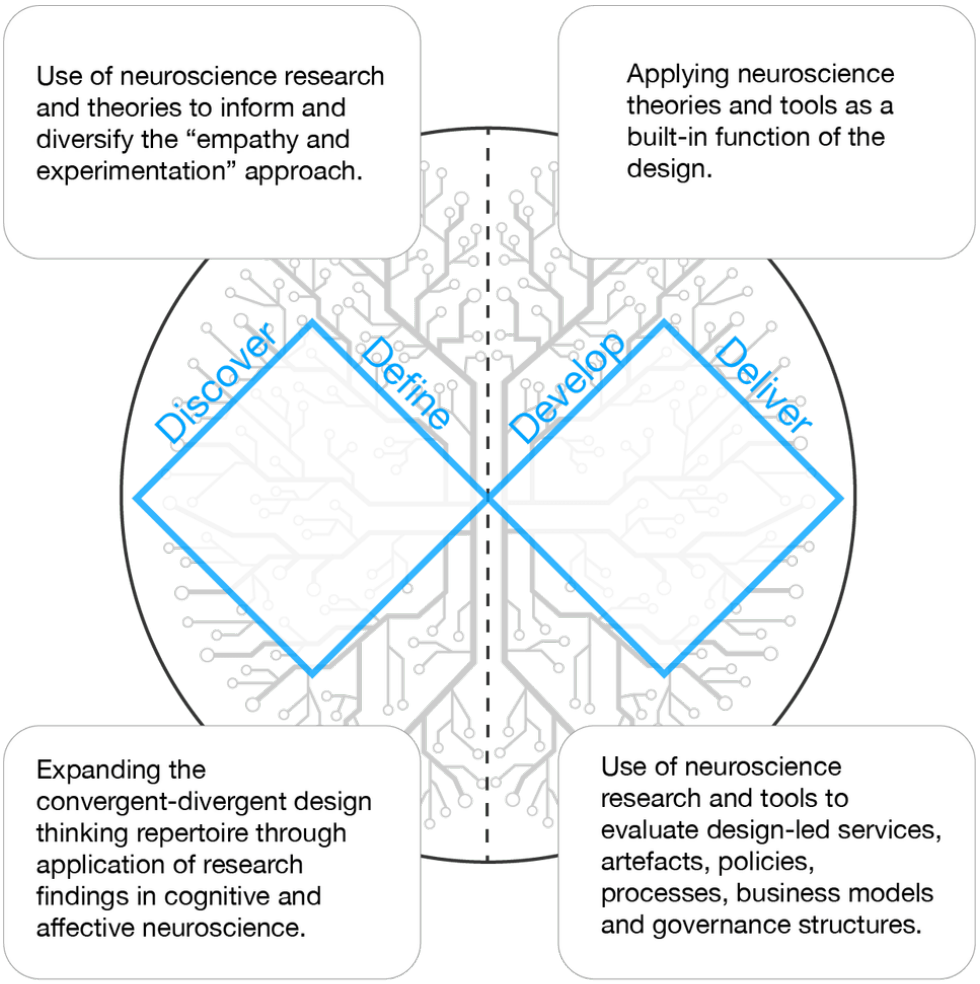


Figure 1: Neuroscience for Design Model 1

P.R.O.B.E.S.

When we the authors met in 2014, Ivanova was in the writing up phase of her doctoral research. The pivotal objective was to introduce a wearable probe – in this case a globally recognised garment – the T-shirt – to advance engagement and understanding of challenging concepts related to novel materials and sensory experience (Ivanova, 2015). Flory, who had founded MindRheo[1] in 2010 had been developing and delivering neuroscience-based workshops and training tools aimed at stimulating brain plasticity for personal and organisational development and advancement. She was also exploring innovative and novel ways to enrich the learning experience, growth of self-awareness, sense of agency[2], and other personal and organisational transformative change components of her practice. The design probe with its empathetic user-centred approach to engagement, personal context, and guided exploration (Mattelmäki, 2003; Wallace et al., 2013; Ivanova, 2015), she felt, was the perfect fit for purposive and strategic

[1] www.mindrheo.com

[2] Sense of agency (SA) or sense of control, refers to self-awareness in initiating, executing and controlling one's actions and responses in the day-to-day world of personal experience (Haggard & Eitam, 2015).

activation of brain plasticity in a range of personal and organisational transformation projects. Over the last five years Flory and Ivanova have collaboratively researched, designed, developed and delivered a number of design probes aimed at improving emotional intelligence, subjective wellbeing, sense of agency, and cognitive and emotional reframing.

