

## VIRTUAL TOUCH

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### Abstract

The paper presents a general overview of how to apply haptics and tactile touch as an artistic material in the context of media art. It presents how touch can be used to form meaningful experiences on its own, and inside virtual and mixed realities using emergent, mobile technologies such as the smartphone.

**Keywords:** haptic, tactile, haptic language, touch, virtual and mixed reality, bodysuit, vibrotactile stimulation, geotagging, geolocative media, invisible sculptures, somaesthetics

### Introduction

*'In the electric age we wear all mankind as our skin.'*

- Marshall McLuhan

The use of touch in the contexts of art and electronic media is an underexplored area [1] [2]. McLuhan's statement above [3] on how we can sense mankind through our electronic skin is fascinating, but true only in an audiovisual sense. In current collaborative virtual environments we can see and hear each other anywhere and anytime across the planet, but we cannot reach out and touch for real. Still there is no corporeal bonding connecting the multitude of

electronic galaxies and networks. We therefore experience what can be described as a somatic neglect [4]. It could be different. This paper presents open, artistic explorations of how it feels to touch and be touched in virtual realities. The paper title *Virtual Touch* is an oxymoron just like Virtual Realities, for if we understand virtual as 'almost', how can one almost be touched? Touch is experienced less as an objective feeling and more as an embodied phenomenon situated in the living, active and sensing body [4]. This is demonstrated in contexts of sensory deprivation: users of flotation chambers report that experiences similar to hallucinations occur when the body lacks sensory input. Without a constant flux of sensory information it starts to produce its own, imaginary ones [5]. This demonstrates how touch can be considered as an active sense which is, from a phenomenological point of view, always actively directed at something [6]. Our experiences of electronic media have changed since the introduction of the Smartphone/iPhone in 2007. The Smartphone gives us new ways to create an 'art of the recently possible'. This impacts upon us in ways that we could not have foreseen even a few years ago. This paper, therefore, presents the *World Ripple* project, which combines geolocative media with touch-based interaction through the use of wearable bodysuits.

### (Un)Thinkable Touch

Touch is a complex and multifaceted phenomenon. Consider the following exercise: imagine a touch you have never felt before; try to imagine how it would feel, then spend a minute describing it. This exercise is most certainly difficult and perplexing, posing us the notoriously difficult challenge of how to objectively and intersubjectively describe our inner, corporal sensations. This (un)thinkable touch is encountered by users of haptic bodysuits. Having little or no experience with mediated touch in virtual realities, we have to form new meanings and understandings for such new sensations. But first, how do we experience touch?

### The complexity of touch

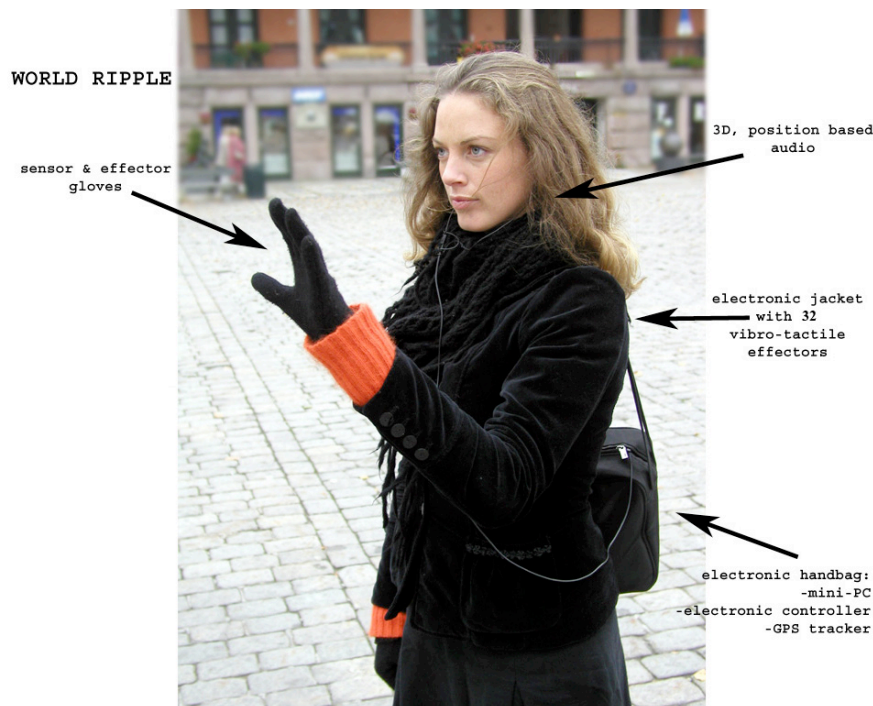
The seemingly innocent and simple question of how it feels to touch and be touched in virtual realities is not an easy one to answer. After all, what does it mean to feel [7]? How do feelings arise? How can they be manipulated, produced, duplicated, stored or even recalled? What 'meanings' can be formed using touch? Can touch possibly change the way we produce and experience art? It is outside the scope of this paper to answer all these questions. It does, however, aim to point out how touch can be considered a genuine artistic material and even medium in its own right by the mentioned brief overview of the touch based project World Ripple that explores the use of touch in experimental experience designs for geolocative media.

