Abstract:
This paper intends to present and reflect upon an applied design research project which is the result of a collaboration between Visual Culture (humanities), University of Copenhagen, the Danish Academy of Design in Copenhagen and Media lab, University of Aalborg. The main issue of the project is to look at and learn from communication through what we wear and bring it to a higher or different level. In the project thermochromic black ink is applied on 2 pieces of garment and at a given temperature, the black ink gets transparent and an underlying pattern will appear. The regulation of temperature is realised through embedded warming pads controlled electronically through the mapping of data gathered remotely by sensors.

With this system we are able to connect different outfits by giving them the ability and possibility to inform each other and react accordingly by changing their visual appearance. The underlying structure of the information system could be biometric properties like hearth beats, distance of separation, coordinates or likewise. Achieved by this system is what we could call “collaborative or communicating clothing” and this will bring forth a new sophisticated platform of expression in terms of fashion, performance art, dance theatre or likewise. This paper will elaborate on the goals, boundaries and consequences of such new potential for the individual expression.

Keywords: Physical Computing, wearables, Human-Human Interaction (HHI), Design Education, Sensor Technology, mobility.

2 - Background:
The background for this project is partly curiosity and partly a wonder about the fact that different design educations often neglect to learn from each other in terms of how to combine knowledge of materiality and tactility with knowledge about communication and technology. Our goal is to work exactly with a fusion of knowledge with *The Urban Nomad* as a point of departure for a collaborative research. This character is not concerned about whether technology is separated from fashion design as research topics or whether embodied and disembodied communication originate from different academic traditions. The modern nomad communicates fluently and with seamless crossings between fashion, mobile technology, physical approach and personal mobility.

**2.1 – The Urban Nomad of Fluid Modernity**

We expect our project to appeal to a contemporary, global and increasingly mobile society and will here focus on a type of nomadic lifestyle, which is voluntary, as it is the case of people travelling for professional purpose or people who have chosen a mobile lifestyle at some moment in their life. This nomadic lifestyle implies a certain socio-economic surplus in order to sustain a suitable degree of choice and freedom. This requires normally dependency upon specific products and technologies like mobile phone, laptop, credit cards and wireless access to the global information system of the Internet. On top of that urban nomadism also requires an emotional and psychological environment in correlation with the underlying lifestyle. This develops a new type of elite who is able to adapt to specific situations and places of elitist character.

What separates elites from non-elites is their relationship to space and time, according to the Polish sociologist Zygmunt Bauman\(^1\). On the one hand elites tend to be globally mobile; just like capital itself they are not tied to place. Capital and elites have liquidity in common and both traverse national borders with ease. Elites are equipped with the technologies of mobility and this nomadic lifestyle is supported by industry, entertainment, culture and institutional structures like online services and wireless access to the internet (hotspots) in airports, leading hotel chains, train stations, cafes etc. As a contradiction, non-elites are tied to the local – tied to communities, relatives, work, land, and to the immobility of economic scarcity. The elite, as introduced in Manuel Castells’ *The Rise of the Network Society*\(^2\), does not operate in places, but in spaces of flows. By this one could say that flows of capital, information, technology, organisational interaction, networks, sounds, symbols, images etc. are controlled and initiated by people with an ability to adapt and who believe in the spirit of mobility and the power of information. ‘Armed’ with technology, the globe-spanning nomadic elite is able to enter what Marc Augé describes as the ‘non-place’ of supermodernity. History, culture, relatives and identity or described differently; lived physic relations are associated with place. In a non-place these form of relations disappears.

*If a place can be defined as relational, historical and concerned with identity, then a space which cannot be defined as relational, or historical, or concerned with identity will be a non-place. The hypothesis advanced here is that supermodernity produces non-places, meaning spaces which are not themselves anthropological places and which, […] do not integrate the earlier places: instead these are listed, classified, promoted to the status of ‘places of memory’, and assigned to a circumscribed and specific position*.\(^3\)
An similar kind of nomad is the digital one who in a sense, is someone who is here, there, and everywhere or really nowhere, constantly connecting and de-connecting to the internet and other networks. Being nowhere or with Augé no-place make the digital nomad easy to reach but difficult to track. This implies limited ability, will or need to comply with rules, social regulations, tax paying and other participations in social conditions. In difference from other nomads, the digital nomad is a rather atomised individual who do not appear in groups, constantly travelling in cyberspace, but also in geographical space – between cities, and people, without investing the whole of their identity in anything, sweeping the stage everywhere they go.

A mixture of the two described kinds of nomads is whom we want to work with. One who has the habit of connecting and de-connecting to networks on the fly, but also one who is adapting to the specified place and situation. We want to work with the possibility to combine the two kinds of nomads by putting the mobility and adaptability towards the urban together with the ability to connect and de-connect to the network. The development of the mobile phone with all the different possibilities, fashion accessories and individual adaptations makes this kind of normadity possible, and especially young people seek contact with other mobile individuals. It is no longer necessary to be ‘outside sociality’ to connect to the internet. The connection can be made on the fly.