Design meets Neuroscience which is a lived experience in multidisciplinary working and collaborative design for us, has yielded a six-component design probe model depicted below (Figure 2). It captures the planning, research and operational phases and processes in our development of design probes.

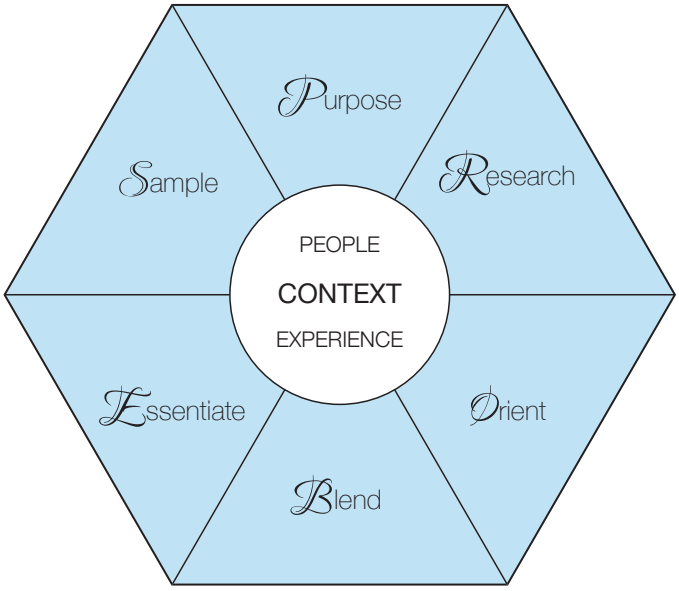


Figure 2: Six-component process model for developing design probes

Context

Tennant (2017), a palaeontologist, defines the term *context* in the context of research, as *"The circumstances that form the setting for an event, statement, or idea, and the terms of which it can be understood."* In terms of design, Esser (2019) advises that *"it is essential to understand users and the context in which they will use your design."* These perspectives demonstrate agreement between the scientist and designer that research, design and implementation are all primarily rooted in context. An example of the context mapping, which is presented in Figure 3, shows the initial mapping exercise for the first design probe – the Emo-T™ – which we developed in 2015. A fuller exposition of the Emo-T™ appears in the section entitled *Multidisciplinary Beginnings*.

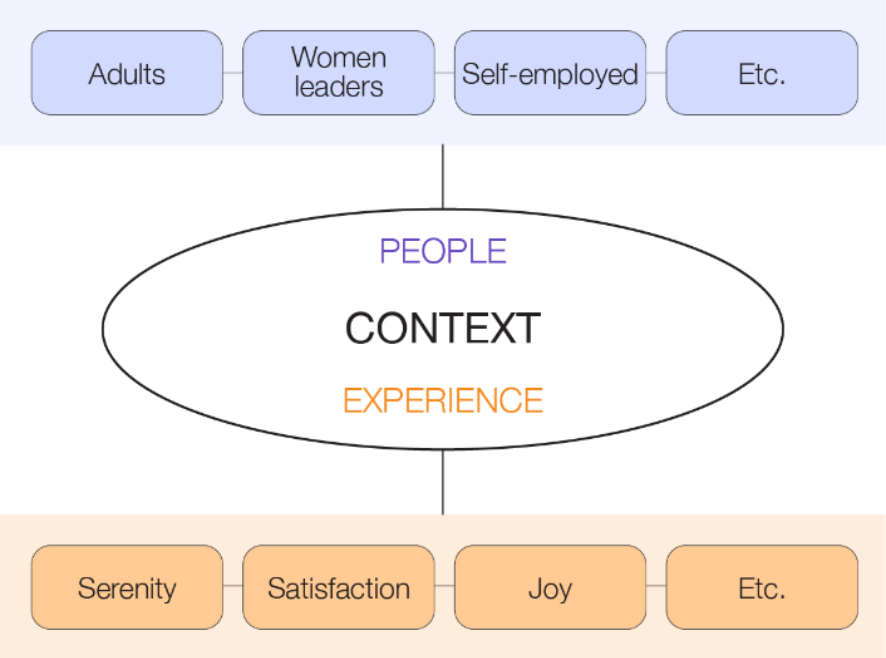


Figure 3: Context of Design Research / Probe

Mapping the people and user experience context through this simple but effective method gives clarity regarding two central themes of “user group” and “user experience” remits for the designer, and direction to the scientist regarding the evidence base to consult and draw from.

