# Art Evolves through Technology: Haptic after the Hegemony of Visual Art

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**Abstract.** Recently and from now on, we'll be hearing the word haptic regularly in consumer multimodal devices. In an era of transition from sight hegemony, the sense of touch is getting a place of visibility. Still, most of us don't think of the sense of touch as being a primary sense. Possibly it is because we don't know this sense well enough. This paper introduces a haptic art concept for a touch reactive dynamic surface as an awareness project. It is intended to construct the knowledge of the self through the sense of touch, following the latest technological advances in smart materials that provide physical interactivity for art explorations.

**Keywords:** art, technology, sense of touch, haptic, organic user interfaces, smart materials, shape shifting materials, dynamic surfaces.

## 1 Introduction

Art is highly dependent on the technology available. In this sense, art characterizes the development state of its tools and means.

Art is in constant renewal following advances in technology. The definition of art changes and its manifestations vary through time and geography. Throughout history, the tools have been characterizing the art making. Cultural changes have named art periods. Some were ephemeral, and others perdure, a few as classic while others persist resistively. What was mostly an artifact is now produced and maintained by computers. The authorship is dislocated from authors to participants, and in an era of easy access to creative software, creators emerge increasingly. New technological tools democratized the art creation and interconnected computers expanded means of exhibition.

As technology evolves, new metaphors provide answers to previous inquiries while other challenges arise. Art used to be static, as a frame capturing a moment, now is moving and changing its form in semi-living and self-sufficient compositions. Digital art works are aware of the surroundings, capable of choosing in what to transform after collecting data information. Emergent technological materials are giving to tangible art works, the ability of transformation from one state to another. It is mainly the capacity of replicating living abilities that raise much curiosity in their creation. New digital art works are earning attitude and a life-like statement. They are organic and ever changing, challenging our behaviors towards them.

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Driven by inherent curiosity, artists explore and extend to new technological materials to provide better the intended concepts and meanings. Artists appropriate of new dynamic materials that weren't initially developed for a creative use. As artists have always challenged imagination through the use of new tools, new media art works fuse transversal disciplines. They move without frontiers between science and technology, involving critically in their creation with a purpose of transformation of thought and action.

## 2 Fundamental Reasons for Art Existence

Art disrupts established norms, and structures comprehension. The purpose of art is to make us think differently from what we are used to, is to provide us with a new understanding of ourselves and what surround us. Art is concerned with questioning and to bring awareness to what might seem understated can make it explicit and reachable for better understanding. Art actively aims to be thought-provoking, stimulating and inspiring. Art creation comes from a restless mind as a representation of inquietude or something that needs to be answered or better explained. Sometimes turning difficult issues accessible to public critical understanding.

## 3 Advances in Technology Predict Art Evolution

Art works used to be perceived at distance, untouchable, but now to be fully experienced they have to be maneuvered requiring physical interaction. Stated by Pallasmaa the "tactile sensibility replaces distancing visual imagery by enhanced materiality, nearness and intimacy." [4]

To stress the need for physicality, one envisions that computers of the future will have any organic form or shape demanding new ways of interaction and new body approaches to shape shifting devices. The device itself will change its physical interface, sensing and responding accordingly to real time physical input. Organic user interfaces will transform the way we use computers. Adding the dynamic response to our physical inputs will certainly change our interactions with computational devices radically. The objects will adapt physically to our biological nature. The dynamic surfaces will change their physical appearance and texturing when we touch or hold them. Prompting new experiential dimensions and renewed haptic relationships between the human body and its surroundings. Technology will be at our use effortlessly, changeable and controllable at our moods and desires along the digital everyday devices become increasingly complex, smaller, less obtrusive, and with minor technological appearance. The technological devices of the future will have distinct physical appearance from today, as they will be everywhere, in any material or surface, flexible or rigid, liquid or solid. Electronic components will be assembled combined with the most disparate materials (paper, fabric, plastic, ceramic, glass, concrete, fluids), providing a variety of different and endless textural possibilities for tactility. Our lifeless everyday objects will soon become lively interfaces for interactions, demanding new physical relations and changing body behaviors. As touch suggests variations between activity and passivity, renewed perceptual means will give rise to the interplay between subject and object.

Since ever, artists explore, appropriate, and recreate the means. Attentive to what is happening in technological developments to adopt the ultimate technologies as their creative tools.