Thermochromic ink – before and after applied heat

3 – The Project

Taking the characteristic of the urban nomad into consideration, the aim of the project is to make the fluidity of modern mobility somehow visible, focusing on the use of technology as a design medium through an intimate knowledge and understanding of its potential and limitations. The visibility is attained by the tactility of textiles, which themselves are among the first composite materials engineered by humans. They have mechanical, aesthetic, and material advantages that make them ubiquitous in both society and industry. The proposed project integrates textile design with thermochromic ink, conductive copper threads and sensor based electronics to create a dynamic changing pattern.
Thermochromic ink is thermochromic pigment encapsulated dye that consists of an outer protective shell that surrounds a liquid crystal substance that changes color as the temperature changes. The choice of thermochromic we made because of the ability to combine a smoothly reacting and analogue technology with a sensor based and digital technology. The termochromic ink has a slow reaction and a very tactile expression that we find very useful in the project where we use different animal communication analogies.

3.1 - Mobile Communication And Clothes Acting Like Pheromone
Clothing has always had a shared evolvement with technology. Together with the development of language and tools the use of materials to cover the human body have been primary cultural operations by which man established a distance between himself and the animal world. Clothes as covering, shielding or bordering the human body has through communication been developed into a cultural issue leading towards fashion, that has largely understood the inherent ambivalence of protection and communication.

The goal of this research is to seamlessly adapt clothes to the electronic communication system, so it becomes an integral part of nomadic adaptability. In this case we combine exploration into reactive patterns, aesthetics, and creation of a new language for wearable expression. Our area of investigation includes person-to-person communication, intimacy, and reaction to environments. In this case, we design a set of clothes, which will recognize and react on each-others presence. When two people wearing reactive clothes approach each other, the pattern of the fabric will slowly change colour. Thereby, we create a metaphor of a paring dance similar to the one performed by peacocks with their colourful plumage. The slow
change of pattern due to the proximity of individuals wearing similar outfit would be similar in its effect to the release of pheromone in animals or to other visual signs interrelated by the partner as a courting behaviour.

A pheromone is any chemical produced by a living organism that transmits a message to other members of the same species. The message can have different functions like an alarm in case of danger, a food trail indicator or as a sexual attractor. Pheromones are highly specific scent molecules that many animals rely upon to find and assess a potential mate. But humans appear to make little, if any, use of pheromone signals. Some researchers have suggested that the limited pheromonal abilities are explained by the development of colour vision, which has taken over as a better way of selecting mates.

3.2 – Scenario
The primary scenario and the one we are using for the first prototyping is that of two people of different sexes each wearing clothes with the same pattern covered with black thermochromic ink. When the distance between the two is within sight range (about 10 m) a censor measuring the pulse, is activated and embedded conductive copper threads will react accordingly and begin to heat up the areas covered with thermochromic ink in order to reveal the underlying pattern. The higher the pulse the higher temperature is transferred to the fabric. The clothes will communicate the inner pulse of the person wearing it and enter spaces of flows, which is characterised by transformability. Through pulses the visibility of this communication will provide the users with a fix point in spite of its fluent nature, because the clothes will take over the preliminary manoeuvres and take away the awkwardness of the first meeting. A lot like bringing a dog to the park and meet with other dog owners and let the dog be the reason for meeting, the clothes will be an obvious reason for the two people noticing each other. Spaces imagined for this type of communication could be the urban nightlife of streets, bars and discotheques. Places with qualities of non-places and spaces where flows of capital, information, technology, organisational interaction, networks, sounds, symbols, images etc. makes the essential ‘fabric’.

3.3 – Playfulness
Important for the project is the ability to explore the playful and expressive aspects of clothing. Play can be described as a mode of acting out our experiences of the world, and by combining that quality with fashion a strong ability to express oneself is made. Play relies on our ability to make connections and associations and it also relies on the ability of others to understand the actions and intentions. Play is something essential to humans throughout their lifetime and human playfulness is seen throughout culture, art, poetry, science,
sport, humor and also in fashion. It seems like our ability to play is a basis for being fully human and fun and laughter add great meaning and fulfillment into our lives. Play is an attitude, a spirit, and a way of doing things and the act of playing is its own destination. The focus is not on the product but the process and the joy of the playing process is its own reward. Hopefully the use of a playful approach will reveal new scenarios for using the implied technology and point at new uses of the combination of fashion and technology.

4 – Perspectives
Many other scenarios can be imagined with this setup, but common for all of them would be making the invisibility of communication visible through the use of clothing. We want to see what happens when our clothes with its everyday use, communication and protection is displaying information that is normally hidden within the body and thereby very private. The border between privacy and the public has been subverted long time ago parallel with the development of mobile technology, so why not challenge this border even further.

Besides that, if we return to the different types of pheromones, one could imagine that this sensor based and heat reacting clothing could be used in different ways. The sensor embedded could be one reacting upon pollution and thereby act as a warning system both in the everyday urban life and in extreme situations of catastrophes. With a different technology applied it would have military qualities with the ability to change type of camouflage on the fly. Or again differently the clothes could act as a mobile barometer with the measurement of pressure, temperature and humidity. Well keep on imagining …..

Our goal is to continuously seek ways of linking forms of data that derive from human communication with the communication and aesthetic capabilities of clothing and the expression and rhythms of the human body by incorporating intelligence and responsiveness into fabrics, allowing wearable wireless applications. The research will consider forms of communication (direct, indirect, unconscious, intended, loud, subtle etc.), levels of interactivity, individual versus social expressions and different kinds of aesthetic expressions.

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