Six-Component Process Model for Developing Design Probes

The six-component PROBE mapping exercise is in effect, a blueprint for developing design probes. Similar to an architect’s plan, this mapping model (Figure 4) provides an at-a-glance design brief for the probe. It’s the blueprint against which both designer and neuroscientist can exchange and blend their ideas, knowledge, expertise and efforts to optimise – in this case – user engagement and experience, in utilising imagination to expand emotional intelligence and emotion regulation.

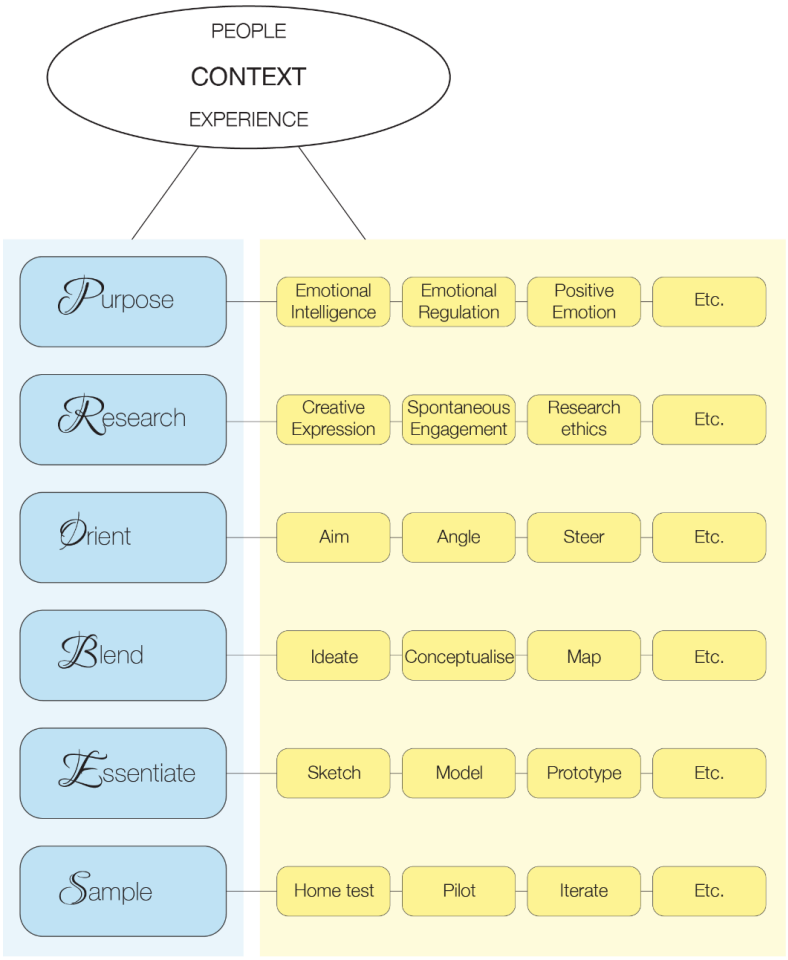


Figure 4: Six-Component Process Model derived from developing the Emo-T™ Probe

The value of design probes which are a synthesis of empathic inquiry, creative play and iteration, in collaboration with cutting-edge psychology and neuroscience, has exponentially added value in provoking and precipitating human cognitive, emotion, and behaviour changes at personal and organisation level. Neuroscience for its part, must rise to a better understanding of the potential for design – of a building, healthcare service, or crime reduction intervention, for example – to influence and engage human beings (Flory & Ivanova, 2019). Our experience in adopting an agile, inclusive, multidisciplinary approach that is a willing sharing for the betterment of the user, is one of the future directions that applies equally to design and designers, and neuroscience and neuroscientists.

Contextual Beginnings: The T-probe

The contextual underpinnings of our multidisciplinary collaboration in developing design probes began with Ivanova's doctoral research project. It is an essential component in the storytelling of our history together of design probes and probe design.