### Touch functionality

Our sensation of touch can be analysed and described through the functionality of the human skin, which has at least five distinct sensors for registering touch on its surface [8]. Added to these are the sensors embedded inside the proprioception, vestibular and kinesthetic systems of the body, monitoring and registering the position and movement of our various joints and muscles [2], [8].

Thus, under investigation, it becomes apparent that our sense of touch is an even more complex phenomenon than it initially appears, as it cannot be separated from other senses. There are several intricate cross-modal relationships between touch and other modes of sensory expression [9]. Furthermore, not only is touch shaped by our physiology, but our perception and understanding thereof is highly influenced by history and culture [18]. In the context of electronic media and art, it is an area open to, and in need of, exploration.

Fig. 1. *World Ripple*, system layout of first version in 2005 (© Stenslie)



## A shorter history of haptic art

Works of art which use technology to produce haptic and touch experiences are uncommon; however, there exists a milieu within which to discuss haptic arts genealogy. In 1921 the futurist Marinetti produced an essay on ‘tactilism’, in which he described the various values he associated with tactile sensations [1]. With this tactile ‘vocabulary’ he produced “the first abstract suggestive table”. The tactile sensations can be imbued with symbolic values, something which Classen suggests points toward a day when touch comes into its own, and “the hands can be as knowing as the brain” [1].

One visual interface which simulates the effect of touch is *Telematic Dreaming* by Paul Sermon [10]. The installation is based on a videoconferencing system in which the participants lie on separate beds that dually function as screens, giving the visual illusion of lying beside one another in the same bed. In this intimate situation the users tend to (visually) touch each other and even report sensations of being touched [1].

Thecla Schiphorst’s installation *Bodymaps* [9] works on a similar principle: visitors can ‘touch’ the image of a body, projected onto a reactive table covered in white velvet. The image (visually) reacts to the touching, rendering the viewer a participant in the work through the sense of touch.

Both Sermon’s and Schiphorst’s installations use touch to allow the user to interact with media; but how can an artwork ‘touch the user back’? There are several haptic technologies in which two-way touch is used as a tool of communication. Furthermore, there are various force-feedback systems like the Reachin Desktop by Reachin Technologies, exoskeletal and external devices for exerting tactile pressure on the skin or haptic displays that simulate shape and texture in three dimensions [1].

Another such system is the InTouch project by The Tangible Media Group at MIT Media Lab [11], in which “two identical inTouch devices use three freely rotating rollers. Force-feedback technology synchronizes each individual roller to the corresponding roller on the distant mechanism” [12] – creating the opportunity to experience or interact, or corporeally or somatically be affected ... in what way?

## The World Ripple Project

The *World Ripple* project, which has



Fig. 2. The bodysuit from the *World Ripple* geolocate sculpture project performance, Ljubljana, 2010 (© Stenslie; photo © Stenslie).

been performed in Ljubljana (2010), Oslo (2011) and Malmö (2012), demonstrates recent developments in the use and experience of touch as an artistic material in multimodal and computer-based environments. The project represents i) how to apply inter-subjective touch as an artistic expression and material; ii) how it presently feels to be touched in such environments; and iii) an outlook onto our somatosensory future within mixed, augmented and virtual realities.

The main aims of the project have been to investigate vibrotactile stimulation and corporeal interaction in media art through building functional prototypes of wearable, smart clothing for geolocate, mobile experience design, to show how touch can be used to construct meaningful experiences. The project has analytically framed and investigated touch through a phenomenological framework emphasising the user’s sense of touch [8].

The research method used in *World Ripple* is built on the methodology of open exploration through critical physical inquiry [9] within practice-led artistic research. Often termed research through practice [13], [14], [8], this method involves the hands-on construction and testing of prototypes. This offers a solid ground for reflection-in-action [15]. Functional prototypes of bodysuits run by smartphones have been iteratively constructed and evaluated. Autoethnographic practices have been used throughout to evaluate the results [8].

## System Description

The project is a mobile, smartphone-based, wearable and smart clothing system for geolocate haptic experiences.

The project explores the use of touch in

experimental experience designs for geolocate media. The users wear a Bodysuit with up to 80 variable, vibrotactile outputs to control physical stimulus (output) and up to 4 digital sensors to ‘feel’ the body of the user (input). The Bodysuit is controlled by a custom built Arduino interface connected to the systems Smartphone.

## Sensations and Experience

The users of *World Ripple* sensually experience invisible and immaterial structures. These structures are called ‘sculptures’. The sculptures are geopositioned and databased structures that are physically experiential. They are made sensually senseable by a tactile, wireless, mobile bodysuit and binaural sound system. The sculptures are triggered by GPS coordinates. They are expressed as audio-haptic structures. These are a combination of vibrotactile, physical stimulations on the body and sound based compositions. The tactile pixels of the bodysuit give the sculptures texture, ‘looks’ and strength. The physical shape of the sculptures, like ‘walls’, ‘borders’, movement and consistency are rendered through different combinations and strengths in the vibrotactile effectors of the bodysuit.