Examples of explorations on sensory experiences, which in different ways relate to the haptic interfaces or explore the tactile qualities of surfaces, artists have integrated new materials by way of technology transfer potential in technology-based art works:

The Water Logo ’09,by Kenya Hara, et al. [3], is a surface that mimics the lotus leaf. Drops of water create a sign on top of a water-repellent fabric giving the audience a multisensory experience. When water droplets fall on lotus leaves, they bead up into balls. This effect happens because the infinitesimal hairs coating the surface of the leaves repel water. The Water Logo uses the Monert material, which is processed by a Nano-tex technique for an ultra water-repellent fabric.

The surface slopes slightly down to the front, so that whenever a drop reaches a certain size, it begins to roll down the sloping surface under the influence of gravity. A drop of water grows up to take the place of each drop that rolls away, to the water logo being constantly renewed. Driven by a hidden mechanism, the water seeps through the fabric in groups of drops that spell out "Senseware" coupling a visual experience with a tactile appearance.

Another example is Six-Forty by Four-Eighty, by Marcelo Coelho, et al. [2], that is an interactive lighting installation, composed of an array of magnetic physical pixels. Reacting to touch each pixel-tile change the color and communicate its state to other tiles by using the human body as the conduit for color information. Touching a pixel-tile makes it cycle through a color palette. When touched for a short time, the pixel-tile starts pulsing to indicate its transmission state. By keeping the first hand in the tile and touching other pixel-tiles with the other hand, the color is copied and pasted from one pixel-tile to another. When is detected a touch, the brightness of the light changes according to an exponential decay based on the behavior of incandescent light bulbs also simulates a soft object elastically deforming with applied pressure. The pixel-tiles can create patterns and animations when grouped together, serving playfully for customizing physical spaces with ferrous surfaces.

Conventional materials incorporate new technologies disrupting traditional uses. The new technological materials are active and participative. The smart materials sense, react and change reversibly in appearance, shape and texture, in response to the environment, adding functionality and meaning to interactive art means.

Currently, sustainability issues require materials to have increased functionality and adaptive capabilities. Mimicking processes and structures of nature through biomimetics and nanotechnology, the smart materials do more and better with fewer resources. These materials identify an era to which art is not indifferent. Technology-based art is representative of its time concerning economic, social, political, cultural, and ecological dispositions. The smart materials adapt well to a fast evolving society, as “their properties are changeable and thus responsive to *transient* needs” as Schodek and Addington asserted. [6]

The option for smart materials for creative applications is seductive due to their behavioral characteristics. Succinctly explained by Schodek and Addington [6], they are suitable because of the “immediacy” as these materials respond promptly.

Because of the “transiency” as they respond to several environmental state. Because of the “self-actuation” as they possess a molecular structure that responds to external influences. Because of the “selectivity” as they respond in a distinct and controlled way. Because of the “directness” as they respond *in loco* to a stimulus, and the most salient, because of the reversibility as they change back to their initial state.

Activated through chemical, electrical, magnetic, optical, thermal, or mechanical stimulus depending on their properties, these responsive materials interact with the environment in which we intervene disobeying the conviction of the “hegemonic material as visual artifact" that Schodek and Addington correspondingly claimed [6], defying our sensory perceptions to transformative material surfaces.

## 4 The Exaltation of a Sense in the Reactant Surface

Senses act interrelated, but notice can be given to senses individually, it depends on the emphatic attention to a particular sense. As Merleau-Ponty explained “the experience of the separate ‘senses’ is gained only when one assumes a highly particularized attitude." [5]

Touch is indispensable for our existence, but its capabilities haven't been exhaustively studied as those of sight and hearing. The sense of touch is ontological and phenomenologically of utmost importance for our normal functioning and well-being. Still there is a lack of haptic knowledge, on what we are able to obtain through tactile sensations, because much is performed unnoticed below the conscious threshold. The difficulty is in the interpretation of haptic sensations experienced by the body.

Knowing that the physical response to an event is determined by subjective sensitivity, previous experiences, and state of awareness, this research intents to infer the importance of the level of expectancy. Inquiring how does the tactile interaction intensify the subjective experience, and how does the change of the tactile stimulus enhance the sensation, for a consciously inner augmented tactile feeling.

Outwardly, it is through touch that we act upon the environment. Touch is the only sense capable of changing its surroundings. Equivalent to what Wallace claims when relates action and its consequent reaction “it is the ability of one substance to act on another that explains why it is possible to identify agents and reagents in the order of nature.” [7]

Mimicking forms of nature, The Reactant is a surface concept that goes through a physical change during a reaction. Through a tactile reaction, this sensitive surface change sits physical nature as it may grow or shrink when we press a finger on it altering our tactile sensations. As texture keeps active the stimulus of this sense, the tactile qualities of the means influence the quality of the experience.