In her fashion-based research inquiry, Ivanova (2015) chose the T-shirt – which she later termed "the T-probe" – to explore participant engagement and response to novel materials and related sensory experience. The following two sections provide examples of the inquiry in practice.

Novelty and User Experience

In relation to novel materials such as fungi-based textiles as an emerging proposition for sustainable fabrics, the challenge was two-fold: novelty, and negative associations such as decay and deterioration, e.g., with moulds (Figures 5 & 6). These cognitive associations and attitudinal mindset would have to first be overcome in order for such types of materials to be introduced successfully and ethically[3] in the future of high street culture.

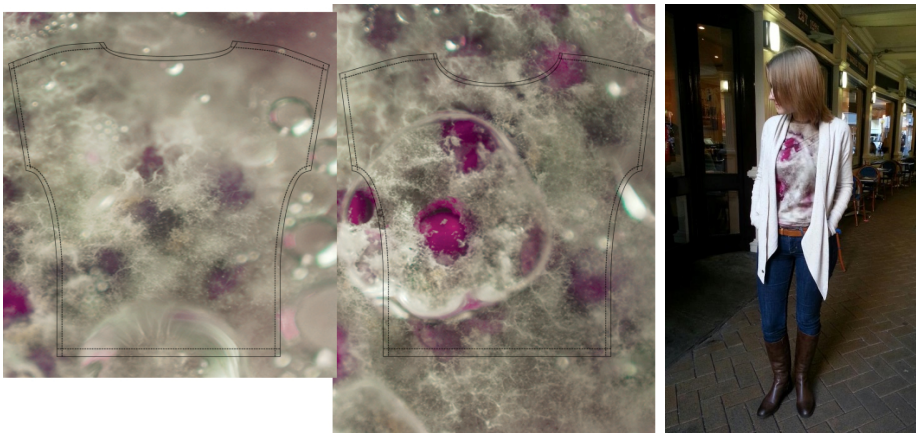


Figure 5 & 6: A 'Mouldy' T-shirt designed by a research participant and then worn in social situations (Shared by the participant via Facebook, September 2012). The T-probe was used to engage participants creatively with mould-based designs by transposing the 'raw' engagement with mould-based visual stimuli to designing an actual garment that they would wear in social situations.

Sensory Experience of Inclusion

In relation to fashion experience, a group of six young adults with dual-sensory (deafblind) and cognitive impairment, a user group who are currently not catered for in mainstream fashion, were introduced to the experience of choosing one's own clothing (Figures 7 -11 below).

[3] In the expanding field of sustainability governance, there is a growing demand for transparency and accountability for raw materials and production processes, making unethical brand claims and marketing detrimental to user perception and experience.

Figures 7-11: Deafblind participants creating their T-shirts with support from communication guides. Techniques included textile collage, image transfers, and direct painting / drawing onto the fabric.

The research aimed to test whether the T-probe could be applied with agility to fulfil a range of design and research intentions at various points of engagement throughout the project, e.g.:

- in participatory workshops, to elicit engagement and gather participant feedback and response;
- in post-workshop settings where participants were required to wear the probe in day-to-day settings such as cafés and at work, and note down any responses and engagement with it by the public;
- in enabling the research and the wider design community to engage with novel ways of thinking about fashion materials and design;
- in scoping ways for probes to be implemented within stakeholder engagement and education;
- in advancing understanding of fashion-led probes.

The literature on design probes revealed very few examples of fashion-led, or 'wearable'[4] probes, which could fulfil the above intentions. Such probes often address technologies and experiences that appear foreign and within the realm of science fiction (Philips, 2006; Philips, 2008). In considering how design probes of such speculative value could be developed within a

[4] i.e., worn on the body (not to be confused with 'wearable' devices)

methodological framework, the practice of designers Helen Storey and Becky Earley appeared more closely aligned with the intentions of the research. Storey's *Field of Jeans* (Story & Ryan, 2012), and Earley's *5 Ways* and *Top 100* projects (Earley and Fletcher, 2003; Earley, 2014) evidenced the potential of everyday, ubiquitous garments such as jeans, scarves and shirts, in creating platforms for discussion and engagement, and eliciting a shift in attitude and perception. The wearability of such garments provides an accessible point of reference to a wider research demographic. Their everydayness presents a relatively culturally neutral ground for discussing novel and complex ideas. Additionally, their replicability and customisability can be quickly employed as a blank canvas for the development, exchange, and communication of ideas.