The combination of physical stimulus with different sound patterns and binaural recordings enhances the crossmodal sense of touch, and gives a strong and immediate sense of physical consistency and spatial experience.

The sculptures of *World Ripple* are experienced in the open, outdoor landscape. As computer constructed, GPS-based structures, they can be endlessly large and dynamic experiences that can cross, be sensed around and even en-

compass the world. The users wear a transparent, bodybased system that is often hidden from the casual eye - a bodysuit which is thin enough to be worn underneath ordinary clothing, combined with a mobile-, sensor- and GPS-based system packaged in an Android-based mobile phone.

*World Ripple*, simply based on presence and users' navigation in space, can be experienced without any previous training or knowledge; users interact with the sculptures by simply walking around.

One of the goals of the project is to transform open and public spaces into sensual, transformable and invisible structures (sculptures). *World Ripple* can be thought of as a living structure worn as a skin of sensations. It lets the user sense an empty, geotagged space filled with haptic sensations. This is a new kind of experience that influences many aspects of users behavior. A common observation by users is that *World Ripple* influences them to behave differently from other people in public space. Users describe differences in the way they move with relation to walking, searching for structures, stopping, and sensing, and also in their physical reactions (exclamations, voice, utterances, etc.). *World Ripple* represents a 'different reality' that both challenges and expands our understanding of the world by overlapping (virtual) data with (physical) reality in order to make experiential fiction.

### User observation and analysis

As part of the artistic research, feedback was collected from several participants by conducting informal interviews with them throughout all the iterations of the system [16]. In combination with direct observations, the following analytical results are based on a *World Ripple* trial in Malmö, Sweden in 2012 [16]:

1. Immersive closure of space: Walking around in the public square during normal daytime activities, users reported they were mindful of the suit beforehand, but once inside one of the suits they quickly became immersed in the experience and forgot the existence of possible onlookers. This indicates a closure of space, strengthening users' sense of an intimate, personal and 'inner' experience.

2. Multimodal strengthening of senses indicating the affective roles of haptics and audio in interaction: the cross-modal combination of sound and touch was experienced as intermingled, intertwined into a mutual strengthening of stimulus.

Most users reported that they focussed mainly on the sound heard, and that this appeared as the strongest stimulus. However, they also commented that the touches experienced made them stay longer, thus intensifying the overall sensation of body and space.

3. Increase of spatial awareness: a higher degree of spatial awareness was both observed and reported. Users wearing one of the systems noticeably changed their movement in space, becoming more aware of how they were moving to find both new and previous zones of experience.

4. Behavioral change: as users were free to move around in the open space, we had tentatively predicted a systematic, grid-like search for the various interactive areas. However, once they entered the first interactive area they tended to move slowly before stopping; thereafter they were observed to move in an irregular, searching manner, moving back and forth, and returning to previous zones. Their quick adaptation to new movement and behaviour indicates how easily users can adapt to haptic technologies.

Outcomes: several outcomes have been generated by the project's various iterations, including new experience designs, variations of smart clothing, and interfaces for geolocate media / smartphones. New combinations of Open Source Arduino hardware and Open Source Android software have been made public. One of the most significant outcomes has been the investigation of a possible 'haptic language'.

### Haptic Language

The vibrotactile stimulators of the bodysuit indicated that a range of haptic sensations and illusions [17] could be produced. One is the so-called TAU phenomenon, which describes a tactual illusion of movement [8]. When the bodysuit produces a series of short and discrete pressure sensations on the skin, they are perceived as movement between the points. Various patterns of vibration over time let the users form and distinguish between haptic messages.

Another of the project's open research questions asks what meanings are perceived. In relation to this concept of a haptic language, Thecla Schiphorst has worked on developing a 'semantics of caress' [9] that investigates how the meaning of touch can be applied to tactile interaction. Her system represents touch and movement as something meaningful, contributing to quality sharing. Having identified intrinsic values of

haptic communication in systems with relatively low haptic resolution, one of the ongoing research questions is how this can be translated into functioning, wearable systems that produce a greater degree of tactile immersion?

### Contributions

A central contribution of the paper is the indication that touch can be content in itself, and can form so called 'haptic storytelling' [8].

New in this approach are the combinations of the various theories on and about touch, from phenomenology to somaesthetics [4], but also the application of this to interactive arts, in which touch is a genuine medium. The paper aims to contribute to the definition of new practices of inquiry and knowledge-making within electronic and media art.

New uses of touch as artistic material bring about a convergence of our various, living and virtual realities. Simultaneously, it diverges from common ethical norms and practices. How do we want to virtually touch and be touched? Where? By whom? And why. These are some of the questions posed by the use of virtual touch.

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