Using for this purpose a shape memory alloy (SMA) actuator wire. The Nitinol, which is a deformable temperature-responsive metal compound, made of nickel and titanium, that assembled with electronic components and combined with non-woven fabrics, allowing flexibility of movement and easing the cooling of the SMA actuator, produce a life-like movement when activated by an intentional stimulus. While in

tactile feedback screens, the physical changes happen under the glass, unreachable for the eye and are developed to deceive our cutaneous system; The Reactant is a tactile sensitive surface that shifts its appearance from one physical state to another. Making use of the recent developments in smart materials, that interact with the environment it is able of responding to changes through emergent sensitive technologies. As sensors and actuators become more sensible, accessible, sustainable, and affordable, permit the artists to explore innovative technologies. This project benefits from the technological evolution of smart materials that reversibly change shape in response to electrical stimuli, mixing the organic with the electromechanical components and systems, to ally the aesthetic to functional adding an inquiring purpose. The Reactant is a haptic art project conceived with the purpose of awareness to a sense that is often neglected.

The concept focuses on how we perceive and retain our surroundings through our sense of touch that provide us a conscious existence of physicality. The way we behave depends directly on the way we perceive our environment. It is the perception of the self in relation to reality. According to Ackerman, the sense of one's self "has to do with touch, with how we feel" [1]. In relating the haptic perception of the self to the surfaces and spaces around, Pallasmaa states that "touch is the sensory mode that integrates our experience of the world with that of ourselves." [4]

The dynamic surface, The Reactant, is a visual and tactile metaphor created to show how our actions influence the behaviors of others. How our immediate reactive instinct predicts our consequent behaviors. Concerning the instinctive action to an unexpected touch, or the first reaction to the embodied experience of feeling something in our skin. The first moment we experience something new is the alluring of an instant that will determine our future behaviors to similar experiences. A lasting involvement depends on the quality of the first impression. We are moved by sensations, constantly looking for unforgettable ones. Commonly, beyond our survival instincts, it is our desire to enhance our experiences when dealing with the most disparate things, from the everyday simplest actions to interactions that challenge our knowledge. Those improvements are related to how we use our senses when experiencing those things. When forming first impressions, it is what we see, hear, smell, taste, and touch that influence our assessments and future behaviors.

## 5 Contributions

The main purpose of this research is to deliver a comprehensive understanding of the phenomenology of the haptic being the expected results of subjective analysis prompted by individual descriptive meanings. To deliver an insightful interpretation on how we've been relating to touch, and why the sense of touch is essential to us, attempting to unravel its hidden characteristics and abilities through art survey. Encompassing a multidisciplinary overview, relating philosophy, psychology, cognitive and natural sciences, social and cultural history, and engineering, aimed to be a useful theoretical framework about the haptic, with convergences between perception, aesthetics, creativity, behavior, and technology. Aims to develop collaborative relationships between research in art and design, as a way to explore future technological implications for public involvement and awareness. Aims to improve our awareness to tactile sensations when interacting with tangible media and intensify the physical experience between users and digital systems.

## 6 Conclusions

Hitherto, consumer haptic devices are devoted to the feedback feeling, but lack the tactual sensation of the material that is usually slick and cold and not truly tactile stimulating.

Besides, people know very little about the sense of touch. Often restrict it to the sensations felt on the skin. They only know the surface of this sense. The sense of touch is critically vital, from controlling the body to perceiving, learning from, and interacting with the environment.

Art can make it explicit and reachable for better understanding, reordering the knowledge of it. The proposed texture shape-changing surface crossing differentiated practices from the inquisitive art to the resolvable design, from the explainable natural sciences to the conceivable engineering, is intended to be an open-ended, critical, and thought-provoking project to raise individual awareness. Meant to be an analytical project through investigation, it is open to questioning one's subjective perceptions challenging each one to know oneself through their touch behavioral reactions.

In collaboration, artists and technologists have an interdependent relationship. They act interrelated pushing each other further. Art stretches technical developments and technology listens to art technical requirements albeit constrained by technical skills, scientific knowledge, and technical limitations. Artists develop, modify and use technical means and tools to stir social awareness and renew aesthetic experiences.

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