Therefore, the research required a probe that:

- could be worn by a diverse demographic;
- was culturally familiar, yet versatile, customisable, and capable of operating within a wide range of social situations;
- was aesthetically simple and neutral, and could serve as a 'blank canvas' or framework for the exploration of new ideas;
- would elicit imaginative engagement;
- fulfilled both a research intention to study user perception, and the design intention to advance understanding and engagement.

> *"Identity, community, difference, gender, sexual preferences, political affiliations, humor, corporate slogans, support for causes, product endorsements, religious beliefs, profundities, athletic teams loyalties, school and college links, travel trophies – T-shirts say it all." (O'Connor, 2010)*

The 'humble' T-shirt, which is universally worn around the globe, and has been historically used as a bridging mechanism to address a variety of challenging topics, e.g., in political and environmental campaigning, in advertising and activism (Talbot, 2013), fulfilled all of the above and was a natural choice as best fit for this research.

During the course of this research enquiry (2011 – 2015) Ivanova had gained invaluable knowledge and practice in contextual alignment and sourcing, and developing relevant materials and artefact-fit to context.

Multidisciplinary Beginnings: The Emo-T™

Emotional intelligence (EI) was a term first used by Salovey and Mayer in 1990 to describe the human ability to master one's own emotions and understand and influence the emotions of others. Over the last three decades much has been written and researched on the subject resulting in evidence-based applications for clinical and non-clinical settings. These include a diverse a range of subjects from post-traumatic stress disorder (PTSD) and depression, to political negotiation and marketing.

Prior to these authors meeting each other, Flory, whose client base included combat-related PTSD survivors had repeated clinical experience of military personnel *"putting on a brave face"* and *"carrying on as normal"* whilst supressing feelings of sadness, alienation, insecurity, fear,

and lack of identity. This was in direct contradiction to the popular belief and EI discursive theory that quoted consistent alignment between outward expression and behaviour and internal emotional experience. To Flory's relief, EI research carried out in Dr Barrett's lab (2011, 2017) at Northwestern University in Illinois, resulted in the categorical statement: *"we have misunderstood the nature of emotions for a very long time."* Through a series of studies, Barrett and colleagues discovered that face and body language which are taken for granted to gauge emotion in ourselves and others, are not as straightforward and reliable as they are alleged to be. Flory interpreted these findings as an exciting new opportunity for incorporating creative and novel ways of addressing the EI component of her clinical and non-clinical practice which includes workshops, learning and development, and organisational consultancy.

Together, Flory and Ivanova's mutual appreciation for the agility of the T-shirt as a probe in a variety of participant engagement settings, led to a series of brainstorm, discussion, and futures-thinking sessions which resulted in the co-creation of the Emo-T™ probe.

As they bounced and blended ideas and discipline-related knowledge and expertise, they were convinced that a T-shirt probe would be an apt item for developing self-awareness and practical learning of EI. Flory's expertise in neuroplasticity, which is the innate flexibility of the brain to form new neural connections throughout life in response to new learning and behaviours, resonated with Ivanova's use of probes to change perception, behaviour and mindset.

The resulting Emo-T™ probe is a creative, fun, relatable, and inclusive way for people across different continents and demographics to feel connected as they collectively learn and train in cultivating and nurturing specific positive emotions and felt-experience (Figures 12 & 13). Evoking and regulating emotion for personal wellbeing and health, we envision, could become a personal practice and art through creative and intelligent design and application of this and other probes, which we continue to develop.

Figures 12 & 13: The Emo-T™ probe used in a group setting to stimulate and elicit specific positive emotions

The Emo-T™ probe is rooted in the neuroscience (Barrett, 2011 and 2017) of emotion and inclusive design thinking and practice. It's a probe that flips the design-to-provoke-emotion concept used in marketing and moviemaking, to emotion-inspired design. The aim is to engage and activate creative imagination related to a positive-feeling emotion, e.g., joy or excitement, which in turn creates a "felt response". Research by leading neurologists and neuroscientists are increasingly uncovering the role that specific emotions and feelings such as empathy, joy,

and gratitude play in decision-making, creative thinking, positive self-image, leadership ability, and personal and professional accomplishments. In our workshops, using the Emo-T™ probe, participants are able to evoke and memorise their experience of positive feeling social interaction or wellbeing emotions.

The Emo-T™ is a paper or cardboard T-shirt which "probes" participants into visualising and imagining that the T-shirt is a self-designed wearable emotion. In "wearing" an emotion of their choice, i.e., one they wish to experience, practice, and express through creative media, the brain registers the information and stores the memory for recall at a later time.

Figures 14-16: Participatory engagement with the emotional experience of "confidence", having reported a previous emotional experience of "chaos" in relation to academic performance

Using creative imagination to evoke a wellbeing emotion, participants express their internal experience through designing the T-shirt via drawing, writing and other artistic media. This creative exercise can take 5 to 10 minutes from start to finish which is an important factor in ensuring emotion-memory retention for future recall. More importantly, participants come to recognise that they have a distinctive felt sense related to a specific emotion. This is like a unique signature.

It is not uncommon for participants to report that a particular bodily sensation that they had been associating with fear or anxiety, is now recognised and understood as positive anticipation and excitement. This personal understanding and cognitive reframe not only bears out Barrett and colleagues' findings (2011), but more importantly, it has expanded the user's EI repertoire and ability to self-regulate emotion through recall and association. Maintaining a visual journal of these T-shirts helps participants to conjure up the emotion instantly through visual association.

The Emo-T™ has been well-received in the boardroom, classroom, leadership, branding and sustainability workshops to date. Our intention is to collate a million Emo-Ts which will become a design portfolio demonstrating the emotion-expression-design connection, whilst also serving as an artistic global platform for future education and training in the development of EI. We call this project the Emo-T™ Global Wall.

Co-creating and developing the Emo-T™ probe with a designer (Ivanova) has been a novel and freeing-up experience for Flory (2017). Departing from the traditional experiment, data collection, analysis and interpretation practice within scientific enquiry, and putting personal experience at the centre of the research aim and design has brought new insights about the importance of personal experience and meaning, and the symbiosis between positive self-expression and self-agency.

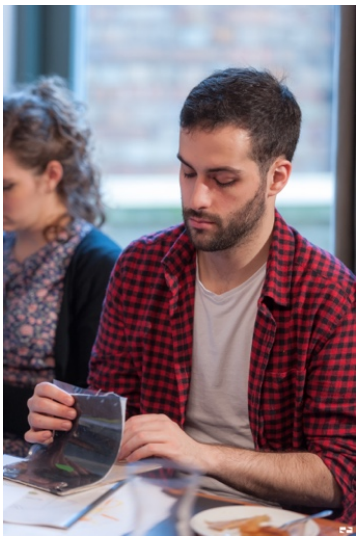
SwatchaThinking™: The Reframe Probe

Texture is ubiquitous and a major portion of the sensory input that we receive every day (Liu et al, 2015). Touch and texture perception cause sensory receptors in the fingers and hands to send information signals up the arm which results in corresponding patterns of activation in the brain. Human beings interpret this as sensation.

Exploration, discovery and coming to sensory conclusions about the world we live in through touch and texture perception begins in early childhood. Toddlers explore their world through hands-on sensory engagement. This learning continues into adulthood. Sensory information stored away in memory from childhood and current lived experiences determine attraction and avoidance preferences with accompanying emotion-based responses. Social media capitalises on these responses through the emoji culture.

Flory had been mulling over the possibility of texture perception and association with cognitive and emotion reframe during the course of her work with PTSD survivors for over a decade. The idea of rekindling and evoking the early childhood instinct for play and exploration through positive-feeling touch periodically surfaced from the ignored recesses of her mind. Ivanova's tacit knowledge of the sensory qualities and feel of materials accumulated through formal education and practice in fashion and textiles was essential in translating these ideas and insights from neuroscience into a palette of fabric swatches to be used as tactile stimuli to reframe cognition and emotion. Over a period of several months spanning 2015 and 2016, the SwatchaThinking™ probe was born.

Ivanova, choosing a variety of fabrics with varying texture, weight, drape, temperature and so on, set up a user-experience design grid of textile materials. Together, the designer and the neuroscientist began to ideate the engagement-association effect of these materials on emotion and thought. The SwatchaThinking™ probe (Figures 17 & 18), nudges participants to engage with the various textures in the swatch to reframe thoughts and feelings about topics and areas in their life that generate feelings of frustration or stagnation. The self-learning and training through voluntary engagement helps in developing new understanding, new perceptions, and better emotional experience.

Figures 17 & 18 Participants engaging with the SwatchaThinking™ probe at a Company "futures-thinking" workshop. Image courtesy of Ezzidin Alwan.

After four successful trials, the probe continues to be well received and used by participants to reframe aspects of thinking and emotion about topics ranging from the personal to the global.

A documented example of the SwatchaThinking™ probe in action is that of a female entrepreneur struggling to bridge the gap between bootstrapping and competing against her "betters" for funding investment. She reported battling feelings of loneliness – an experience that often accompanies early start-ups. She was asked to choose a material in the swatch the "feel" of which was a good fit for her emotions. Beginning with the fear-evoking thought of *"there's no money in the bank"* and associating this thought with the tactility of coarse-grit abrasive sandpaper, she progressively shifted to softer fabrics like cotton and silk chiffon. With this fabric came new thinking ("*Actually, I have enough to get by"*) that then progressed to personal, professional, and global insights about money, monetisation, investment, and so on. This entrepreneur thus began an organic process of reframing her relationship with money and the creative leadership her business demanded.

Strategic reframe can remain a purely intellectual exercise in a clinical or therapeutic setting. True internal shift begins with a shift in emotional association which is then expressed through new behaviours and habit formation. Reversing a top-down reframe approach through using touch to identify where one is, and then identifying a new texture or texture range that one wishes to arrive at in their lived-experience, begins the reframe process of *"changing one's mind."*

Our research, design and implementation efforts on the SwatchaThinking™ probe continues to progress and evolve.

Design Meets Neuroscience: Future Directions

The frontiers of design and neuroscience are shifting at a rapid pace every day as these disciplines continue to evolve, expand the remit of their applications base, and form cross- and multidisciplinary teams and partnerships across the globe to develop better futures and new experiences for people and communities. Recent advances in neuro-technologies and designer-led applications ranging from encouraging environmental awareness (Gaver et al., 2013) to mobile health interventions (Poole, 2013) have placed both these disciplines at the centre of the ever-expanding Industry 4.0 world we live in.

Every day new frontiers are forged as neurobiologists and cognitive scientists look beyond the mere structure-function neuronal correlations of thought, emotion, and behaviour. Understanding this growing evidence-base through a mind well-trained in critical, rigorous, and creative thinking heralds immense potential for ground-breaking applications and multidisciplinary collaboration. In adopting a translational approach in sharing knowledge and cutting-edge research, and embracing an equitable stakeholder attitude in multidisciplinary endeavours, scientists can significantly increase the potential for creating and implementing innovative, novel and mitigating solutions to global problems and crises ranging from hunger and nutritional deprivation, to the worldwide increase in recurring or early onset ill health problems expressed through coronary disease and depression. Designers have a major role to play in this futures direction agenda. At the heart of the designer mindset and focus is empathy-driven user engagement and the "experiencer" who is best informed to provide the key for scientists and designers to develop ideas, insights, hypotheses, pathways, and quantum leaps that result in positive changes and improvement.

Proliferating the knowledge transfer "space" with inter- and multidisciplinary workshops, research, think tanks, conferences and expert panels is an essential in the way forward for design research. Building and strengthening communities of people actively engaged in multidisciplinary research and design, collaboratively addressing key issues and possible solutions, building bridges that remove barriers to understanding and cooperation between disciplines is no small task. The authors endeavour to do this through their collaborative partnership.

Charles T Munger, the world-renowned investor and businessman considers multidisciplinary partnerships the key to successful outcomes. Munger's words (2005) succinctly summarise our own experience of working together:

> "*If you skilfully follow the multidisciplinary path, you will never wish to come back. It would be like cutting off your hands.*"

Although we're still in the early stages of the Design meets Neuroscience paradigm, every day reveals new opportunities and potential for complementary and compatible intersection between the two disciplines. Cognitive and affective neurosciences in particular have the capacity to inform and clarify design-related decisions involving emotions, mental associations, and affective response. In this way the *"empathise and experiment"* approach is fulfilled through multidisciplinary exchange.

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